z/OS
2.5

Language Environment Debugging Guide

GA32-0908-50

Note

Before using this information and the product it supports, read the information in "Notices" on page 485.

This edition applies to Version 2 Release 5 of z/OS® (5650-ZOS) and to all subsequent releases and modifications until otherwise indicated in new editions.

Last updated: 2023-03-24

Contents

Figures

Tables

About this document

z/OS Language Environment Debugging Guide provides assistance with detecting, finding, and fixing programming errors that occur during run time under Language Environment®. It can help you establish a debugging process to analyze data and narrow the scope and location of where an error might have occurred. You can read about how to prepare a routine for debugging, how to classify errors, and how to use the debugging facilities Language Environment provides. Also included are chapters on debugging HLL-specific routines and routines that run under CICS®. Debugging for AMODE 64 applications is covered in separate chapters, corresponding to the topics and contents that were provided.

This book is intended for application programmers who are interested in techniques for debugging runtime programs. You should be familiar with:

- Language Environment.
- Appropriate languages that use the accepted compilers.
- Program storage concepts.

Using your documentation

The publications provided with Language Environment are designed to help you:

- Manage the runtime environment for applications generated with a Language Environment-conforming compiler.
- Write applications that use the Language Environment callable services.
- Develop interlanguage communication applications.
- Customize Language Environment.
- Debug problems in applications that run with Language Environment.
- Migrate your high-level language applications to Language Environment.

Language programming information is provided in the supported high-level language programming manuals, which provide language definition, library function syntax and semantics, and programming guidance information.

Each publication helps you perform different tasks, some of which are listed in Table 1 on page xxvii.

Table 1. How to use z/OS Language Environment publications

To ...	Use ...
Evaluate Language Environment	*z/OS Language Environment Concepts Guide*
Plan for Language Environment	*z/OS Language Environment Concepts Guide* *z/OS Language Environment Runtime Application Migration Guide*
Install Language Environment	*z/OS Program Directory* in the z/OS Internet library (www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosInternetLibrary)
Customize Language Environment	*z/OS Language Environment Customization*
Understand Language Environment program models and concepts	*z/OS Language Environment Concepts Guide* *z/OS Language Environment Programming Guide* *z/OS Language Environment Programming Guide for 64-bit Virtual Addressing Mode*

Table 1. How to use z/OS Language Environment publications (continued)

To ...	Use ...
Find syntax for Language Environment runtime options and callable services	*z/OS Language Environment Programming Reference*
Develop applications that run with Language Environment	*z/OS Language Environment Programming Guide* and your language programming guide
Debug applications that run with Language Environment, diagnose problems with Language Environment	*z/OS Language Environment Debugging Guide*
Get details on runtime messages	*z/OS Language Environment Runtime Messages*
Develop interlanguage communication (ILC) applications	z/OS Language Environment Writing Interlanguage Communication Applications and your language programming guide
Migrate applications to Language Environment	*z/OS Language Environment Runtime Application Migration Guide* and the migration guide for each Language Environment-enabled language

How to read syntax diagrams

This section describes how to read syntax diagrams. It defines syntax diagram symbols, items that may be contained within the diagrams (keywords, variables, delimiters, operators, fragment references, operands) and provides syntax examples that contain these items.

Syntax diagrams pictorially display the order and parts (options and arguments) that comprise a command statement. They are read from left to right and from top to bottom, following the main path of the horizontal line.

For users accessing the IBM Documentation using a screen reader, syntax diagrams are provided in dotted decimal format.

Symbols

The following symbols may be displayed in syntax diagrams:

Symbol
Definition

►►───
Indicates the beginning of the syntax diagram.

───►
Indicates that the syntax diagram is continued to the next line.

►───
Indicates that the syntax is continued from the previous line.

───►◄
Indicates the end of the syntax diagram.

Syntax items

Syntax diagrams contain many different items. Syntax items include:

- Keywords - a command name or any other literal information.
- Variables - variables are italicized, appear in lowercase, and represent the name of values you can supply.

- Delimiters - delimiters indicate the start or end of keywords, variables, or operators. For example, a left parenthesis is a delimiter.
- Operators - operators include add (+), subtract (-), multiply (*), divide (/), equal (=), and other mathematical operations that may need to be performed.
- Fragment references - a part of a syntax diagram, separated from the diagram to show greater detail.
- Separators - a separator separates keywords, variables or operators. For example, a comma (,) is a separator.

Note: If a syntax diagram shows a character that is not alphanumeric (for example, parentheses, periods, commas, equal signs, a blank space), enter the character as part of the syntax.

Keywords, variables, and operators may be displayed as required, optional, or default. Fragments, separators, and delimiters may be displayed as required or optional.

Item type
: **Definition**

Required
: Required items are displayed on the main path of the horizontal line.

Optional
: Optional items are displayed below the main path of the horizontal line.

Default
: Default items are displayed above the main path of the horizontal line.

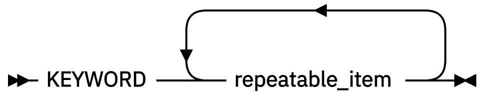
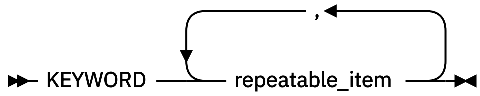
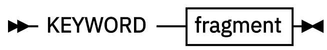
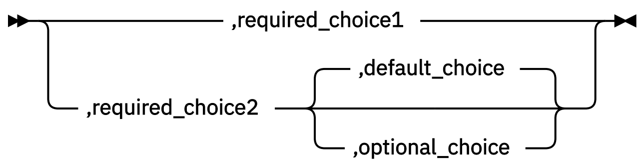
Syntax examples

The following table provides syntax examples.

Table 2. Syntax examples

Item	Syntax example
Required item. Required items appear on the main path of the horizontal line. You must specify these items.	▶▶─ KEYWORD ── required_item ─▶◀
Required choice. A required choice (two or more items) appears in a vertical stack on the main path of the horizontal line. You must choose one of the items in the stack.	▶▶─ KEYWORD ─┬─ required_choice1 ─┬─▶◀ └─ required_choice2 ─┘
Optional item. Optional items appear below the main path of the horizontal line.	▶▶─ KEYWORD ─┬───────────────┬─▶◀ └─ optional_item ─┘
Optional choice. An optional choice (two or more items) appears in a vertical stack below the main path of the horizontal line. You may choose one of the items in the stack.	▶▶─ KEYWORD ─┬───────────────┬─▶◀ ├─ optional_choice1 ─┤ └─ optional_choice2 ─┘
Default. Default items appear above the main path of the horizontal line. The remaining items (required or optional) appear on (required) or below (optional) the main path of the horizontal line. The following example displays a default with optional items.	┌─ default_choice1 ─┐ ▶▶─ KEYWORD ─┼───────────────┼─▶◀ ├─ optional_choice2 ─┤ └─ optional_choice3 ─┘
Variable. Variables appear in lowercase italics. They represent names or values.	▶▶─ KEYWORD ── *variable* ─▶◀

Table 2. Syntax examples (continued)

Item	Syntax example
Repeatable item. An arrow returning to the left above the main path of the horizontal line indicates an item that can be repeated. A character within the arrow means you must separate repeated items with that character. An arrow returning to the left above a group of repeatable items indicates that one of the items can be selected,or a single item can be repeated.	 
Fragment. The fragment symbol indicates that a labelled group is described below the main syntax diagram. Syntax is occasionally broken into fragments if the inclusion of the fragment would overly complicate the main syntax diagram.	 **fragment** 

z/OS information

This information explains how z/OS references information in other documents and on the web.

When possible, this information uses cross document links that go directly to the topic in reference using shortened versions of the document title. For complete titles and order numbers of the documents for all products that are part of z/OS, see *z/OS Information Roadmap*.

To find the complete z/OS library, go to IBM Documentation (www.ibm.com/docs/en/zos).

How to send your comments to IBM

We invite you to submit comments about the z/OS product documentation. Your valuable feedback helps to ensure accurate and high-quality information.

Important: If your comment regards a technical question or problem, see instead "If you have a technical problem" on page xxxi.

Submit your feedback by using the appropriate method for your type of comment or question:

Feedback on z/OS function
If your comment or question is about z/OS itself, submit a request through the IBM RFE Community (www.ibm.com/developerworks/rfe/).

Feedback on IBM® Documentation function
If your comment or question is about the IBM Documentation functionality, for example search capabilities or how to arrange the browser view, send a detailed email to IBM Documentation Support at ibmdocs@us.ibm.com.

Feedback on the z/OS product documentation and content
If your comment is about the information that is provided in the z/OS product documentation library, send a detailed email to mhvrcfs@us.ibm.com. We welcome any feedback that you have, including comments on the clarity, accuracy, or completeness of the information.

To help us better process your submission, include the following information:

- Your name, company/university/institution name, and email address
- The following deliverable title and order number: z/OS Language Environment Debugging Guide, GA32-0908-50
- The section title of the specific information to which your comment relates
- The text of your comment.

When you send comments to IBM, you grant IBM a nonexclusive authority to use or distribute the comments in any way appropriate without incurring any obligation to you.

IBM or any other organizations use the personal information that you supply to contact you only about the issues that you submit.

If you have a technical problem

If you have a technical problem or question, do not use the feedback methods that are provided for sending documentation comments. Instead, take one or more of the following actions:

- Go to the IBM Support Portal (support.ibm.com).
- Contact your IBM service representative.
- Call IBM technical support.

Summary of changes

This information includes terminology, maintenance, and editorial changes. Technical changes or additions to the text and illustrations for the current edition are indicated by a vertical line to the left of the change.

Note: IBM z/OS policy for the integration of service information into the z/OS product documentation library is documented on the z/OS Internet Library under IBM z/OS Product Documentation Update Policy (www-01.ibm.com/servers/resourcelink/svc00100.nsf/pages/ibm-zos-doc-update-policy?OpenDocument).

Summary of changes for z/OS Language Environment Debugging Guide for Version 2 Release 5 (V2R5)

New

The following content is new.

March 2023

- IBM Open XL C/C++ for z/OS is supported. See "What Language Environment supports" on page xxxvii.

September 2021

- Information for debugging applications that were written to make use of Language Environment AMODE 31 and AMODE 64 interoperability was added. See Part 4, "Debugging AMODE 31 Language Environment and AMODE 64 Language Environment interoperability applications," on page 469.
- "What Language Environment supports" on page xxxvii was updated to include IBM Open Enterprise SDK for Go.

Changed

The following content is changed.

April 2022

- In "Displaying and modifying runtime options with the CLER transaction" on page 319, the note about runtime option ALL31 was changed.
- Chapter 10, "Preparing your AMODE 64 application for debugging," on page 323 was updated because Language Environment supports PL/I.

September 2021

These report headers were updated for V2R5:

- The options report header.
- The storage report header.
- The options report for AMODE 64 applications.
- The storage report for AMODE 64 applications.

Deleted

The following content is deleted.

September 2021

None.

Summary of changes for z/OS Language Environment Debugging Guide for Version 2 Release 4 (V2R4)

New

The following content is new.

June 2021 refresh
With APAR PH28966, you can debug applications that use Language Environment AMODE 31 and AMODE 64 interoperability. For more information, see Part 4, "Debugging AMODE 31 Language Environment and AMODE 64 Language Environment interoperability applications," on page 469.

December 2020 refresh
For APAR PH30936, the IPCS VERBEXIT LEDATA output was updated. See "Understanding the Language Environment IPCS VERBEXIT LEDATA output" on page 362.

Changed

The following content is changed.

Prior to December 2020 refresh

- Language Environment now supports IBM ToolKit for Swift on z/OS in the list of compiler products.
- To enhance the security of programs, certain memory regions such as the library heap are now marked non-executable by default. The LEDATA VERBEXIT output was updated. For more information, see "Understanding the Language Environment IPCS VERBEXIT LEDATA output" on page 88.
- These report headers were updated for V2R3:
  - (Figure 2 on page 12)
  - (Figure 156 on page 325)
  - (Figure 157 on page 327)

Deleted

The following content is deleted.

- None.

Summary of changes for Language Environment for z/OS Version 2 Release 3 (V2R3)

The most recent updates are listed at the top of the section.

New

Because APAR PI91583 added support for lengths that are longer than 7 bytes, the service portion of Traceback for both CEEDUMP and LEDATA Verbexit was updated. See "Sections of the Language Environment dump" on page 54 and "Sections of the Language Environment LEDATA VERBEXIT formatted output" on page 103.

Support was provided for system times beyond 2038/2042. The following sections contain new information:

- Chapter 3, "Using Language Environment debugging facilities," on page 33
  - "Understanding the C/C++-specific LEDATA output" on page 118

- Chapter 12, “Using Language Environment AMODE 64 debugging facilities,” on page 339
  - “Understanding the C/C++-specific LEDATA output” on page 396

Support was added for stack guard. The following section contains new information for this support:

- “Common Anchor Area” on page 64

Language Environment now enforces the same security rules that are enforced by ABEND dump processing. For more information, see the new section “Controlling access to CEEDUMPs and DYNDUMPs” on page 149.

Support was added to allow vector applications to run under ERTLI CICS. The following section contains new information:

- “Common Anchor Area” on page 64

Changed

- These report headers were updated for V2R3:
  - The options report header (Figure 1 on page 10)
  - The storage report header (Figure 2 on page 12)
  - The options report for AMODE 64 applications (Figure 156 on page 325)
  - The storage report for AMODE 64 applications (Figure 157 on page 327)
- “MEMCHECK VHM memory leak analysis tool” on page 218 now indicates that the trace is limited to 1024 entries and will wrap.
- Various updates were made to replace *IBM Debug Tool for z/OS* with *IBM z/OS Debugger*.

What Language Environment supports

Language Environment supports z/OS (5650-ZOS).

IBM Language Environment (also called Language Environment) provides common services and language-specific routines in a single runtime environment for C, C++, COBOL, Fortran (z/OS only; no support for z/OS UNIX System Services or CICS), PL/I, and assembler applications. It offers consistent and predictable results for language applications, independent of the language in which they are written.

Language Environment is the prerequisite runtime environment for applications that are generated with the following IBM compiler products:

- z/OS XL C/C++ (feature of z/OS)
- z/OS C/C++
- OS/390® C/C++
- C/C++ for MVS/ESA
- C/C++ for z/VM®
- XL C/C++ for z/VM
- AD/Cycle C/370
- IBM Toolkit for Swift on z/OS
- VisualAge® for Java™, Enterprise Edition for OS/390
- Enterprise COBOL for z/OS
- Enterprise COBOL for z/OS and OS/390
- COBOL for OS/390 & VM
- COBOL for MVS™ & VM (formerly COBOL/370)
- Enterprise PL/I for z/OS
- Enterprise PL/I for z/OS and OS/390
- VisualAge PL/I
- PL/I for MVS & VM (formerly PL/I MVS & VM)
- VS FORTRAN and FORTRAN IV (in compatibility mode)
- IBM Open Enterprise SDK for Go
- IBM Open XL C/C++ for z/OS

Although not all compilers listed are currently supported, Language Environment supports the compiled objects that they created.

Language Environment supports, but is not required for, an interactive debug tool for debugging applications in your native z/OS environment. Debug Tool is also available as a stand-alone product as well as Debug Tool Utilities and Advanced Functions. For more information, see the IBM z/OS Debugger (developer.ibm.com/mainframe/products/ibm-zos-debugger).

Language Environment supports, but is not required for, VS FORTRAN Version 2 compiled code (z/OS only).

Language Environment consists of the common execution library (CEL) and the runtime libraries for C/C++, COBOL, Fortran, and PL/I.

For more information about IBM Toolkit for Swift on z/OS, program number 5655-SFT, see the product documentation.

For more information about VisualAge for Java, Enterprise Edition for OS/390, program number 5655-JAV, see the product documentation.

Part 1. Introduction to debugging in Language Environment

This part provides information about options and features you can use to prepare your routine for debugging. It describes some common errors that occur in routines and provides methods of generating dumps to help you get the information you need to debug your routine.

Chapter 1. Preparing your routine for debugging

This chapter describes options and features that you can use to prepare your routine for debugging. The following topics are covered:

- Compiler options for C, C++, COBOL, Fortran, and PL/I
- Language Environment runtime options
- Use of storage in routines
- Options for modifying condition handling
- Assembler user exits
- Enclave termination behavior
- User-created messages
- Language Environment feedback codes and condition tokens

Setting compiler options

The following sections discuss language-specific compiler options important to debugging routines in Language Environment. These sections cover only the compiler options that are important to debugging. For a complete list of compiler options, see the appropriate HLL publications.

The use of some compiler options (such as TEST) can affect the performance of your routine. You must set these options before you compile. In some cases, you might need to remove the option and recompile your routine before delivering your application.

XL C and XL C++ compiler options

When using XL C, set the TEST(ALL) suboption; this is equivalent to specifying TEST(LINE,BLOCK,PATH,SYM,HOOK). For XL C++, the option TEST is equivalent to TEST(HOOK). Table 3 on page 3 lists the TEST suboptions that you can use to simplify runtime debugging.

Table 3. TEST suboptions to simplify debugging

Suboption name	Description
ALL	Sets all of the TEST suboptions.
BLOCK	Generates symbol information for nested blocks.
HOOK	Generates all possible hooks.
LINE	Generates line number hooks and allows a debugging tool to generate a symbolic dump.
PATH	Generates hooks at all path points; for example, hooks are inserted at if-then-else points before a function call and after a function call.
SYM	Generates symbol table information and enables Language Environment to generate a dump at run time. When you specify SYM, you also get the value and type of variables displayed in the Local Variables section of the dump. For example, if in block 4 the variable x is a signed integer of 12, and in block 2 the variable x is a signed integer of 1, the following output appears in the Local Variables section of the dump: `%BLOCK4:>x   signed int         12` `%BLOCK2:>x   signed int          1` If a nonzero optimization level is used, variables do not appear in the dump.

You can use the C/C++ compiler options shown in Table 4 on page 4 to make runtime debugging easier. For more information about these options, see GONUMBER|NOGONUMBER and TEST|NOTEST in *z/OS XL C/C++ User's Guide*.

Table 4. C/C++ compiler options to simplify runtime debugging

Compiler option	Description
AGGREGATE (C)	Specifies that a layout for `struct` and `union` type variables appear in the listing.
ATTRIBUTE (C++)	For XL C++ compile, cross reference listing with attribute information. If XREF is specified, the listing also contains reference, definition and modification information.
CHECKOUT (C)	Provides informational messages indicating possible programming errors.
EVENTS	Produces an events file that contains error information and source file statistics.
EXPMAC	Macro expansions with the original source.
FLAG	Specifies the minimum severity level that is tolerated.
GONUMBER	Generates line number tables corresponding to the input source file. This option is turned on when the TEST option is used. This option is needed to show statement numbers in dump output.
INFO (C++)	Indication of possible programming errors.
INLINE	Inline Summary and Detailed Call Structure Reports. (Specify with the REPORT sub-option).
INLRPT	Generates a report on status of functions that were inlined. The OPTIMIZE option must also be specified.
LIST	Listing of the pseudo-assembly listing produced by the compiler.
OFFSET	Displays the offset addresses relative to the entry point of each function.
PHASEID	Causes each compiler module (phase) to issue an informational message which identifies the compiler phase module name, product identifier, and build level.
PPONLY	Completely expanded z/OS XL C, or z/OS XL C++ source code, by activating the preprocessor (PP) only. The output shows, for example, all the "#include" and "#define" directives.
SERVICE	Places a string in the object module, which is displayed in the traceback if the application fails abnormally.
SHOWINC	All included text in the listing.
SOURCE	Includes source input statements and diagnostic messages in the listing.
TERMINAL	Directs all error messages from the compiler to the terminal. If not specified, this is the default.
TEST	Generates information for debugging interface. This also generates symbol tables needed for symbolic variables in the dump.
XPLINK (BACKCHAIN)	Generates a prolog that saves redundant information in the calling function's stack frame.
XPLINK (STOREARGS)	Generates code to store arguments that are normally passed in registers, into the argument area.
XREF	For XL C compile, cross reference listing with reference, definition, and modification information. For XL C++ compile, cross reference listing with reference, definition, and modification information. If you specify ATTRIBUTE, the listing also contains attribute information.

For more information about Interprocedural Analysis (IPA), see Using the IPA in *z/OS XL C/C++ Programming Guide*.

COBOL compiler options

When using COBOL V4R2 and prior releases, set the SYM suboption of the TEST compiler option. The SYM suboption of TEST causes the compiler to add debugging information into the object program to resolve user names in the routine and to generate a symbolic dump of the DATA DIVISION. With this suboption specified, statement numbers will also be used in the dump output along with offset values.

When using COBOL V5R1 and later releases, instead of setting the SYM suboption, set the DWARF suboption of the TEST compiler option. This has the same effect as the SYM option above concerning debug information in the object program.

To simplify debugging, use the NOOPTIMIZE compiler option. Program optimization can change the location of parameters and instructions in the dump output.

You can use the COBOL compiler options shown in Table 5 on page 5 to prepare your program for runtime debugging. For more detail on these options and functions, see the appropriate programming guide in the Enterprise COBOL for z/OS library (www.ibm.com/support/docview.wss?uid=swg27036733).

Table 5. COBOL compiler options for runtime debugging

Compiler option	Description
LIST	Produces a listing of the assembler expansion of your source code and global tables, literal pools, information about working storage, and size of routine's working storage.
MAP	Produces lists of items in data division including a data division map, global tables, literal pools, a nested program structure map, and attributes.
OFFSET	Produces a condensed PROCEDURE DIVISION listing containing line numbers, statement references, and location of the first instruction generated for each statement.
OUTDD	Specifies the destination of DISPLAY statement messages.
SOURCE	Produces a listing of your source program with any statements embedded by PROCESS, COPY, or BASIS statements.
TEST	Produces object code that can run with a debugging tool, or adds information to the object program to produce formatted dumps. With or without any suboptions, this option forces the OBJECT option. When specified with any of the hook-location suboption values except NONE, this option forces the NOOPTIMIZE option. DWARF suboption includes statement numbers in the Language Environment dump and produces a symbolic dump. **Note:** For COBOL V4R2 and prior releases, use the SYM suboption instead of DWARF.
VBREF	Produces a cross-reference of all verb types used in the source program and a summary of how many times each verb is used.
XREF	Creates a sorted cross-reference listing.

Fortran compiler options

You can use these Fortran compiler options shown in Table 6 on page 5 to prepare your program for runtime debugging. For more detail on these options and functions, see *VS FORTRAN Version 2 Programming Guide for CMS and MVS* or *VS FORTRAN Version 2 Language and Library Reference* .

Table 6. Fortran compiler options for runtime debugging

Compiler option	Description
FIPS	Specifies if standard language flagging is to be performed. This is valuable if you want to write a program conforming to Fortran 77.
FLAG	Specifies the level of diagnostic messages to be written. **I** (Information), **E** (Error), **W** (Warning), or **S** (Severe). You can also use FLAG to suppress messages that are below a specified level. This is useful if you want to suppress information messages, for example.
GOSTMT	Specifies that statement numbers are included in the runtime messages and in the Language Environment dump.

Compiler option	Description
ICA	Specifies if intercompilation analysis is to be performed, specifies the files containing intercompilation analysis information to be used or updated, and controls output from intercompilation analysis. Specify ICA when you have a group of programs and subprograms that you want to process together and you need to know if there are any conflicting external references, mismatched commons, and so on.
LIST	Specifies if the object module list is to be written. The LIST option lets you see the pseudo-assembly language code that is similar to what is actually generated.
MAP	Specifies if a table of source program variable names, named constants, and statement labels and their displacements is to be produced.
OPTIMIZE	Specifies the optimizing level to be used during compilation. If you are debugging your program, it is advisable to use NOOPTIMIZE.
SDUMP	Specifies if dump information is to be generated.
SOURCE	Specifies if a source listing is to be produced.
SRCFLG	Controls insertion of error messages in the source listing. SRCFLG allows you to view error messages after the initial line of each source statement that caused the error, rather than at the end of the listing.
SXM	Formats SREF or MAP listing output to a 72-character width.
SYM	Invokes the production of SYM cards in the object text file. SYM cards contain location information for variables within a Fortran program.
TERMINAL	Specifies whether error messages and compiler diagnostics are to be written on the SYSTERM data set and whether a summary of messages for all the compilations is to be written at the end of the listing.
TEST	Specifies whether to override any optimization level above OPTIMIZE(0). This option adds runtime overhead.
TRMFLG	Specifies whether to display the initial line of source statements in error and their associated error messages at the terminal.
XREF	Creates a cross-reference listing.
VECTOR	Specifies whether to invoke the vectorization process. A vectorization report provides detailed information about the vectorization process.

Table 6. Fortran compiler options for runtime debugging (continued)

PL/I compiler options

When using PL/I, specify the TEST compiler option to control the level of testing capability that are generated as part of the object code. Suboptions of the TEST option such as SYM, BLOCK, STMT, and PATH control the location of test hooks and specify whether or not a symbol table is generated. For more information about TEST, its suboptions, and the placement of test hooks, see the IBM Enterprise PL/I for z/OS library (www.ibm.com/support/docview.wss?uid=swg27036735).

To simplify debugging and decrease compile time, set optimization to NOOPTIMIZE or OPTIMIZE(0). Higher optimization levels can change the location where parameters and instructions appear in the dump output.

You can use the compiler options listed in Table 7 on page 6 to prepare PL/I routines for debugging. For more detail on PL/I compiler options, see the IBM Enterprise PL/I for z/OS library (www.ibm.com/support/docview.wss?uid=swg27036735).

Table 7. PL/I compiler options for debugging

Compiler option	Description
AGGREGATE	Specifies that a layout for arrays and major structures appears in the listing.

Table 7. PL/I compiler options for debugging (continued)

Compiler option	Description
ESD	Includes the external symbol dictionary in the listing.
GONUMBER / GOSTMT	Tells the compiler to produce additional information specifying that line numbers from the source routine can be included in runtime messages and in the Language Environment dump.
INTERRUPT	Specifies that users can establish an ATTENTION ON-unit that gains control when an attention interrupt occurs.
LIST	Produces a listing of the assembler expansion of source code and global tables, literal pools, information about working storage, and size of routine's working storage.
LMESSAGE	Tells the compiler to produce runtime messages in a long form. If the cause of a runtime malfunction is a programmer's understanding of language semantics, specifying LMESSAGE could better explain warnings or other information generated by the compiler.
MAP	Tells the compiler to produce tables showing how the variables are mapped in the static internal control section and in the stack frames, thus enabling static internal and automatic variables to be found in the Language Environment dump. If LIST is also specified, the MAP option also produces tables showing constants, control blocks, and INITIAL variable values.
OFFSET	Specifies that the compiler prints a table of statement or line numbers for each procedure with their offset addresses relative to the primary entry point of the procedure.
SOURCE	Specifies that the compiler includes a listing of the source routine in the listing.
STORAGE	Includes a table of the main storage requirements for the object module in the listing.
TERMINAL	Specifies what parts of the compiler listing produced during compilation are directed to the terminal.
TEST	Specifies the level of testing capability that is generated as part of the object code. TEST also controls the location of test hooks and whether or not the symbol table is generated. Because the TEST option increases the size of the object code and can affect performance, limit the number and placement of hooks.
XREF and ATTRIBUTES	Creates a sorted cross-reference listing with attributes.

Enterprise PL/I for z/OS compiler options

Table 8 on page 7 lists the Enterprise PL/I for z/OS compiler options that you can specify when preparing your Enterprise PL/I for z/OS routines for debugging. For more information about the Enterprise PL/I for z/OS compiler options, see the IBM Enterprise PL/I for z/OS library (www.ibm.com/support/docview.wss?uid=swg27036735).

Table 8. Enterprise PL/I for z/OS compiler options for debugging

Compiler option	Description
AGGREGATE	Specifies that a layout for arrays and major structures appears in the listing.
GONUMBER / GOSTMT	Tells the compiler to produce additional information specifying that line numbers from the source routine can be included in runtime messages and in the Language Environment dump.
INTERRUPT	Specifies that users can establish an ATTENTION ON-unit that gains control when an attention interrupt occurs.
LIST	Produces a listing of the assembler expansion of source code and global tables, literal pools, information about working storage, and size of working storage for the routine.
OFFSET	Displays the offset addresses relative to the entry point of each function.
SOURCE	Specifies that the compiler includes a listing of the source routine in the listing.
STORAGE	Includes a table of the main storage requirements for the object module in the listing.

Table 8. Enterprise PL/I for z/OS compiler options for debugging (continued)

Compiler option	Description
TEST	Specifies the level of testing capability that is generated as part of the object code. TEST also controls the location of test hooks and whether the symbol table is generated. Because the TEST option increases the size of the object code and can affect performance, limit the number and placement of hooks.
XREF and ATTRIBUTES	Creates a sorted cross-reference listing with attributes.

Using Language Environment runtime options

Several runtime options affect debugging in Language Environment. The TEST runtime option, for example, can be used with a debugging tool to specify the level of control the debugging tool has when the routine being initialized is started. The ABPERC, CHECK, DEPTHCONDLMT, DYNDUMP, ERRCOUNT, HEAPCHK, INTERRUPT, TERMTHDACT, TRACE, TRAP, and USRHDLR options affect condition handling. The ABTERMENC option affects how an application ends (that is, with an abend or with a return code and reason code) when an unhandled condition of severity 2 or greater occurs. Table 9 on page 8 lists the Language Environment runtime options that affect debugging. For more information about these runtime options, see *z/OS Language Environment Programming Reference*.

Table 9. Language Environment runtime options for debugging

Runtime option	Description
ABPERC	Specifies that the indicated abend code bypasses the condition handler.
ABTERMENC	Specifies enclave termination behavior for an enclave ending with an unhandled condition of severity 2 or greater.
CEEDUMP	Specifies options to control the processing of the Language Environment dump report.
CHECK	Determines if runtime checking is performed.
NODEBUG	Controls the COBOL USE FOR DEBUGGING declarative.
DEPTHCONDLMT	Specifies the limit for the depth of nested synchronous conditions in user-written condition handlers. (Asynchronous signals do not affect DEPTHCONDLMT.)
DYNDUMP	Provides a way to obtain IPCS-readable dumps of user applications that would ordinarily be lost due to the absence of a SYSMDUMP, SYSUDUMP, or SYSABEND DD statement
ERRCOUNT	Specifies the number of synchronous conditions of severity 2 or greater tolerated. (Asynchronous signals do not affect ERRCOUNT.)
HEAPCHK	Determines if additional heap check tests are performed.
HEAPZONES	Activates user heap overlay toleration and checking.
INFOMSGFILTER	Filters user specified informational messages from the MSGFILE. **Note:** Affects only those messages generated by Language Environment and any routine that calls CEEMSG. Other routines that write to the message file, such as CEEMOUT, do not have a filtering option.
INTERRUPT	Causes Language Environment to recognize attention interrupts.
MSGFILE	Specifies the ddname of the Language Environment message file.
MSGQ	Specifies the number of instance specific information (ISI) blocks that are allocated on a per-thread basis for use by an application. Located within the Language Environment condition token is an ISI token. The ISI contains information used by the condition manager to identify and react to a specific occurrence of a condition.

Runtime option	Description
PROFILE	Controls the use of an optional profiler tool, which collects performance data for the running application. When this option is in effect, the profiler is loaded and the debugger cannot be loaded. If the TEST option is in effect when PROFILE is specified, the profiler tool will not be loaded.
RPTOPTS	Produces a report that shows the runtime options in effect; see "Determining the runtime options in effect" on page 9.
RPTSTG	Generates a report of the storage that is used by an enclave; see "Controlling storage allocation" on page 11.
STORAGE	Specifies that Language Environment initializes all heap and stack storage to a user-specified value.
TERMTHDACT	Controls response when an enclave terminates due to an unhandled condition of severity 2 or greater.
TEST	Specifies the conditions under which a debugging tool assumes control.
TRACE	Activates Language Environment runtime library tracing and controls the size of the trace table, the type of trace, and whether the trace table should be dumped unconditionally upon termination of the application.
TRAP	When TRAP is set to ON, Language Environment traps routine interrupts and abends, and optionally prints trace information or invokes a user-written condition handling routine. With TRAP set to OFF, the operating system handles all interrupts and abends. You should generally set TRAP to ON, or your runtime results can be unpredictable.
USRHDLR	Specifies the behavior of two user-written condition handlers. The first handler that is specified will be registered at stack frame 0. The second handler that is specified will be registered before any other user-written condition handlers once the handler is enabled by a condition.
XUFLOW	Specifies if an exponent underflow causes a routine interrupt.

Table 9. Language Environment runtime options for debugging (continued)

Determining the runtime options in effect

The runtime options in effect at the time the routine is run can affect routine behavior. Use RPTOPTS(ON) to generate an options report in the Language Environment message file when your routine terminates. The options report lists runtime options, and indicates where they were set. Figure 1 on page 10 shows a sample options report.

```
Options Report for Enclave main 09/17/21 03:30:35 PM
Language Environment V02 R05.00

LAST WHERE SET               OPTION
-------------------------------------------------------------------------------
IBM-supplied default           ABPERC(NONE)
IBM-supplied default           ABTERMENC(ABEND)
IBM-supplied default         NOAIXBLD
IBM-supplied default           ALL31(ON)
IBM-supplied default           ANYHEAP(16384,8192,ANYWHERE,FREE)
IBM-supplied default         NOAUTOTASK
IBM-supplied default           BELOWHEAP(8192,4096,FREE)
IBM-supplied default           CBLOPTS(ON)
IBM-supplied default           CBLPSHPOP(ON)
IBM-supplied default           CBLQDA(OFF)
IBM-supplied default           CEEDUMP(60,SYSOUT=*,FREE=END,SPIN=UNALLOC)
IBM-supplied default           CHECK(ON)
IBM-supplied default           COUNTRY(US)
IBM-supplied default         NODEBUG
IBM-supplied default           DEPTHCONDLMT(10)
IBM-supplied default           DYNDUMP(*USERID,NODYNAMIC,TDUMP)
IBM-supplied default           ENVAR("")
IBM-supplied default           ERRCOUNT(0)
IBM-supplied default           ERRUNIT(6)
IBM-supplied default           FILEHIST
IBM-supplied default           FILETAG(NOAUTOCVT,NOAUTOTAG)
Default setting              NOFLOW
PARMLIB(CEEPRMML)              HEAP(4194304,5242880,ANYWHERE,KEEP,8192,4096)
IBM-supplied default           HEAPCHK(OFF,1,0,0,0,1024,0,1024,0)
IBM-supplied default           HEAPPOOLS(OFF,8,10,32,10,128,10,256,10,1024,
                               10,2048,10,0,10,0,10,0,10,0,10,0,10,0,10)
IBM-supplied default           HEAPZONES(0,ABEND,0,ABEND)
```

```
IBM-supplied default           INFOMSGFILTER(OFF,,,,)
IBM-supplied default           INQPCOPN
IBM-supplied default           INTERRUPT(OFF)
IBM-supplied default           LIBSTACK(4096,4096,FREE)
IBM-supplied default           MSGFILE(SYSOUT,FBA,121,0,NOENQ)
IBM-supplied default           MSGQ(15)
IBM-supplied default           NATLANG(ENU)
Ignored                      NONONIPTSTACK(See THREADSTACK)
IBM-supplied default           OCSTATUS
IBM-supplied default           PAGEFRAMESIZE(4K,4K,4K)
IBM-supplied default         NOPC
IBM-supplied default           PLITASKCOUNT(20)
IBM-supplied default           POSIX(OFF)
IBM-supplied default           PROFILE(OFF,"")
IBM-supplied default           PRTUNIT(6)
IBM-supplied default           PUNUNIT(7)
IBM-supplied default           RDRUNIT(5)
IBM-supplied default           RECPAD(OFF)
Invocation command             RPTOPTS(ON)
SETCEE command                 RPTSTG(ON)
IBM-supplied default         NORTEREUS
IBM-supplied default         NOSIMVRD
IBM-supplied default           STACK(131072,131072,ANYWHERE,KEEP,524288,131072)
IBM-supplied default           STORAGE(NONE,NONE,NONE,0)
IBM-supplied default           TERMTHDACT(TRACE,,96)
IBM-supplied default         NOTEST(ALL,"*","PROMPT","INSPPREF")
IBM-supplied default           THREADHEAP(4096,4096,ANYWHERE,KEEP)
IBM-supplied default           THREADSTACK(OFF,4096,4096,ANYWHERE,KEEP,131072,
                               131072)
IBM-supplied default           TRACE(OFF,4096,DUMP,LE=0)
IBM-supplied default           TRAP(ON,SPIE)
IBM-supplied default           UPSI(00000000)
IBM-supplied default         NOUSRHDLR(,)
IBM-supplied default           VCTRSAVE(OFF)
IBM-supplied default           XPLINK(OFF)
IBM-supplied default           XUFLOW(AUTO)
```

Figure 1. Options report example produced by runtime option RPTOPTS(ON)

Understanding the HEAPZONES and HEAPCHK runtime options

The HEAPZONES and HEAPCHK runtime options are useful for debugging overlay damage problems that occur in the user heap. Though similar in that both options can be used for debugging purposes, the runtime options activate very different behavior in the runtime when specified.

HEAPZONES is a lightweight mechanism that detects heap overlay damage only during the freeing of an element. It looks for damage in the heap check zone of the freed element only.

Selecting a non-quiet output option causes HEAPZONES to display information about the damaged heap element. When messaging is requested, the address of the damaged element along with information specific to the heap check zone are included in the message. Depending on the type of damage, the value of the heap check zone is displayed. The data area of the damaged location is displayed following any issued informational messages. This runtime option can also be used as a mechanism to tolerate heap overlay damage by simply requesting no output (QUIET).

Depending on the size of the heap check zone and the number of allocation requests, the user may notice a significant amount of extra storage being used by the application. Performance may be affected due to the overhead of examining each heap check zone.

HEAPCHK investigates the entire user heap for damage during heap related calls at a frequency based on the specified settings in the option. Because HEAPCHK will traverse the entire user heap, a slow down in application performance will occur. Information about HEAPCHK diagnostic output is discussed in Chapter 3, "Using Language Environment debugging facilities," on page 33.

When deciding which runtime option is better suited to use with your application, consider the differences between HEAPZONES and HEAPCHK relating to performance, storage usage, and time of damage detection. Although both runtime options affect performance, an application that chooses HEAPCHK will perform slower than an application that chooses HEAPZONES. If storage usage is a concern, HEAPCHK will not consume extra amounts of storage in the manner that HEAPZONES will. Determining when heap damage has occurred may be simpler to accomplish if HEAPCHK is chosen because of the frequency and scope of its analysis.

For more information about the HEAPZONES runtime option, see HEAPZONES in *z/OS Language Environment Programming Reference*.

For more information about the HEAPCHK runtime option, see HEAPCHK in *z/OS Language Environment Programming Reference*.

Using the CLER CICS transaction to display and set runtime options

The CICS transaction CLER allows you to display all the current Language Environment runtime options for a region, and to modify a subset of these options. For more information about the CICS CLER transaction, see "Displaying and modifying runtime options with the CLER transaction" on page 319.

Controlling storage allocation

The following runtime options control storage allocation:

- STACK
- THREADSTACK
- LIBSTACK
- THREADHEAP
- HEAP
- ANYHEAP
- BELOWHEAP
- STORAGE
- HEAPPOOLS

To generate a report of the storage a routine (or more specifically, an enclave) used during its run, specify the RPTSTG(ON) runtime option. The storage report, generated during enclave termination provides statistics that can help you understand how space is being consumed as the enclave runs. If you want to tune storage management, the statistics can help you set the corresponding storage-related runtime options for future runs. The output is written to the Language Environment message file. For more information about tuning, see Tuning heap storage in *z/OS Language Environment Programming Guide*.

Neither the storage report nor the corresponding runtime options include the storage that Language Environment acquires during early initialization, before runtime options processing, and before the start of space management monitoring. In addition, Language Environment does not report alternative Vendor Heap Manager activity.

Figure 2 on page 12 and Figure 4 on page 14 are examples of storage reports that are produced when RPTSTG(ON) is specified. The sections that follow these reports describe the contents of the reports.

```
 Storage Report for Enclave main 09/17/21 03:31:45 PM
Language Environment V02 R05.00

     STACK statistics:
       Initial size:                                        4096
       Increment size:                                      4096
       Maximum used by all concurrent threads:              7488
       Largest used by any thread:                          7488
       Number of segments allocated:                           2
       Number of segments freed:                               0
     THREADSTACK statistics:
       Initial size:                                        4096
       Increment size:                                      4096
       Maximum used by all concurrent threads:              3352
       Largest used by any thread:                          3352
       Number of segments allocated:                           6
       Number of segments freed:                               0
     LIBSTACK statistics:
       Initial size:                                        4096
       Increment size:                                      4096
       Maximum used by all concurrent threads:                 0
       Largest used by any thread:                             0
       Number of segments allocated:                           0
       Number of segments freed:                               0
     THREADHEAP statistics:
       Initial size:                                        4096
       Increment size:                                      4096
       Maximum used by all concurrent threads:                 0
       Largest used by any thread:                             0
       Successful Get Heap requests:                           0
       Successful Free Heap requests:                          0
       Number of segments allocated:                           0
       Number of segments freed:                               0
```

Figure 2. Storage report produced by runtime option RPTSTG(ON)

```
  HEAP statistics:
       Initial size:                                        49152
       Increment size:                                      16384
       Total heap storage used (sugg. initial size):        29112
       Successful Get Heap requests:                          251
       Successful Free Heap requests:                         218
       Number of segments allocated:                            1
       Number of segments freed:                                0
     HEAP24 statistics:
       Initial size:                                         8192
       Increment size:                                       4096
       Total heap storage used (sugg. initial size):            0
       Successful Get Heap requests:                            0
       Successful Free Heap requests:                           0
       Number of segments allocated:                            0
       Number of segments freed:                                0
     ANYHEAP statistics:
       Initial size:                                        32768
       Increment size:                                      16384
       Total heap storage used (sugg. initial size):       104696
       Successful Get Heap requests:                           28
       Successful Free Heap requests:                          15
       Number of segments allocated:                            6
       Number of segments freed:                                5
     BELOWHEAP statistics:
       Initial size:                                         8192
       Increment size:                                       8192
       Total heap storage used (sugg. initial size):            0
       Successful Get Heap requests:                            0
       Successful Free Heap requests:                           0
       Number of segments allocated:                            0
       Number of segments freed:                                0
     Additional Heap statistics:
       Successful Create Heap requests:                         1
       Successful Discard Heap requests:                        1
       Total heap storage used:                              4912
       Successful Get Heap requests:                            3
       Successful Free Heap requests:                           3
       Number of segments allocated:                            2
       Number of segments freed:                                2
     Largest number of threads concurrently active:             2
 End of Storage Report
```

Figure 3. Storage report produced by runtime option RPTSTG(ON) (continued)

Figure 4 on page 14 shows an example of a storage report that is produced with XPLINK

```
 Storage Report for Enclave main 09/17/21 03:31:45 PM
Language Environment V02 R05.00

    STACK statistics:
      Initial size:                                    131072
      Increment size:                                  131072
      Maximum used by all concurrent threads:            5416
      Largest used by any thread:                        5416
      Number of segments allocated:                         1
      Number of segments freed:                             0
    THREADSTACK statistics:
      Initial size:                                      4096
      Increment size:                                    4096
      Maximum used by all concurrent threads:           45536
      Largest used by any thread:                        6552
      Number of segments allocated:                        60
      Number of segments freed:                             0
    XPLINK STACK statistics:
      Initial size:                                    524288
      Increment size:                                  131072
      Largest used by any thread:                       20400
      Number of segments allocated:                         1
      Number of segments freed:                             0
    XPLINK THREADSTACK statistics:
      Initial size:                                    131072
      Increment size:                                  131072
      Largest used by any thread:                       22160
      Number of segments allocated:                        30
      Number of segments freed:                             0
    LIBSTACK statistics:
      Initial size:                                      4096
      Increment size:                                    4096
      Maximum used by all concurrent threads:               0
      Largest used by any thread:                           0
      Number of segments allocated:                         0
      Number of segments freed:                             0
    THREADHEAP statistics:
      Initial size:                                      4096
      Increment size:                                    4096
      Maximum used by all concurrent threads:               0
      Largest used by any thread:                           0
      Successful Get Heap requests:                         0
      Successful Free Heap requests:                        0
      Number of segments allocated:                         0
      Number of segments freed:                             0
    HEAP statistics:
      Initial size:                                     32768
      Increment size:                                   32768
      Total heap storage used (sugg. initial size):    286576
      Successful Get Heap requests:                        71
      Successful Free Heap requests:                        1
      Number of segments allocated:                        10
      Number of segments freed:                             0
```

Figure 4. Storage report produced by RPTSTG(ON) with XPLINK

```
HEAP24 statistics:
  Initial size:                                         8192
  Increment size:                                       4096
  Total heap storage used (sugg. initial size):            0
  Successful Get Heap requests:                            0
  Successful Free Heap requests:                           0
  Number of segments allocated:                            0
  Number of segments freed:                                0
ANYHEAP statistics:
  Initial size:                                        16384
  Increment size:                                       8192
  Total heap storage used (sugg. initial size):      1139712
  Successful Get Heap requests:                          487
  Successful Free Heap requests:                         431
  Number of segments allocated:                           50
  Number of segments freed:                               36
BELOWHEAP statistics:
  Initial size:                                         8192
  Increment size:                                       4096
  Total heap storage used (sugg. initial size):            0
  Successful Get Heap requests:                            0
  Successful Free Heap requests:                           0
  Number of segments allocated:                            0
  Number of segments freed:                                0
Additional Heap statistics:
  Successful Create Heap requests:                         0
  Successful Discard Heap requests:                        0
  Total heap storage used:                                 0
  Successful Get Heap requests:                            0
  Successful Free Heap requests:                           0
  Number of segments allocated:                            0
  Number of segments freed:                                0
HEAPPOOLS Statistics:
  Pool  1     size:     8 Get Requests:          3
    Successful Get Heap requests:     1-    8              3
  Pool  2     size:    32 Get Requests:        268
    Successful Get Heap requests:     9-   16             36
    Successful Get Heap requests:    17-   24              3
    Successful Get Heap requests:    25-   32            229
  Pool  3     size:   128 Get Requests:        186
    Successful Get Heap requests:    33-   40              3
    Successful Get Heap requests:    41-   48              8
    Successful Get Heap requests:    49-   56            111
    Successful Get Heap requests:    57-   64              4
    Successful Get Heap requests:    65-   72              2
    Successful Get Heap requests:    73-   80              4
    Successful Get Heap requests:    81-   88              6
    Successful Get Heap requests:    89-   96              2
    Successful Get Heap requests:    97-  104              1
    Successful Get Heap requests:   105-  112              5
    Successful Get Heap requests:   113-  120             31
    Successful Get Heap requests:   121-  128              9
```

Figure 5. Storage report produced by RPTSTG(ON) with XPLINK (continued)

```
      Pool  4     size:   256 Get Requests:          38
         Successful Get Heap requests:   137-  144               2
         Successful Get Heap requests:   145-  152               2
         Successful Get Heap requests:   153-  160               2
         Successful Get Heap requests:   161-  168               1
         Successful Get Heap requests:   169-  176               4
         Successful Get Heap requests:   177-  184               4
         Successful Get Heap requests:   185-  192               2
         Successful Get Heap requests:   193-  200               2
         Successful Get Heap requests:   201-  208               3
         Successful Get Heap requests:   209-  216               2
         Successful Get Heap requests:   217-  224               3
         Successful Get Heap requests:   225-  232               3
         Successful Get Heap requests:   233-  240               1
         Successful Get Heap requests:   241-  248               3
         Successful Get Heap requests:   249-  256               4
       Pool  5.1   size:  1024 Get Requests:         230
       Pool  5.2   size:  1024 Get Requests:           3
       Pool  5.3   size:  1024 Get Requests:           5
         Successful Get Heap requests:   257-  264             225
         Successful Get Heap requests:   273-  280               2
         Successful Get Heap requests:   281-  288              10
         Successful Get Heap requests:   841-  848               1
       Pool  6     size:  2048 Get Requests:           2
         Successful Get Heap requests:  1113- 1120               1
         Successful Get Heap requests:  1137- 1144               1
       Requests greater than the largest cell size:            2
     HEAPPOOLS Summary:
       Specified Element   Extent   Cells Per  Extents    Maximum      Cells In
       Cell Size Size      Percent  Extent     Allocated  Cells Used   Use
       ------------------------------------------------------------------------
             8       16     10        204          1          1           0
            32       40     10         81          3        226         225
           128      136     10         24          4         88          77
           256      264     10         12          1          1           0
          1024     1032     10          4         57        228         227
          1024     1032     10          4          1          2           0
          1024     1032     10          4          1          3           0
          2048     2056     10          4          1          2           2
       ------------------------------------------------------------------------
       Suggested Percentages for current Cell Sizes:
         HEAPP(ON,8,1,32,28,128,37,256,1,(1024,3),90,2048,13,0)
       Suggested Cell Sizes:
         HEAPP(ON,
               32,,56,,88,,120,,128,,168,,
               208,,248,,288,,848,,1144,,2080,)
     Largest number of threads concurrently active:           11
 End of Storage Report
```

Figure 6. Storage report produced by RPTSTG(ON) with XPLINK (continued)

The statistics for initial and incremental allocations of storage types that have a corresponding runtime option differ from the runtime option settings when their values have been rounded up by the implementation, or when allocations larger than the amounts specified were required during execution. All of the following are rounded up to an integral number of double-words:

- Initial STACK allocations
- Initial allocations of THREADSTACK
- Initial allocations of all types of heap
- Incremental allocations of all types of stack and heap

The runtime options should be tuned appropriately to avoid performance problems. See *z/OS Language Environment Programming Guide* for tips on tuning.

Stack storage statistics

Language Environment stack storage is managed at the thread level; each thread has its own stack-type resources. Table 10 on page 17 describes the fields in the storage report that contain various statistics about stack storage.

Table 10. Storage report fields that display stack storage statistics	
Statistics categories	**Field contents**
• STACK • THREADSTACK • LIBSTACK • IPT STACK	The following fields display statistics for the upward-growing stack. **Initial size** Actual size of the initial segment assigned to each thread. If a pthread-attributes-table is provided on the invocation of pthread-create, then the stack size specified in the pthread-attributes-table will take precedence over the STACK runtime option. **Increment size** Size of each incremental segment acquired, as determined by the increment portion of the corresponding runtime option. **Maximum used by all concurrent threads** Maximum amount allocated in total at any one time by all concurrently executing threads. **Largest used by any thread** Largest amount allocated ever by any single thread. **Number of segments allocated** Number of segments allocated by all threads which includes the initial segments. **Number of segments freed** Number of incremental segments freed by all threads during the life of the threads. This does not include any incremental segments that were freed during thread termination.
• XPLINK STACK • XPLINK THREADSTACK	The following sections of the storage report display statistics for the downward-growing stack; they are only apply if XPLINK is in effect. **Initial size** Actual size of the initial segment assigned to each thread. **Increment size** Size of each incremental segment acquired, as determined by the increment portion of the corresponding runtime option. **Maximum used by all concurrent threads** Maximum amount allocated in total at any one time by all concurrently executing threads. **Number of segments allocated** Number of segments allocated by all threads which includes the initial segments. **Number of segments freed** Number of incremental segments freed by all threads during the life of the threads. This does not include any incremental segments that were freed during thread termination.

Determining the applicable threads

If the application is not a multithreading or PL/I multitasking application, then the STACK statistics are for the one and only thread that executed, and the THREADSTACK statistics are all zero.

If the application is a multithreading or PL/I multitasking application, and THREADSTACK(ON) was specified, then the STACK statistics are for the initial thread (the IPT), and the THREADSTACK statistics are for the other threads. However, if THREADSTACK(OFF) was specified, then the STACK statistics are for all of the threads, initial and other.

Allocating stack storage

Another type of stack, called the reserve stack, is allocated for each thread and used to handle out-of-storage conditions. Its size is controlled by the 4th subparameter of the STORAGE runtime option, but its usage is neither tracked nor reported in the storage report.

In a single-threaded environment, Language Environment allocates the initial segments for STACK, LIBSTACK and reserve stack using GETMAIN. The LIBSTACK initial segment allocation is deferred until first use, except when STACK(,,BELOW,,) is in effect. The reserve stack is allocated with STACK. In a multi-threaded POSIX(ON) environment, allocation of stack storage for the initial processing thread (IPT) is the same as the single-threaded environment. For threads other than the IPT, the initial STACK (or THREADSTACK) segment and reserve stack is allocated from ANYHEAP or BELOWHEAP, according to the STACK (or THREADSTACK) location. The initial LIBSTACK segment allocation is again deferred until first use, except when STACK(,,BELOW,,) or THREADSTACK(ON,,,BELOW,,) is in effect. When a STACK, THREADSTACK, or LIBSTACK overflow occurs on any thread, Language Environment obtains the new segment using GETMAIN. The reserve stack does not tolerate overflow.

Heap storage statistics

Language Environment heap storage, other than what is explicitly defined using THREADHEAP, is managed at the enclave level. Each enclave has its own heap-type resources, which are shared by the threads that execute within the enclave. Heap storage defined using THREADHEAP is controlled at the thread level.

Table 11 on page 18 describes the fields in the storage report that contain various statistics about heap storage. These statistics, in all cases, specify totals for the whole enclave. For THREADHEAP, they indicate the total across all threads in the enclave.

Table 11. Storage report fields that display heap storage statistics

Statistics categories	Field contents
THREADHEAP	**Initial size** Default initial allocation, as specified by the corresponding runtime option. For HEAP24, the initial size is the value of the *initsz24* of the HEAP option. **Increment size** Minimum incremental allocation, as specified by the corresponding runtime option. For HEAP24, the increment size is the value of the *incrsz24* of the HEAP option. **Maximum used by all concurrent threads** Maximum total amount used by all concurrent threads at any one time. **Largest used by any thread** Largest amount used by any single thread **Successful Get Heap requests** Number of Get Heap requests. **Successful Free Heap requests** Number of Free Heap requests. **Number of segments allocated** Number of incremental segments allocated. **Number of segments freed** Number of incremental segments individually freed.

Statistics categories	Field contents
• HEAP • HEAP24 • ANYHEAP • BELOWHEAP	**Initial size** Default initial allocation, as specified by the corresponding runtime option. For HEAP24, the initial size is the value of the *initsz24* of the HEAP option. **Increment size** Minimum incremental allocation, as specified by the corresponding runtime option. For HEAP24, the increment size is the value of the *incrsz24* of the HEAP option.. **Total heap storage used** Largest total amount used by the enclave at any one time. **Successful Get Heap requests** Number of Get Heap requests. **Successful Free Heap requests** Number of Free Heap requests. The number of Free Heap requests could be less than the number of Get Heap requests if the pieces of heap storage acquired by individual Get Heap requests were not freed individually, but rather were freed implicitly in the course of enclave termination. **Number of segments allocated** Number of incremental segments allocated. **Number of segments freed** Number of incremental segments individually freed. The number of incremental segments individually freed could be less than the number allocated if the segments were not freed individually, but rather were freed implicitly in the course of enclave termination.
Additional heap statistics	Besides the fixed types of heap, additional types of heap can be created, each with its own heap ID. You can create and discard these additional types of heap by using the CEECRHP callable service. **Successful Create Heap requests** Number of successful Create Heap requests. **Successful Discard Heap requests** Number of successful Discard Heap requests. The number of Discard Heap requests could be less than the number of Create Heap requests if the special heaps allocated by individual Create Heap requests were not freed individually, but rather were freed implicitly in the course of enclave termination. **Total heap storage used** Largest total amount used by the enclave at any one time. **Successful Get Heap requests** Number of Get Heap requests. **Successful Free Heap requests** Number of Free Heap requests. **Number of segments allocated** Number of incremental segments allocated. **Number of segments freed** Number of incremental segments individually freed.

Table 11. Storage report fields that display heap storage statistics (continued)

HEAPPOOLS storage statistics

The HEAPPOOLS runtime option (for C/C++ applications only) controls usage of the HEAPPOOLS storage algorithm at the enclave level. The HEAPPOOLS algorithm allows for the definition of one to twelve heap pools, each consisting of a number of storage cells of a specified length. For further details regarding HEAPPOOLS storage statistics in the storage report, see "HEAPPOOLS storage statistics" on page 214.

Modifying condition handling behavior

Setting the condition handling behavior of your routine affects the response that occurs when the routine encounters an error. You can modify condition handling behavior in the following ways:

- Callable services
- Runtime options
- User-written condition handlers
- POSIX functions (used to specifically set signal actions and signal masks)

Language Environment callable services

Table 12 on page 20 lists the callable services that you can use to modify condition handling. For more information about callable services, see Language Environment callable services in *z/OS Language Environment Programming Reference*.Note that Fortran programs cannot directly call Language Environment callable services. For more information about how to invoke callable services from Fortran, see *Language Environment for MVS & VM Fortran Run-Time Migration Guide*.

Table 12. Callable services that modify condition handling

Name	Description
CEE3ABD	Terminates an enclave using an abend.
CEE3AB2	Terminate enclave with an abend and reason code.
CEEMRCE	Moves the resume cursor to an explicit location where resumption is to occur after a condition has been handled.
CEEMRCR	Moves the resume cursor relative to the current position of the handle cursor.
CEE3CIB	Returns a pointer to a condition information block (CIB) associated with a given condition token. The CIB contains detailed information about the condition.
CEE3GRO	Returns the offset of the location within the most current Language Environment-conforming routine where a condition occurred.
CEE3SPM	Specifies the settings of the routine mask. The routine mask controls: • Fixed overflow • Decimal overflow • Exponent underflow • Significance You can use CEE3SPM to modify Language Environment hardware conditions. Because such modifications can affect the behavior of your routine, however, you should be careful when doing so.
CEE3SRP	Sets a resume point within user application code to resume from a Language Environment user condition handler.

Language Environment runtime options

Table 13 on page 21 shows the Language Environment runtime options that can affect your routine's condition handling behavior.

Table 13. Runtime options that modify condition handling

Runtime option	Description
ABPERC	Specifies a system- or user-specified abend code that percolates without further action while the Language Environment condition handler is enabled. Normal condition handling activities are performed for everything except the specified abend code. System abends are specified as S*hhh*, where *hhh* is a hexadecimal system abend code. User abends are specified as U*dddd*, where *dddd* is a decimal user abend code. Any other 4-character EBCDIC string, such as NONE, that is not of the form S*hhh* can also be specified as a user-specified abend code. You can specify only one abend code with this option. This option assumes the use of TRAP(ON). ABPERC is not supported in CICS. Language Environment ignores ABPERC(0Cx). No abend is percolated and Language Environment condition handling semantics are in effect.
CHECK	Specifies that checking errors within an application are detected. The Language Environment-conforming languages can define error checking differently.
DEPTHCONDLMT	Limits the extent to which synchronous conditions can be nested in a user-written condition handler. (Asynchronous signals do not affect DEPTHCONDLMT.) For example, if you specify 5, the initial condition and four nested conditions are processed. If the limit is exceeded, the application terminates with abend code 4091 and reason code 21 (X'15').
ERRCOUNT	Specifies the number of synchronous conditions of severity 2, 3, and 4 that are tolerated before the enclave terminates abnormally. (Asynchronous signals do not affect ERRCOUNT.) If you specify 0 an unlimited number of conditions is tolerated.
INTERRUPT	Causes attentions recognized by the host operating system to be passed to and recognized by Language Environment after the environment has been initialized.
TERMTHDACT	Sets the level of information that is produced when a condition of severity 2 or greater remains unhandled within the enclave. The parameter settings for different levels of information include: • QUIET for no information • MSG for message only • TRACE for message and a traceback • DUMP for message, traceback, and Language Environment dump • UAONLY for message and a system dump of the user address space • UATRACE for message, Language Environment dump with traceback information only, and a system dump of the user address space • UADUMP for message, traceback, Language Environment dump, and system dump • UAIMM for a system dump of the user address space of the original abend or program interrupt prior to the Language Environment condition manager processing the condition.
TRAP(ON)	Fully enables the Language Environment condition handler. This causes the Language Environment condition handler to intercept error conditions and routine interrupts. During typical operation, you should use TRAP(ON) when running your applications. When TRAP(ON,NOSPIE) is specified, Language Environment handles all program interrupts and abends through an ESTAE. Use this feature when you do not want Language Environment to issue an ESPIE macro.

Table 13. Runtime options that modify condition handling (continued)

Runtime option	Description
TRAP(OFF)	Disables the Language Environment condition handler from handling abends and program checks/interrupts. ESPIE is not issued with TRAP(OFF), it is still possible to invoke the condition handler through the CEESGL callable service and pass conditions to registered user-written condition handlers. Specify TRAP(OFF) when you do not want Language Environment to issue an ESTAE or an ESPIE. However, TRAP(OFF) can cause several unexpected side effects. For more information, see the TRAP runtime option in TRAP in *z/OS Language Environment Programming Reference*. When TRAP(OFF), TRAP(OFF,SPIE), or TRAP(OFF,NOSPIE) is specified and either a program interrupt or abend occurs, the user exit for termination is ignored.
USRHDLR	Specifies the behavior of two user-written condition handlers. The first handler specified will be registered at stack frame 0. The second handler specified will be registered before any other user-written condition handlers, once the handler is enabled by a condition. When you specify USRHDLR(*lastname*,*supername*), *lastname* gets control at stack frame 0. The *supername* will get control first, before any user-written condition handlers but after *supername* has gone through the enablement phase, when a condition occurs.
XUFLOW	Specifies if an exponent underflow causes a routine interrupt.

Customizing condition handlers

User-written condition handlers permit you to customize condition handling for certain conditions. You can register a user-written condition handler for the current stack frame by using the CEEHDLR callable service. You can use the Language Environment USRHDLR runtime option to register a user-written condition handler for stack frame 0. You can also use USRHDLR to register a user-written condition handler before any other user condition handlers.

When the Language Environment condition manager encounters the condition, it requests that the condition handler associated with the current stack frame handle the condition. If the condition is not handled, the Language Environment condition manager percolates the condition to the next (earlier) stack frame, and so forth to earlier stack frames until the condition has been handled. Conditions that remain unhandled after the first (earliest) stack frame has been reached are presented to the Language Environment condition handler. One of the following Language Environment default actions is then taken, depending on the severity of the condition:

- Resume
- Percolate
- Promote
- Fix-up and resume

For more information about user-written condition handlers, see Coding a user-written condition handler in *z/OS Language Environment Programming Guide*.

Invoking the assembler user exit

For debugging purposes, the CEEBXITA assembler user exit can be invoked during:

- Enclave initialization
- Enclave termination
- Process termination

The functions of the CEEBXITA user exit depend on when the user exit is invoked and whether it is application-specific or installation-wide. Application-specific user exits must be linked with the application load module and run only when that application runs. Installation-wide user exits must be linked with the Language Environment initialization/termination library routines and run with all Language Environment library routines. Because an application-specific user exit has priority over any installation-wide user exit, you can customize a user exit for a particular application without affecting the user exit for any other applications.

At enclave initialization, the CEEBXITA user exit runs prior to the enclave establishment. Thus you can modify the environment in which your application runs in the following ways:

- Specify runtime options
- Allocate data sets/files in the user exit
- List abend codes to be passed to the operating system
- Check the values of routine arguments

At enclave termination, the CEEBXITA user exit runs prior to the termination activity. Thus, you can request an abend and perform specified actions based on received return and reason codes. (This does not apply when Language Environment terminates with an abend.)

At process termination, the CEEBXITA user exit runs after the enclave termination activity completes. Thus you can request an abend and deallocate files.

The assembler user exit must have an entry point of CEEBXITA, must be reentrant, and must be capable of running in AMODE(ANY) and RMODE(ANY).

You can use the assembler user exit to establish enclave termination behavior for an enclave ending with an unhandled condition of severity 2 or greater in the following ways:

- If you do not request an abend in the assembler user exit for the enclave termination call, Language Environment honors the setting of the ABTERMENC option to determine how to end the enclave.
- If you request an abend in the assembler user exit for the enclave termination call, Language Environment issues an abend to end the enclave.

For more information about the assembler user exit, see CEEBXITA assembler user exit interface in *z/OS Language Environment Programming Guide*.

Establishing enclave termination behavior for unhandled conditions

To establish enclave termination behavior when an unhandled condition of severity 2 or greater occurs, use one of the following methods:

- The assembler user exit. For more information, see "Invoking the assembler user exit" on page 22.
- POSIX signal default action. For more information, see Language Environment and POSIX signal handling interactions in *z/OS Language Environment Programming Guide*.
- The ABTERMENC runtime option. The ABTERMENC runtime option sets the enclave termination behavior for an enclave ending with an unhandled condition of severity 2 or greater.

  If you specify the IBM-supplied default suboption ABEND, Language Environment issues an abend to end the enclave regardless of the setting of the CEEAUE_ABND flag. Additionally, the assembler user exit can alter the abend code, abend reason code, abend dump attribute, and the abend task/step attribute. For more information about using ABTERMENC, see ABTERMENC in *z/OS Language Environment Programming Reference*. For more information about the assembler user exit, see CEEBXITA assembler user exit interface in *z/OS Language Environment Programming Guide*.

  If you specify the RETCODE suboption, Language Environment uses the CEEAUE_ABND flag value set by the assembler user exit (which is called for enclave termination) to determine whether to issue an abend to end the enclave when an unhandled condition of severity 2 or greater occurs.

Using messages in your routine

You can create messages and use them in your routine to indicate the status and progress of the routine during run time, and to display variable values. The process of creating messages and using them requires that you create a message source file, and convert the source file into loadable code for use in your routine.

You can use the Language Environment callable service CEEMOUT to direct user-created message output to the Language Environment message file. To direct the message output to another destination, use the Language Environment MSGFILE runtime option to specify the ddname of the file.

When multiple Language Environment environments are running in the same address space and the same MSGFILE ddname is specified, writing contention can occur. To avoid contention, use the MSGFILE suboption ENQ. ENQ tells Language Environment to perform serialization around writes to the MSGFILE ddname specified which eliminates writing contention. Writing contention can also be eliminated by specifying unique MSGFILE ddnames.

Each Language Environment-conforming language also provides ways to display both user-created and runtime messages. (For an explanation of Language Environment runtime messages, see "Interpreting runtime messages" on page 28.)

The following sections discuss how to create messages in each of the HLLs. For a more detailed explanation of how to create messages and use them in C, C/C++, COBOL, Fortran, or PL/I routines, see *z/OS Language Environment Programming Guide*.

C/C++

For C/C++ routines, output from the `printf` function is directed to `stdout`, which is associated with SYSPRINT. All C/C++ runtime messages and perror() messages are directed to `stderr`. `stderr` corresponds to the ddname associated with the Language Environment MSGFILE runtime option. The destination of the `printf` function output can be changed by using the redirection 1>&2 at routine invocation to redirect `stdout` to the `stderr` destination. Both streams can be controlled by the MSGFILE runtime option.

COBOL

For COBOL programs, you can use the DISPLAY statement to display messages. Output from the DISPLAY statement is directed to SYSOUT. SYSOUT is the IBM-supplied default for the Language Environment message file. The OUTDD compiler option can be used to change the destination of the DISPLAY messages.

Fortran

For Fortran programs, runtime messages, output written to the print unit, and other output (such as output from the SDUMP callable service) are directed to the file specified by the MSGFILE runtime option. If the print unit is different than the error message unit (PRTUNIT and ERRUNIT runtime options have different values), however, output from the PRINT statement won't be directed to the Language Environment message file.

PL/I

Under PL/I, runtime messages are directed to the file specified in the Language Environment MSGFILE runtime option, instead of the PL/I SYSPRINT STREAM PRINT file. User-specified output is still directed to the PL/I SYSPRINT STREAM PRINT file. To direct this output to the Language Environment MSGFILE file, specify the runtime option MSGFILE(SYSPRINT).

Using condition information

If a condition that might require attention occurs while an application is running, Language Environment builds a condition token. The condition token contains 12 bytes (96 bits) of information about the condition that Language Environment or your routines can use to respond appropriately. Each condition is associated with a single Language Environment runtime message. You can use this condition information in two primary ways:

- To specify the feedback code parameter when calling Language Environment services (see "Using the feedback code parameter" on page 25).
- To code a symbolic feedback code in a user-written condition handler (see "Using the symbolic feedback code" on page 26).

Using the feedback code parameter

The feedback code is an optional parameter of the Language Environment callable services. (For COBOL/370 programs, you must provide the `fc` parameter in each call to a Language Environment callable service. For C/C++, Enterprise COBOL for z/OS, COBOL for OS/390, COBOL for MVS & VM, and PL/I routines, this parameter is optional. For more information about `fc` and condition tokens, see Understanding the structure of the condition token in *z/OS Language Environment Programming Guide*.

When you provide the feedback code (`fc`) parameter, the callable service in which the condition occurs sets the feedback code to a specific value called a condition token.

The condition token does not apply to asynchronous signals. For a discussion of the distinctions between synchronous signals and asynchronous signals with POSIX(ON), see Language Environment and POSIX signal handling interactions in *z/OS Language Environment Programming Guide*.

When you do not provide the `fc` parameter, any nonzero condition is signaled and processed by Language Environment condition handling routines. If you have registered a user-written condition handler, Language Environment passes control to the handler, which determines the next action to take. If the condition remains unhandled, Language Environment writes a message to the Language Environment message file. The message is the translation of the condition token into English (or another supported national language).

Language Environment provides callable services that can be used to convert condition tokens to routine variables, messages, or signaled conditions. Table 14 on page 25 lists these callable services and their functions.

Table 14. Callable services that can convert condition tokens to routine variables, messages, or signaled conditions

Callable service	Description
CEEMSG	Transforms the condition token into a message and writes the message to the message file.
CEEMGET	Transforms the condition token into a message and stores the message in a buffer.
CEEDCOD	Decodes the condition token; that is, separates it into distinct user-supplied variables. Also, if a language does not support structures, CEEDCOD provides direct access to the token.
CEESGL	Signals the condition. This passes control to any registered user-written condition handlers. If a user-written condition handler does not exist, or the condition is not handled, Language Environment by default writes the corresponding message to the message file and terminates the routine for severity 2 or higher. For severity 0 and 1, Language Environment continues without writing a message. COBOL, however, issues severity 1 messages before continuing. CEESGL can signal a POSIX condition. For more information about CEESGL, see CEESGL—Signal a condition in *z/OS Language Environment Programming Reference*.

There are two types of condition tokens. Case 1 condition tokens contain condition information, including the Language Environment message number. All Language Environment callable services and most application routines use case 1 condition tokens. Case 2 condition tokens contain condition information and a user-specified class and cause code. Application routines, user-written condition handlers, assembler user exits, and some operating systems can use case 2 condition tokens.

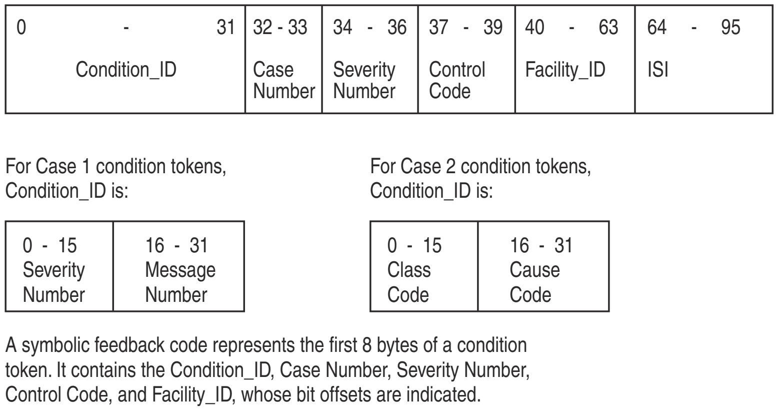


Figure 7. Language Environment condition token

For example, in the condition token: X'0003032D 59C3C5C5 00000000'

- X'0003' is severity.
- X'032D' is message number 813.
- X'59' are hexadecimal flags for case, severity, and control.
- X'C3C5C5' is the CEE facility ID.
- X'00000000' is the ISI. (In this case, no ISI was provided.)

If a Language Environment traceback or dump is generated while a condition token is being processed or when a condition exists, Language Environment writes the runtime message to the condition section of the traceback or dump. If a condition is detected when a callable service is invoked without a feedback code, the condition token is passed to the Language Environment condition manager. The condition manager polls active condition handlers for a response. If a condition of severity 0 or 1 remains unhandled, Language Environment resumes without issuing a message. Language Environment does issue messages, however, for COBOL severity 1 conditions. For unhandled conditions of severity 2 or greater, Language Environment issues a message and terminates. For a list of Language Environment runtime messages and corrective information, see *z/OS Language Environment Runtime Messages*.

If a second condition is raised while Language Environment is attempting to handle a condition, the message `CEE0374C CONDITION = <message no.>` is displayed using a write-to-operator (WTO). The message number in the CEE0374C message indicates the original condition that was being handled when the second condition was raised. This can happen when a critical error is signaled (for example, when internal control blocks are damaged).

If the output for this error message appears several times in sequence, the conditions appear in order of occurrence. Correcting the earliest condition can cause your application to run successfully.

Using the symbolic feedback code

The symbolic feedback code represents the first 8 bytes of a 12-byte condition token. You can think of the symbolic feedback code as the nickname for a condition. As such, the symbolic feedback code can be used in user-written condition handlers to screen for a given condition, even if it occurs at different locations in an application. For more information about symbolic feedback codes, see Using symbolic feedback codes in *z/OS Language Environment Programming Guide*.

Chapter 2. Classifying errors

This chapter describes errors that commonly occur in Language Environment routines. It also explains how to use runtime messages and abend codes to obtain information about errors in your routine.

Identifying problems in routines

The following sections describe how you can identify errors in Language Environment routines. Included are common error symptoms and solutions.

Language Environment module names

You can identify Language Environment-supplied module elements by any of the following three-character prefixes:

- CEE (Language Environment)
- CEL (Language Environment and C/C++ runtime library)
- EDC (C/C++)
- FOR (Fortran)
- IBM (PL/I)
- IGZ (COBOL)

Module elements or text files with other prefixes are not part of the Language Environment product.

Common errors in routines

These common errors have simple solutions:

- If you do not have enough virtual storage, increase your region size or decrease your storage usage (stack size) by using the storage-related runtime options and callable services. (See "Controlling storage allocation" on page 11 for information about using storage in routines.)
- If you do not have enough disk space, increase your disk allocation.
- If executable files are not available, check your executable library to ensure that they are defined. For example, check your STEPLIB or JOBLIB definitions.

If your error is not caused by any of these items, examine your routine or routines for changes since the last successful run. If there have been changes, review these changes for errors that might be causing the problem. One way to isolate the problem is to branch around or comment out recent changes and rerun the routine. If the run is successful, the error can be narrowed to the scope of the changes.

Duplicate names that are shared between Fortran routines and C library routines can produce unexpected results. Language Environment provides several cataloged procedures to properly resolve duplicate names. For more information about how to avoid name conflicts, see Resolving library module name conflicts between Fortran and C in *z/OS Language Environment Programming Guide*.

Changes in optimization levels, addressing modes, and input/output file formats can also cause unanticipated problems in your routine.

In most cases, generated condition tokens or runtime messages point to the nature of the error. The runtime messages offer the most efficient corrective action. To help you analyze errors and determine the most useful method to fix the problem, Table 15 on page 28 lists common error symptoms, possible causes, and programmer responses.

Table 15. Common error symptoms, possible causes, and programmer responses

Error Symptom	Possible cause	Programmer response
Numbered runtime message appears	Condition that is raised in routine.	For any messages you receive, read the Programmer Response. For information about message structure, see "Interpreting runtime messages" on page 28.
User abend code < 4000	• A non-Language Environment abend occurred. • The assembler user exit requested an abend for an unhandled condition of severity ≥2.	See the Language Environment abend codes in Language Environment abend codes in *z/OS Language Environment Runtime Messages*. Check for a subsystem-generated abend or a user-specified abend.
User abend code ≥ 4000	• Language Environment detected an error and could not proceed. • An unhandled software-raised condition occurred and ABTERMENC(ABEND) was in effect. • The assembler user exit requested an abend for an unhandled condition of severity 4.	For any abends you receive, read the appropriate explanation that is listed in Language Environment abend codes in *z/OS Language Environment Runtime Messages*.
System abend with TRAP(OFF)	Cause depends on type of malfunction.	Respond appropriately. See the messages and codes book of the operating system.
System abend with TRAP(ON)	System-detected error.	See the messages and codes information of the operating system.
No response (wait/loop)	Application logic failure.	Check routine logic. Ensure that ERRCOUNT and DEPTHCONDLMT runtime options are set to a nonzero value.
Unexpected message (message received was not from most recent service)	Condition that is caused by something that is related to current service.	Generate a traceback by using CEE3DMP.
Incorrect output	Incorrect file definitions, storage overlay, incorrect routine mask setting, references to uninitialized variables, data input errors, or application routine logic error.	Correct the appropriate parameters.
No output	Incorrect ddname, file definitions, or message file setting.	Correct the appropriate parameters.
Nonzero return code from enclave	Unhandled condition of severity 2, 3, or 4, or the return code was issued by the application routine.	Check the Language Environment message file for runtime message.
Unexpected output	Conflicting library module names.	See the name conflict resolution steps that are outlined in Resolving library module name conflicts between Fortran and C in *z/OS Language Environment Programming Guide*.

Interpreting runtime messages

The first step in debugging your routine is to look up any runtime messages. To find runtime messages, check the message file:

- On z/OS, runtime messages are written by default to ddname SYSOUT. If SYSOUT is not specified, then the messages are written to SYSOUT=*.
- On CICS, the runtime messages are written to the CESE transient data QUEUE.

The default message file ddname can be changed by using the MSGFILE runtime option. For information about displaying runtime messages for Language Environment, COBOL, Fortran, or PL/I routines, see Handling message output in *z/OS Language Environment Programming Guide*.

Runtime messages provide users with additional information about a condition, and possible solutions for any errors that occurred. They can be issued by Language Environment common routines or language-specific runtime routines and contain a message prefix, message number, severity code, and descriptive text.

In the following example Language Environment message:

```
CEE3206S The system detected a specification exception.
```

- The message prefix is CEE.
- The message number is 3206.
- The severity code is S.
- The message text is `The system detected a specification exception`.

Language Environment messages can appear even though you made no explicit calls to Language Environment services. C/C++, COBOL, and PL/I runtime library routines commonly use the Language Environment services. This is why you can see Language Environment messages even when the application routine does not directly call common runtime services.

Message prefix

The message prefix indicates the Language Environment component that generated the message. The message prefix is the first three characters of the message number and is also the facility ID in the condition token. See the following table for more information about Language Environment runtime messages.

Message Prefix	Language Environment Component
CEE	Common run time
EDC	C/C++ run time
FOR	Fortran run time
IBM	PL/I run time
IGZ	COBOL run time

The messages for the various components can be found in *z/OS Language Environment Runtime Messages* and in *z/OS MVS Diagnosis: Reference*.

Message number

The message number is the 4-digit number following the message prefix. Leading zeros are inserted if the message number is less than four digits. It identifies the condition raised and references additional condition and programmer response information.

Severity code

The severity code is the letter following the message number and indicates the level of attention called for by the condition. Messages with severity of I are informational messages and do not usually require any corrective action. In general, if more than one runtime message appears, the first noninformational message indicates the problem. For a complete list of severity codes, severity values, condition information, and default actions, see Interpreting runtime messages in *z/OS Language Environment Programming Guide*.

Message text

The message text provides a brief explanation of the condition.

Understanding abend codes

Under Language Environment, abnormal terminations generate abend codes. There are two types of abend codes: 1) user (Language Environment and user-specified) abends and 2) system abends. User abends follow the format of U*dddd*, where *dddd* is a decimal user abend code. System abends follow the format of S*hhh*, where *hhh* is a hexadecimal abend code. Language Environment abend codes are usually in the range of 4000 to 4095. However, some subsystem abend codes can also fall in this range. User-specified abends use the range of 0 to 3999. The following figure shows examples of abend codes.

```
User (Language Environment) abend code:U4041
User-specified abend code:U0005
System abend code:S80A
```

The Language Environment callable service CEE3ABD terminates your application with an abend. You can set the `clean-up` parameter value to determine how the abend is processed and how Language Environment handles the raised condition. For more information about CEE3ABD, see CEE3ABD —Terminate enclave with an abend in *z/OS Language Environment Programming Reference*.

You can specify the ABTERMENC runtime option to determine what action is taken when an unhandled condition of severity 2 or greater occurs. For more information about ABTERMENC, see "Establishing enclave termination behavior for unhandled conditions" on page 23. Also see ABTERMENC in *z/OS Language Environment Programming Reference*.

User abends

If you receive a Language Environment abend code, see Language Environment abend codes in *z/OS Language Environment Runtime Messages* for a list of abend codes, error descriptions, and programmer responses.

System abends

If you receive a system abend code, look up the code and the corresponding information in the publications for the system you are using.

When a system abend occurs, the operating system can generate a system dump. System dumps are written to ddname SYSMDUMP, SYSABEND, or SYSUDUMP. If the DYNDUMP runtime option is used in combination with the TERMTHDACT runtime option, the system dump can be written without the ddname specified. System dumps show the memory state at the time of the condition. See "Generating a system dump" on page 81 for more information about system dumps.

Using edcmtext to obtain information about errno2 values

Language Environment provides the `edcmtext` utility (similar to `bpxmtext`), which allows faster error resolution when an errno2 is encountered in Language Environment. Use the `edcmtext` utility to display errno2 reason code text. This utility produces a description and action for the errno2 value.

The `bpxmtext` utility calls `edcmtext` when the errno2 value is in the range reserved for the C runtime library or `edcmtext` can be invoked directly with the errno2 value as input.

Format

z/OS UNIX environment	TSO/E environment
`edcmtext` *errno2_value*	EDCMTEXT *errno2_value*

Description

The edcmtext utility displays the description and action text for C/C++ runtime library errno2 values, no other values are supported by this command. This command is intended as an aid for problem determination.

The *errno2_value* is specified as 8 hexadecimal characters.

You can specify one of the following in place of a errno2 value to view a help dialog: *-h*, *help*, *?*. You can also specify the -U option to display the output in uppercase.

Usage notes

- The *errno2_values* are also accepted in mixed case and with hex digits prefixed with the "0x".
- The range of values for the XL C/C++ runtime library is 0X'C0000000' through 0X'CFFFFFFF'.
- The utility bpxmtext displays the description and action text for reason codes returned from the kernel, in addition to *errno2_values* returned from the C/C++ runtime library. You should use bpxmtext when the source of the *errno2_values* is unknown. For more information, see *z/OS UNIX System Services Command Reference*.

Message returns

If you specify a *-h*, *help* or *?* in place of the *errno2_value,* the following message is displayed:

```
Usage: edcmtext errno2_value
```

If no text is available for the *errno2_value*, the following message is displayed:

```
errno2_value: No information is currently available for this errno2_value.
```

If the *errno2_value* is not comprised of 1-8 hex digits, the following message is displayed:

```
Usage: edcmtext errno2_value
```

If the *errno2_value* is not in the C/C++ runtime library range, the following message is displayed:

```
Notice: The errn2_value is not in the C/C++ runtime library range.
```

If **edcmtext** is not run in a TSO/E or z/OS UNIX environment, the following message is displayed:

```
Error: The environment is not TSO/E or z/OS UNIX.
```

Examples

The command edcmtext C00B0021 produces data displayed in the following format:

```
JrEdc1opsEinval01: The mode argument passed to fopen() or freopen() did not begin
with r, w, or a.

Action: Correct the mode argument.  The first keyword of the mode argument must be
the open mode.  Ensure the open mode is specified first and begins with r, w, or a.

Source: edc1opst.c
```

Exit Values

0
: Successful completion

2
: Failure due to an argument that is not 1–8 hex digits

8
: Bad Input due to an *errno2_value* out of the C/C++ runtime range.

14
: Environment not TSO/E or z/OS UNIX

>20
: Contact IBM due to Internal Error

Chapter 3. Using Language Environment debugging facilities

This chapter describes methods of debugging routines in Language Environment. Currently, most problems in Language Environment and member language routines can be determined through the use of a debugging tool or through information provided in the Language Environment dump.

Debug tools

Debug tools are designed to help you detect errors early in your routine. IBM offers Debug Tool, a comprehensive compile, edit, and debug product that is provided with the C/C++ for MVS/ESA, COBOL for OS/390 & VM, COBOL for MVS & VM, PL/I for MVS & VM, and VisualAge for Java compiler products. IBM Debug Tool for z/OS is also available as a standalone product for debugging XL C/C++ applications. For more information, see the IBM z/OS Debugger (developer.ibm.com/mainframe/products/ibm-zos-debugger).

You can use the IBM Debug Tool to examine, monitor, and control how your routines run, and debug your routines interactively or in batch mode. Debug Tool also provides facilities for setting breakpoints and altering the contents and values of variables. Language Environment runtime options can be used with Debug Tool to debug or analyze your routine. See the Debug Tool publications for a detailed explanation of how to invoke and run Debug Tool. For more information, see the IBM z/OS Debugger (developer.ibm.com/mainframe/products/ibm-zos-debugger).

You can use **dbx** to debug Language Environment applications, including C/C++ programs. dbx - Use the debugger in *z/OS UNIX System Services Command Reference* has information on dbx subcommands. Debugging XL C/C++ programs in *z/OS UNIX System Services Programming Tools* contains usage information.

Language Environment dump service, CEE3DMP

The following sections provide information about using the Language Environment dump service, and describe the contents of the Language Environment dump. The Language Environment dump service can be invoked by the following methods:

- CEE3DMP callable service (non-64-bit only)
- TERMTHDACT runtime option
- HLL-specific functions

Generating a Language Environment dump with CEE3DMP

For non-64-bit, the CEE3DMP callable service generates a dump of the runtime environment for Language Environment and the member language libraries at the point of the CEE3DMP call. You can call CEE3DMP directly from an application routine.

Depending on the CEE3DMP options you specify, the dump can contain information about conditions, tracebacks, variables, control blocks, stack and heap storage, file status and attributes, and language-specific information.

All output from CEE3DMP is written to the default ddname CEEDUMP. CEEDUMP, by default, sends the output to the SDSF output queue. You can direct the output from the CEEDUMP to a specific sysout class by using the environment variable, _CEE_DMPTARG=SYSOUT(*x*), where *x* is the output class.

Under z/OS UNIX, if the application is running in an address-space created as a result of a `fork()`, `spawn()`, `spawnp()`, `vfork()`, or one of the exec family of functions, then the CEEDUMP is placed in the z/OS UNIX file system in one of the following directories in the specified order:

1. The directory found in environment variable _CEE_DMPTARG, if found.
2. The current working directory, if this is not the root directory (/), the directory is writable, and the CEEDUMP path name does not exceed 1024 characters.
3. The directory found in environment variable TMPDIR (an environment variable that indicates the location of a temporary directory if it is not `/tmp`).
4. The `/tmp` directory.

The syntax for CEE3DMP is:

```
►►─ CEE3DMP ── ( ── title ── , ── options ── , ── fc ── ) ─►◄
```

title
An 80-byte fixed-length character string that contains a title that is printed at the top of each page of the dump.

options
A 255-byte fixed-length character string that contains options that describe the type, format, and destination of dump information. The options are declared as a string of keywords that are separated by blanks or commas. Some options also have suboptions that follow the option keyword, and are contained in parentheses. The last option declaration is honored if there is a conflict between it and any preceding options. Table 16 on page 34 lists the CEE3DMP *options* and related information.

The IBM-supplied default settings for CEE3DMP are:

```
ENCLAVE(ALL) TRACEBACK
THREAD(CURRENT) FILES VARIABLES NOBLOCKS NOSTORAGE
STACKFRAME(ALL) PAGESIZE(60) FNAME(CEEDUMP)
CONDITION ENTRY NOGENOPTS REGSTOR(96)
```

***fc* (output)**
A 12-byte feedback token code that indicates the result of a call to CEE3DMP. If specified as an argument, feedback information, in the form of a condition token, is returned to the calling routine. If not specified, and the requested operation was not successfully completed, the condition is signaled to the condition manager.

Table 16 on page 34 summarizes the dump options available to CEE3DMP. For more information about the CEE3DMP callable service and dump options, see CEE3DMP—Generate dump in *z/OS Language Environment Programming Reference*. For an example of a Language Environment dump, see “Understanding the Language Environment dump” on page 40.

Table 16. CEE3DMP options

Dump options	Abbreviation	Action Taken
ENCLAVE(ALL)	ENCL	Dumps all enclaves associated with the current process. (In ILC applications in which a C/C++ routine calls another member language routine, and that routine in turn calls CEE3DMP, traceback information for the C/C++ routine is not provided in the dump.) This is the default setting for ENCLAVE.
ENCLAVE(CURRENT). **On CICS, only ENCLAVE(CURRENT) and ENCLAVE(1) settings are supported.**	ENCL(CUR)	Dumps the current enclave.

Table 16. CEE3DMP options (continued)		
Dump options	**Abbreviation**	**Action Taken**
ENCLAVE(*n*) **On CICS, only ENCLAVE(CURRENT) and ENCLAVE(1) settings are supported.**	ENCL(*n*)	Dumps a fixed number of enclaves, indicated by *n*.
THREAD(ALL)	THR(ALL)	Dumps all threads in this enclave (including in a PL/I multitasking environment).
THREAD(CURRENT)	THR(CUR)	Dumps the current thread in this enclave.
TRACEBACK	TRACE	Includes a traceback of all active routines. The traceback shows transfer of control from calls or exceptions. Calls include PL/I transfers of control from BEGIN-END blocks or ON-units.
NOTRACEBACK	NOTRACE	Does not include a traceback of all active routines.
FILES	FILE	Includes attributes of all open files. File control blocks are included when the BLOCKS option is also specified. File buffers are included when the STORAGE option is specified.
NOFILES	NOFILE	Does not include file attributes.
VARIABLES	VAR	Includes a symbolic dump of all variables, arguments, and registers.
NOVARIABLES	NOVAR	Does not include variables, arguments, and registers.
BLOCKS	BLOCK	Dumps control blocks from Language Environment and member language libraries. Global control blocks, as well as control blocks associated with routines on the call chain, are printed. Control blocks are printed for the routine that called CEE3DMP. The dump proceeds up the call chain for the number of routines that are specified by the STACKFRAME option. Control blocks for files are also dumped if the FILES option was specified. See the FILES option for more information. If the TRACE runtime option is set to ON, the trace table is dumped if BLOCKS is specified. If the Heap Storage Diagnostics report is requested using the HEAPCHK runtime option, the report is displayed when BLOCKS is specified.
NOBLOCKS	NOBLOCK	Does not include control blocks.
STORAGE	STOR	Dumps the storage used by the routine. The number of routines dumped is controlled by the STACKFRAME option.
NOSTORAGE	NOSTOR	Suppresses storage dumps.
STACKFRAME(ALL)	SF(ALL)	Dumps all stack frames from the call chain. This is the default setting for STACKFRAME.
STACKFRAME(*n*)	SF(*n*)	Dumps a fixed number of stack frames, indicated by *n*, from the call chain. The specific information dumped for each stack frame depends on the VARIABLES, BLOCK, and STORAGE options declarations. The first stack frame dumped is the caller of CEE3DMP, followed by its caller, and proceeding backward up the call chain.
PAGESIZE(*n*)	PAGE(*n*)	Specifies the number of lines, *n*, on each page of the dump.
FNAME(s)	FNAME(s)	Specifies the ddname of the file to which the dump is written.

Table 16. CEE3DMP options (continued)

Dump options	Abbreviation	Action Taken
CONDITION	COND	Dumps condition information for each condition active on the call chain.
NOCONDITION	NOCOND	For each condition active on the call chain, does not dump condition information.
ENTRY	ENT	Includes a description of the program unit that called CEE3DMP and the registers on entry to CEE3DMP.
NOENTRY	NOENT	Does not include a description of the program unit that called CEE3DMP or registers on entry to CEE3DMP.
GENOPTS	GENO	Generates a runtime options report in the dump output. This will be the default if an unhandled condition occurs, and a CEEDUMP is generated due to the setting of the TERMTHDACT runtime option setting.
NOGENOPTS	NOGENO	Does not generate a runtime options report in the dump output. NOGENOPTS is the default for user-called dumps.
REGSTOR(*reg_stor_amount*)	REGST(*reg_stor_amount*)	Controls the amount of storage to be dumped around registers. Default is 96 bytes. Specify REGSTOR(0) if no storage around registers is required.

Generating a Language Environment dump with TERMTHDACT

The TERMTHDACT runtime option produces a dump during program checks, abnormal terminations, or calls to the CEESGL service. You must use TERMTHDACT(DUMP) in conjunction with TRAP(ON) to generate a Language Environment dump. You can use TERMTHDACT to produce a traceback, Language Environment dump, or user address space dump when a thread ends abnormally because of an unhandled condition of severity 2 or greater. If this is the last thread in the process, the enclave goes away. A thread terminating in a non-POSIX environment is analogous to an enclave terminating because Language Environment Version 1 supports only single threads. For information about enclave termination, see Enclave termination in *z/OS Language Environment Programming Guide for 64-bit Virtual Addressing Mode*.

The TERMTHDACT suboptions QUIET, MSG, TRACE, DUMP, UAONLY, UATRACE, UADUMP, and UAIMM control the level of information available. Table 17 on page 36 lists the suboptions, the levels of information produced, and the destination of each.

Table 17. TERMTHDACT suboptions, level of information, and destinations

Suboption	Level of Information	Destination
QUIET	No information	No destination.
MSG	Message	Terminal or ddname specified in MSGFILE runtime option.
TRACE	Message and Language Environment dump containing only a traceback	Message goes to terminal or ddname specified in MSGFILE runtime option. Traceback goes to CEEDUMP file.
DUMP	Message and complete Language Environment dump	Message goes to terminal or ddname specified in MSGFILE runtime option. Language Environment dump goes to CEEDUMP file.

Table 17. TERMTHDACT suboptions, level of information, and destinations (continued)

Suboption	Level of Information	Destination
UAONLY	SYSMDUMP, SYSABEND dump, or SYSUDUMP depending on the DD card used in the JCL in z/OS. In CICS, a transaction dump is created. In non-CICS you will get a system dump of your user address space if the appropriate DD statement is used. **Note:** A Language Environment dump is not generated.	Language Environment generates a U4039 abend which allows a system dump of the user address space to be generated. For z/OS, the system dump is written to the ddname specified; for CICS the transaction dump goes to DFHDMPA or the DFHDMPB data set.
UATRACE	Message, Language Environment dump containing only a traceback, and a system dump of the user address space	Message goes to terminal or ddname specified in MSGFILE runtime option. Traceback goes to CEEDUMP file. Language Environment generates a U4039 abend which allows a system dump of the user address space to be generated. For z/OS, the system dump is written to the ddname specified; for CICS the transaction dump goes to DFHDMPA or the DFHDMPB data set.
UADUMP	Message, Language Environment dump, and SYSMDUMP, SYSABEND dump, or SYSUDUMP depending on the DD card used in the JCL in z/OS. In CICS, a transaction dump is created.	Message goes to terminal or ddname specified in MSGFILE runtime option. Language Environment dump goes to CEEDUMP file. Language Environment generates a U4039 abend which allows a system dump of the user address space to be generated. For z/OS, the system dump is written to the ddname specified; for CICS the transaction dump goes to DFHDMPA or the DFHDMPB data set.
UAIMM	Language Environment generates a system dump of the original abend/program interrupt of the user address space. In CICS, a transaction dump is created. In non-CICS you will get a system dump of your user address space if the appropriate DD statement is used. After the dump is taken by the operating system, Language Environment condition manager continues processing. **Note:** Under CICS, UAIMM yields UAONLY behavior. Under non-CICS, TRAP(ON,NOSPIE) must be in effect. When TRAP(ON,SPIE) is in effect, UAIMM yields UAONLY behavior. For software raised conditions or signals, UAIMM behaves the same as UAONLY.	Message goes to terminal or ddname specified in MSGFILE runtime option. User address space dump goes to ddname specified for z/OS; or a CICS transaction dump goes to the DFHDMPA or DFHDMPB data set.

The TRACE and UATRACE suboptions of TERMTHDACT use these dump options:

- CONDITION
- ENCLAVE(ALL)
- FILES
- FNAME(CEEDUMP)
- GENOPTS
- NOBLOCKS

- NOENTRY
- NOSTORAGE
- STACKFRAME(ALL)
- THREAD(ALL)
- TRACEBACK
- VARIABLES

The DUMP and UADUMP suboptions of TERMTHDACT use these dump options:

- BLOCKS
- CONDITION
- ENCLAVE(ALL)
- FILES
- FNAME(CEEDUMP)
- GENOPTS
- NOENTRY
- STACKFRAME(ALL)
- STORAGE
- THREAD(ALL)
- TRACEBACK
- VARIABLES

Although you can modify CEE3DMP options, you cannot change options for a traceback or dump produced by TERMTHDACT.

Considerations for setting TERMTHDACT options

The output of TERMTHDACT may vary depending upon which languages and subsystems are processing the request. This section describes the considerations associated with issuing the TERMTHDACT suboptions. For more information about the TERMTHDACT runtime option, see TERMTHDACT in *z/OS Language Environment Programming Reference*.

- COBOL Considerations

  The following TERMTHDACT suboptions for COBOL are recommended: UAONLY, UATRACE, and UADUMP. A system dump will always be generated when one of these suboptions is specified.
- PL/I Considerations

  After a normal return from a PL/I ERROR ON-unit, or from a PL/I FINISH ON-unit, Language Environment considers the condition unhandled. If a GOTO is not performed and the resume cursor is not moved, then the thread terminates. The TERMTHDACT setting guides the amount of information that is produced, so the message is not presented twice.
- PL/I MTF Considerations

  TERMTHDACT applies to a task that terminates abnormally due to an unhandled condition of severity 2 or higher that is percolated beyond the initial routine's stack frame. All active subtasks that were created from the incurring task will terminate abnormally, but the enclave will continue to run.
- z/OS UNIX Considerations
  - The TERMTHDACT option applies when a thread terminates abnormally. Abnormal termination of a single thread causes termination of the entire enclave. If an unhandled condition of severity 2 or higher percolates beyond the first routine's stack frame the enclave terminates abnormally.
  - If an enclave terminates due to a POSIX default signal action, then TERMTHDACT applies to conditions that result from software signals, program checks, or abends.

- If running under a shell and Language Environment generates a system dump, then a storage dump is generated to a file based on the kernel environment variable, _BPXK_MDUMP.

- CICS Considerations
  - TERMTHDACT output is written to a transient data queue named CESE, or to the CICS transaction dump, depending on the setting of the CESE|CICSDDS suboption of the TERMTHDACT runtime option. Table 18 on page 39 shows the behavior of CESE|CICSDDS when they are used with the other suboptions of TERMTHDACT.
  - Because Language Environment does not own the ESTAE, the suboption UAIMM will be treated as UAONLY.
  - All associated Language Environment dumps will be suppressed if termination processing is the result of an EXEC CICS ABEND with NODUMP.
  - Program checks and other abends will cause CICS to produce a CICS transaction dump.

Table 18. Condition handling of 0Cx abends

Options	**TERMTHDACT(*X*,CESE,)**	**TERMTHDACT(*X*,CICSDDS,)**
QUIET	No output.	No output.
MSG	Message written to CESE queue or MSGFILE.	Message written to CESE queue or MSGFILE.
TRACE	The traceback is written to the CESE queue, followed by U4038 abend with nodump option.	• Language Environment will write traceback, variables, COBOL working storage, C writeable static. The member handlers will be invoked to provide the desired output to the new transaction server queue (which CICS will read and write to CICS transaction dump later). • U4039 abend to force CICS transaction dump followed by U4038 abend with nodump option. • Message to CESE or MSGFILE.
DUMP	CEEDUMP to CESE queue followed by U4038 abend with nodump option.	• CEEDUMP to new transaction server queue which CICS will read and write to CICS transaction dump later. • U4039 abend to force CICS transaction dump followed by U4038 abend with nodump option. • Message to CESE or MSGFILE.
UATRACE	U4039 abend with traceback to CESE queue followed by U4038 abend with nodump option.	• Language Environment will write traceback, variables, COBOL working storage, C writeable statics. The member handlers will be invoked to provide the desired output to the new transaction server queue (which CICS will read and write to CICS transaction dump later). • U4039 abend to force CICS transaction dump followed by U4038 abend with nodump option. • Message to CESE or MSGFILE.
UADUMP	U4039 abend with CEEDUMP to CESE queue followed by U4038 abend with nodump option.	• CEEDUMP to new transaction server queue which CICS will read and write to CICS transaction dump later. • U4039 abend to force CICS transaction dump followed by U4038 abend with nodump option. • Message to CESE or MSGFILE.

Table 18. Condition handling of 0Cx abends (continued)

Options	**TERMTHDACT(*X*,CESE,)**	**TERMTHDACT(*X*,CICSDDS,)**
UAONLY	U4039 abend followed by U4038 abend with nodump option.	• U4039 abend followed by U4038 abend with nodump option. • No CEEDUMP information is generated. • Same as CESE.
UAIMM	U4039 abend followed by U4038 abend with nodump option.	• U4039 abend followed by U4038 abend with nodump option. • No CEEDUMP information is generated. • Same as CESE.

Generating a Language Environment dump with language-specific functions

In addition to the CEE3DMP callable service and the TERMTHDACT runtime option, you can use language-specific routines such as C functions, the Fortran SDUMP service, and the PL/I PLIDUMP service to generate a dump.

C/C++ routines can use the functions `cdump()`, `csnap()`, and `ctrace()` to produce a Language Environment dump. All three functions call the CEE3DMP callable service, and each function includes an options string consisting of different CEE3DMP options that you can use to control the information contained in the dump. For more information on these functions, see "Generating a Language Environment dump of a C/C++ routine" on page 178.

Fortran programs can call SDUMP, DUMP/PDUMP, or CDUMP/CPDUMP to generate a Language Environment dump. CEE3DMP cannot be called directly from a Fortran program. For more information on these functions, see "Generating a Language Environment dump of a Fortran routine" on page 247.

PL/I routines can call PLIDUMP instead of CEE3DMP to produce a dump. PLIDUMP includes options that you can specify to obtain a variety of information in the dump. For a detailed explanation about PLIDUMP, see "Generating a Language Environment dump of a PL/I for MVS & VM routine" on page 268.

Understanding the Language Environment dump

The Language Environment dump service generates output of data and storage from the Language Environment runtime environment on an enclave basis. This output contains the information needed to debug most basic routine errors.

This sample illustrates a dump for enclave main. The example assumes full use of the CEE3DMP dump options. Ellipses are used to summarize some sections of the dump and information regarding unhandled conditions may not be present at all. Sections of the dump are numbered to correspond with the descriptions given in "Sections of the Language Environment dump" on page 54.

The CEE3DMP was generated by the C program CELSAMP shown in Figure 8 on page 41. CELSAMP uses the DLL CELDLL shown in Figure 11 on page 44.

```
#pragma options(SERVICE("1.1.d"),NOOPT,TEST(SYM))
#pragma runopts(TERMTHDACT(UADUMP),POSIX(ON),DYNDUMP(,DYNAMIC,))
#pragma runopts(TRACE(ON,1M,NODUMP,LE=1),HEAPCHK(ON,1,0,10,10))
#pragma runopts(RPTSTG(ON),HEAPPOOLS(ON))
#define _OPEN_THREADS
#include <pthread.h>
#include <stdio.h>
#include <stdlib.h>
#include <dll.h>
#include <signal.h>
#include <leawi.h>
#include <ceeedcct.h>

pthread_mutex_t      mut;
pthread_t            thread[2];
int                  threads_joined = 0;
char *               t1 = "Thread 1";
char *               t2 = "Thread 2";
/*******************************************************************/
/*  thread_cleanup: condition handler to clean up threads          */
/*******************************************************************/
void thread_cleanup(_FEEDBACK *cond,_INT4 *input_token,
                    _INT4 *result, _FEEDBACK *new_cond) {

  /* values for handling the conditions */
  #define percolate   20
  printf(">>> Thread_CleanUp: Msg # is %d\n",cond->tok_msgno);
  if (!threads_joined) {
    printf(">>> Thread_CleanUp: Unlocking mutex\n");
    pthread_mutex_unlock(&mut);
    printf(">>> Thread_CleanUp: Joining threads\n");
    if (pthread_join(thread[0],NULL) == -1 )
      perror("Join of Thread #1 failed");
    if (pthread_join(thread[1],NULL) == -1 )
      perror("Join of Thread #2 failed");
    threads_joined = 1;
  }
  *result = percolate;
  printf(">>> Thread_CleanUp: Percolating condition\n");
}
/*******************************************************************/
/*  thread_func: Invoked via pthread_create.                       */
/*******************************************************************/
void *thread_func(void *parm)
{
  printf(">>> Thread_func: %s locking mutex\n",parm);
  pthread_mutex_lock(&mut);
  pthread_mutex_unlock(&mut);
  printf(">>> Thread_func: %s exitting\n",parm);
  pthread_exit(NULL);
}
```

Figure 8. The C program CELSAMP

```
main()
{
  dllhandle *          handle;
  int                  i = 0;
  FILE*                fp1;
  FILE*                fp2;
  _FEEDBACK            fc;
  _INT4                token;
  _ENTRY               pgmptr;

  printf("Init MUTEX...\n");
  if (pthread_mutex_init(&mut, NULL) == -1) {
    perror("Init of mut failed");
    exit(101);
  }

  printf("Lock Mutex Lock...\n");
  if (pthread_mutex_lock(&mut) == -1) {
    perror("Lock of mut failed");
    exit(102);
  }

  printf("Create 1st thread...\n");
  if (pthread_create(&thread[0],NULL,thread_func,(void *)t1) ==
-1) {
    perror("Could not create thread #1");
    exit(103);
  }

  printf("Create 2nd thread...\n");
  if (pthread_create(&thread[1],NULL,thread_func,(void *)t2) ==
-1) {
    perror("Could not create thread #2");
    exit(104);
  }
  printf("Register thread cleanup condition handler...\n");
  pgmptr.address = (_POINTER)thread_cleanup;
  pgmptr.nesting = NULL;
  token = 1;
  CEEHDLR (&pgmptr, &token, &fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf( "CEEHDLR failed with message number %d\n",fc.tok_msgno);
    exit(105);
  }
  printf("Load DLL...\n");
  handle = dllload("CELDLL");
  if (handle == NULL) {
    perror("Could not load DLL CELDLL");
    exit(106);
  }

  printf("Query DLL with incorrect function name...\n");
  pgmptr.address = (_POINTER)dllqueryfn(handle,"name_not_in_dll");
  if (pgmptr.address != NULL) {
    perror("Found incorrect function name in DLL");
    exit(111);
  }

  printf("Query DLL...\n");
  pgmptr.address = (_POINTER)dllqueryfn(handle,"dump_n_perc");
  if (pgmptr.address == NULL) {
    perror("Could not find dump_n_perc");
    exit(107);
  }
```

Figure 9. The C program CELSAMP (continued)

```
  printf("Register condition handler...\n");
   pgmptr.nesting = NULL;
   token = 2;
   CEEHDLR (&pgmptr, &token, &fc);
   if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
     printf( "CEEHDLR failed with message number %d\n",
        fc.tok_msgno);
     exit(108);
   }

   printf("Write to some files...\n");
   fp1 = fopen("myfile.data", "w");
   if (!fp1) {
     perror("Could not open myfile.data for write");
     exit(109);
   }

   fprintf(fp1, "record 1\n");
   fprintf(fp1, "record 2\n");
   fprintf(fp1, "record 3\n");

   fp2 = fopen("memory.data", "wb,type=memory");
   if (!fp2) {
     perror("Could not open memory.data for write");
     exit(112);
   }

   fprintf(fp2, "some data");
   fprintf(fp2, "some more data");
   fprintf(fp2, "even more data");

   printf("Divide by zero...\n");
   i = 1/i;
   printf("Error -- Should not get here\n");
   exit(110);
 }
```

Figure 10. The C program CELSAMP (continued)

```
/* DLL containing Condition Handler that takes dump and percolates */
#pragma options(SERVICE("1.3.b.0001"),TEST(SYM),NOOPT)
#pragma export(dump_n_perc)
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <string.h>
#include <ceeedcct.h>
char wsa_array[10] = { 'C','E','L','D','L','L',' ','W','S','A'};
#define OPT_STR "THREAD(ALL) BLOCKS STORAGE GENOPTS"
#define TITLE_STR "Sample dump produced by calling CEE3DMP"

void dump_n_perc(_FEEDBACK *cond,_INT4 *input_token,
                 _INT4 *result, _FEEDBACK *new_cond) {

  /* values for handling the conditions */
  #define percolate   20

  _CHAR80 title;
  _CHAR255 options;
  _FEEDBACK fc;

  printf(">>> dump_n_perc: Msg # is %d\n",cond->tok_msgno);

  /* check if the DIVIDE-BY-ZERO message (0C9) */
  if (cond->tok_msgno == 3209) {
    memset(options,' ',sizeof(options));
    memcpy(options,OPT_STR,sizeof(OPT_STR)-1);

    memset(title,' ',sizeof(title));
    memcpy(title,TITLE_STR,sizeof(TITLE_STR)-1);

    printf(">>> dump_n_perc: Taking dump\n");
    CEE3DMP(title,options,&fc);
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEE3DMP failed with msgno %d\n",fc.tok_msgno);
      exit(299);
    }
  }
  *result = percolate;
  printf(">>> dump_n_perc: Percolating condition\n");
}
```

Figure 11. The C DLL CELDLL

For easy reference, the sections of the following dump are numbered to correspond with the descriptions in "Sections of the Language Environment dump" on page 54.

```
[1]CEE3DMP V1 R13.0: Sample dump produced by calling CEE3DMP                          03/07/10 10:25:18
AM                Page:    1

ASID: 0019   Job ID: JOB00014   Job name: CELSAMP    Step name: STEP1      PID: 33554435   Parent PID: 1   User name:
MEGA

[2]CEE3845I CEEDUMP Processing started.

[3]CEE3DMP called by program unit //'POSIX.CRTL.C(CELDLL)' (entry point dump_n_perc) at statement 34 (offset +0000012E).

[4]Registers on Entry to CEE3DMP:

  PM....... 0100
  GPR0..... 00000000_265ED088  GPR1..... 00000000_265ECF28  GPR2..... 00000000_265ECF88  GPR3..... 00000000_2699A0FA
  GPR4..... 00000000_265ECF38  GPR5..... 00000000_2699A330  GPR6..... 00000000_00000002  GPR7..... 00000000_25E0E410
  GPR8..... 00000000_A5ECD622  GPR9..... 00000000_265E6148  GPR10.... 00000000_265EACDF  GPR11.... 00000000_A5F97290
  GPR12.... 00000000_25E16B48  GPR13.... 00000000_265ECE90  GPR14.... ********_A699A1F0  GPR15.... 00000000_A5EF8428
  FPR0..... 4DC5CB77  3FFA1D9D           FPR2..... 00000000  00000000
  FPR4..... 00000000  00000000           FPR6..... 00000000  00000000
  VR0...... 4DC5CB77 3FFA1D9D 00000000 00000000       VR1...... 00000000 00000000 00000000 00000000
  VR2...... 18000000 00000000 00000000 00000000       VR3...... 00000000 00000000 00000000 00000000
  VR4...... 00000000 00000000 00000000 00000000       VR5...... 00000000 00000000 00000000 00000000
  VR6...... 00000000 00000000 00000000 00000000       VR7...... 00000000 00000000 00000000 00000000
  VR8...... 00000000 00000000 00000000 00000000       VR9...... 00000000 00000000 00000000 00000000
  VR10..... 00000000 00000000 00000000 00000000       VR11..... 00000000 00000000 00000000 00000000
  VR12..... 00000000 00000000 00000000 00000000       VR13..... 00000000 00000000 00000000 00000000
  VR14..... 00000000 00000000 00000000 00000000       VR15..... 00000000 00000000 00000000 00000000
  VR16..... 00000000 00000000 00000000 00000000       VR17..... 00000000 00000000 00000000 00000000
  VR18..... 00000000 00000000 00000000 00000000       VR19..... 00000000 00000000 00000000 00000000
  VR20..... 00000000 00000000 00000000 00000000       VR21..... 00000000 00000000 00000000 00000000
  VR22..... 00000000 00000000 00000000 00000000       VR23..... 00000000 00000000 00000000 00000000
  VR24..... 00000000 00000000 00000000 00000000       VR25..... 00000000 00000000 00000000 00000000
```

```
  VR26..... 00000000 00000000 00000000 00000000        VR27..... 00000000 00000000 00000000 00000000
  VR28..... 00000000 00000000 00000000 00000000        VR29..... 00000000 00000000 00000000 00000000
  VR30..... 00000000 00000000 00000000 00000000        VR31..... 00000000 00000000 00000000 00000000
    GPREG STORAGE:
      Storage around GPR0 (265ED088)
        -0020 265ED068  40404040 40404040 40404040 40404040  40404040 40404040 40404040 404040CC
|                               .|
        +0000 265ED088  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC  25E0E438 CCCCCCCC CCCCCCCC 265ECF38
|.................U..........;..|
        +0020 265ED0A8  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC  0000CCCC 265ECE90 265ED6E0 A5EF9240
|....................;...;O.v.k |
      Storage around GPR1 (265ECF28)
        -0020 265ECF08  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC
|................................|
        +0000 265ECF28  265ECF38 265ECF88 265ED088 CCCCCCCC  E2819497 93854084 A4949740 97999684
|.;...;.h.;.h....Sample dump prod|
        +0020 265ECF48  A4838584 4082A840 83819393 89958740  C3C5C5F3 C4D4D740 40404040 40404040  |uced by calling
CEE3DMP         |
.
.
.
      Storage around GPR15(25EF8428)
        -0020 25EF8408  F0F3F1F9 F1F7F5F9 F0F0F0F1 F0C3F0F0  0007C8D3 C5F7F7F7 F0000000 00000000  |
0319175900010C00..HLE7770.......|
        +0000 25EF8428  47F0F014 00C3C5C5 00000628 000030C8  47F0F001 90ECD00C C0B00000 17940D80
|.00..CEE.......H.00..........m..|
        +0020 25EF8448  EB000020 000C18A0 EB110020 000C1821  EBEE0020 000C183E EBFF0020 000C184F
|...............................||

[5]Information for enclave main

  [6]Information for thread 2625860000000000

  Registers on Entry to CEE3DMP:
    PM....... 0100
    GPR0..... 00000000_265ED088  GPR1..... 00000000_265ECF28  GPR2..... 00000000_265ECF88  GPR3..... 00000000_2699A0FA
    GPR4..... 00000000_265ECF38  GPR5..... 00000000_2699A330  GPR6..... 00000000_00000002  GPR7..... 00000000_25E0E410
    GPR8..... 00000000_A5ECD622  GPR9..... 00000000_265E6148  GPR10.... 00000000_265EACDF  GPR11.... 00000000_A5F97290
    GPR12.... 00000000_25E16B48  GPR13.... 00000000_265ECE90  GPR14.... ********_A699A1F0  GPR15.... 00000000_A5EF8428
    FPR0..... 4DC5CB77  3FFA1D9D            FPR2..... 00000000  00000000
    FPR4..... 00000000  00000000            FPR6..... 00000000  00000000
    VR0...... 4D000000 00000BD1 00000000 00000000        VR1...... 00000000 00000000 00000000 00000000
    VR2...... 18000000 00000000 00000000 00000000        VR3...... 00000000 00000000 00000000 00000000
    VR4...... 00000000 00000000 00000000 00000000        VR5...... 00000000 00000000 00000000 00000000
    VR6...... 00000000 00000000 00000000 00000000        VR7...... 00000000 00000000 00000000 00000000
    VR8...... 00000000 00000000 00000000 00000000        VR9...... 00000000 00000000 00000000 00000000
    VR10..... 00000000 00000000 00000000 00000000        VR11..... 00000000 00000000 00000000 00000000
    VR12..... 00000000 00000000 00000000 00000000        VR13..... 00000000 00000000 00000000 00000000
    VR14..... 00000000 00000000 00000000 00000000        VR15..... 00000000 00000000 00000000 00000000
    VR16..... 00000000 00000000 00000000 00000000        VR17..... 00000000 00000000 00000000 00000000
    VR18..... 00000000 00000000 00000000 00000000        VR19..... 00000000 00000000 00000000 00000000
    VR20..... 00000000 00000000 00000000 00000000        VR21..... 00000000 00000000 00000000 00000000
    VR22..... 00000000 00000000 00000000 00000000        VR23..... 00000000 00000000 00000000 00000000
    VR24..... 00000000 00000000 00000000 00000000        VR25..... 00000000 00000000 00000000 00000000
    VR26..... 00000000 00000000 00000000 00000000        VR27..... 00000000 00000000 00000000 00000000
    VR28..... 00000000 00000000 00000000 00000000        VR29..... 00000000 00000000 00000000 00000000
    VR30..... 00000000 00000000 00000000 00000000        VR31..... 00000000 00000000 00000000 00000000
    GPREG STORAGE:
      Storage around GPR0 (265ED088)
        -0020 265ED068  40404040 40404040 40404040 40404040  40404040 40404040 40404040 404040CC
|                               .|
        +0000 265ED088  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC  25E0E438 CCCCCCCC CCCCCCCC 265ECF38
|.................U..........;..|
        +0020 265ED0A8  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC  0000CCCC 265ECE90 265ED6E0 A5EF9240
|....................;...;O.v.k |
.
.
.
  [7]Traceback:

    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     dump_n_perc +0000012E  34          CELDLL               CELDLL                         1.3.B.0  Call
    2     CEEPGTFN    +0000005A              CEEPLPKA                                                     Call
    3     CEEHDSP     +0000259A              CEEPLPKA             CEEHDSP                        HLE7770  Call
    4     main        +000009BA  150         CELSAMP              CELSAMP                        1.1.D    Exception
    5     EDCZMINV    +000000C2              CEEEV003                                                     Call
    6     CEEBBEXT    +000001B8              CEEPLPKA             CEEBBEXT                       HLE7770  Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     265ECE90   2699A0C0   2699A0C0   +0000012E  20070105   C/C++     POSIX EBCDIC  HFP
    2     265ECDD8   25F97290   25F973F0   -00000106  20100319   LIBRARY    POSIX
    3     265E9CE0   25ECB180   25ECB180   +0000259A  20100319   CEL       POSIX
    4     265E9208   25E000C0   25E000C0   +000009BA  20070105   C/C++     POSIX EBCDIC  HFP
    5     265E90F0   2659CF6E   2659CF6E   +000000C2  20100319   LIBRARY    POSIX
    6     265E9030   25E92F60   25E92F60   +000001B8  20100319   CEL       POSIX
```

```
    Fully Qualified Names
    DSA   Entry       Program Unit                               Load Module
    1     dump_n_perc //'POSIX.CRTL.C(CELDLL)'                   CELDLL
    4     main        //'POSIX.CRTL.C(CELSAMP)'                  CELSAMP
```

```
    Full Service Level
    DSA   Entry       Service
    6     dump_n_perc 1.3.B.0001

  [8]Condition Information for Active Routines

    Condition Information for //'POSIX.CRTL.C(CELSAMP)' (DSA address 265E9208)
      CIB Address: 265EA5D8
      Current Condition:
        CEE3209S The system detected a fixed-point divide exception (System Completion Code=0C9).
      Location:
        Program Unit: //'POSIX.CRTL.C(CELSAMP)'
        Entry:        main Statement: 150 Offset: +000009BA
      Machine State:
        ILC..... 0002    Interruption Code..... 0009
        PSW..... 078D2400 A5E00A7C
        GPR0..... 00000000_00000000  GPR1..... 00000000_A647FE0A  GPR2..... 00000000_265E92C5  GPR3.....
00000000_25E000FA
        GPR4..... 00000000_265E92C2  GPR5..... 00000000_25E00ED0  GPR6..... 00000000_00000000  GPR7.....
00000000_00000001
        GPR8..... 00000000_00000030  GPR9..... 00000000_80000000  GPR10.... 00000000_A659CF62  GPR11....
00000000_A5E92F60
        GPR12.... 00000000_25E16B48  GPR13.... 00000000_265E9208  GPR14.... 00000000_A5E00A66  GPR15....
00000000_00000012

    Storage dump near condition, beginning at location: 25E00A6A
      +000000 25E00A6A  4400C1AC 5800D0AC 41600001 8E600020  1D601807 5000D0AC 4400C1AC 58F039E2
|..A......-...-...-..&.....A..0.S|
    GPREG STORAGE:
      Storage around GPR0 (00000000)
        +0000 00000000    Inaccessible storage.
        +0020 00000020    Inaccessible storage.
        +0040 00000040    Inaccessible storage.
.
.
.
  [9]Parameters, Registers, and Variables for Active Routines:

    dump_n_perc (DSA address 265ECE90):
      UPSTACK DSA
      Parameters:
        new_cond         struct _FEEDBACK *
                                         0x25E0EA5C
        result           signed long int *
                                         0x265EA6C4
        input_token      signed long int *
                                         0x265EA6B8
        cond             struct _FEEDBACK *
                                         0x265EA5F0
      Saved Registers:
        GPR0..... 265ED088  GPR1..... 265ECF28  GPR2..... 265ECF88  GPR3..... 2699A0FA
        GPR4..... 265ECF38  GPR5..... 2699A330  GPR6..... 00000002  GPR7..... 25E0E410
        GPR8..... A5ECD622  GPR9..... 265E6148  GPR10.... 265EACDF  GPR11.... A5F97290
        GPR12.... 25E16B48  GPR13.... 265ECE90  GPR14.... A699A1F0  GPR15.... A5EF8428
    GPREG STORAGE:
      Storage around GPR0 (265ED088)
        -0020 265ED068  40404040 40404040 40404040 40404040  40404040  40404040 40404040 404040CC
|                               .|
.
.
.
      Local Variables:
        title[0..6]      unsigned char         'S'     'a'     'm'     'p'     'l'     'e'     ' '
        title[7..13]                           'd'     'u'     'm'     'p'     ' '     'p'     'r'
        title[14..20]                          'o'     'd'     'u'     'c'     'e'     'd'     ' '
        title[21..27]                          'b'     'y'     ' '     'c'     'a'     'l'     'l'
        title[28..34]                          'i'     'n'     'g'     ' '     'C'     'E'     'E'
        title[35..41]                          '3'     'D'     'M'     'P'     ' '     ' '     ' '
        title[42..48]                          ' '     ' '     ' '     ' '     ' '     ' '     ' '
                title[49..55] to title[70..76] elements same as above.
        title[77..79]                          ' '     ' '     ' '
        options[0..6]    unsigned char         'T'     'H'     'R'     'E'     'A'     'D'     '('
        options[7..13]                         'A'     'L'     'L'     ')'     ' '     'B'     'L'
```

```
        options[14..20]                        'O'     'C'     'K'     'S'     ' '     'S'     'T'
        options[21..27]                        'O'     'R'     'A'     'G'     'E'     ' '     'G'
        options[28..34]                        'E'     'N'     'O'     'P'     'T'     'S'     ' '
        options[35..41]                        ' '     ' '     ' '     ' '     ' '     ' '     ' '
                options[42..48] to options[245..251] elements same as above.
        options[252..254]                       ' '     ' '     ' '
        fc               struct _FEEDBACK
         tok_sev          signed short int   -13108
         tok_msgno        signed short int   -13108
         tok_case         unsigned:2                 3
         tok_sever        unsigned:3                 1
         tok_ctrl         unsigned:3                 4
         tok_facid[0..2]  unsigned char      '\xCC'  '\xCC'  '\xCC'
         tok_isi          signed int          -858993460
        __func__[0..6]   static unsigned char
                                               'd'     'u'     'm'     'p'     '_'     'n'     '_'
        __func__[7..11]                        'p'     'e'     'r'     'c'    '\0'
.
```

```
.
.
    main (DSA address 265E9208):
      UPSTACK DSA
      Saved Registers:
        GPR0..... 00000000  GPR1..... A647FE0A  GPR2..... 265E92C5  GPR3..... 25E000FA
        GPR4..... 265E92C2  GPR5..... 25E00ED0  GPR6..... 00000000  GPR7..... 00000001
        GPR8..... 00000030  GPR9..... 80000000  GPR10.... A659CF62  GPR11.... A5E92F60
        GPR12.... 25E16B48  GPR13.... 265E9208  GPR14.... A5E00A66  GPR15.... 00000012
    GPREG STORAGE:
      Storage around GPR0 (00000000)
        +0000 00000000    Inaccessible storage.
.
.
.
  [10]Control Blocks for Active Routines:

    DSA for dump_n_perc: 265ECE90
      +000000  FLAGS.... 10CC      member... CCCC      BKC...... 265ECDD8  FWC...... 265ED0B8  R14...... A699A1F0
      +000010  R15...... A5EF8428  R0....... 265ED088  R1....... 265ECF28  R2....... 265ECF88  R3....... 2699A0FA
      +000024  R4....... 265ECF38  R5....... 2699A330  R6....... 00000002  R7....... 25E0E410  R8....... A5ECD622
      +000038  R9....... 265E6148  R10...... 265EACDF  R11...... A5F97290  R12...... 25E16B48  reserved. 00000000
      +00004C  NAB...... 265ED0B8  PNAB..... CCCCCCCC  reserved. CCCCCCCC  CCCCCCCC
      +000064  reserved. CCCCCCCC  reserved. CCCCCCCC  MODE..... CCCCCCCC  reserved. CCCCCCCC
      +000078  reserved. CCCCCCCC  reserved. CCCCCCCC
    DSA for CEEPGTFN: 265ECDD8
      +000000  FLAGS.... 10CC      member... CCCC      BKC...... 265E9CE0  FWC...... CCCCCCCC  R14...... A5F972EC
      +000010  R15...... 2699A0C0  R0....... 2660AB50  R1....... 25E0E438  R2....... 265EA5D8  R3....... 26999CE8
      +000024  R4....... 265ECDD8  R5....... 25ED009C  R6....... CCCCCCCC  R7....... CCCCCCCC  R8....... CCCCCCCC
      +000038  R9....... CCCCCCCC  R10...... CCCCCCCC  R11...... CCCCCCCC  R12...... CCCCCCCC  reserved. 00000000
      +00004C  NAB...... 265ECE90  PNAB..... CCCCCCCC  reserved. CCCCCCCC  CCCCCCCC
      +000064  reserved. CCCCCCCC  reserved. CCCCCCCC  MODE..... CCCCCCCC  reserved. CCCCCCCC
      +000078  reserved. CCCCCCCC  reserved. CCCCCCCC
    DSA for CEEHDSP: 265E9CE0
      +000000  FLAGS.... 0808      member... CEE1      BKC...... 265E9208  FWC...... 265ECDD8  R14...... A5ECD71C
      +000010  R15...... A5F97290  R0....... 26999CE8  R1....... 25E0E438  R2....... 265EA5D8  R3....... 25E0CF18
      +000024  R4....... 25ECFF70  R5....... 25ED009C  R6....... 00000002  R7....... 25E0E410  R8....... A5ECD622
      +000038  R9....... 265EBCDE  R10...... 265EACDF  R11...... A5ECB180  R12...... 25E16B48  reserved. 00000000
      +00004C  NAB...... 265ECDD8  PNAB..... CCCCCCCC  reserved. CCCCCCCC  CCCCCCCC
      +000064  reserved. CCCCCCCC  reserved. CCCCCCCC  MODE..... CCCCCCCC  reserved. CCCCCCCC
      +000078  reserved. CCCCCCCC  reserved. CCCCCCCC
    DSA for main: 265E9208
      +000000  FLAGS.... 10CC      member... CCCC      BKC...... 265E90F0  FWC...... 265E92E8  R14...... A5E00A66
      +000010  R15...... 2641988C  R0....... 25E011A4  R1....... 265E92A0  R2....... 265E92C5  R3....... 25E000FA
      +000024  R4....... 265E92C2  R5....... 25E00ED0  R6....... 265E92CC  R7....... 265E92D0  R8....... 00000030
      +000038  R9....... 80000000  R10...... A659CF62  R11...... A5E92F60  R12...... 25E16B48  reserved. 00000000
      +00004C  NAB...... 265E92E8  PNAB..... CCCCCCCC  reserved. CCCCCCCC  CCCCCCCC
      +000064  reserved. CCCCCCCC  reserved. CCCCCCCC  MODE..... CCCCCCCC  reserved. CCCCCCCC
      +000078  reserved. CCCCCCCC  reserved. CCCCCCCC
```

```
    CIB for main: 265EA5D8
      +000000 265EA5D8  C3C9C240 00000000 00000000 010C0004  00000000 00000000 00030C89 59C3C5C5  |
CIB .......................i.CEE|
      +000020 265EA5F8  00000002 265EA6E8 00030C89 59C3C5C5  00000002 00000000 265E9208 A601B000
|.....;wY...i.CEE.........;k.w...|
      +000040 265EA618  00000000 265E9208 25E00A7C 25E0E858  00000003 00000000 00000000 00000000
|.....;k....@..Y.................|
      +000060 265EA638  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
      +000080 265EA658 - +00009F 265EA677             same as above
      +0000A0 265EA678  00000000 00000000 00000000 00000000  40250400 940C9000 00000009 00000000
|................ ...m...........|
      +0000C0 265EA698  00000000 25E012E0 265E9208 265E9208  25E00A7A 00000000 00000000 00000001
|.........;k..;k....:............|
      +0000E0 265EA6B8  00000002 00000003 00000002 00000014  00000003 00000000 00000000 00000000
|................................|
      +000100 265EA6D8  00000008 25E0EA70 00000000 CCCCCCCC  E9D4C3C8 02000001 00000000 A647FE0A
|................ZMCH........w...|
.
.
.
  [11]Storage for Active Routines:

    DSA frame: 265ECE90
      +000000 265ECE90  10CCCCCC 265ECDD8 265ED0B8 A699A1F0  A5EF8428 265ED088 265ECF28 265ECF88
|.....;.Q.;..wr.0v.d..;.h.;...;.h|
      +000020 265ECEB0  2699A0FA 265ECF38 2699A330 00000002  25E0E410 A5ECD622 265E6148 265EACDF
|.r...;...rt.......U.v.O..;/..;..|
      +000040 265ECED0  A5F97290 25E16B48 00000000 265ED0B8  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC  |
v9....,......;..................|
      +000060 265ECEF0  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC
|................................|
      +000080 265ECF10  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC  CCCCCCCC CCCCCCCC 265ECF38 265ECF88
|........................;...;.h|
      +0000A0 265ECF30  265ED088 CCCCCCCC E2819497 93854084  A4949740 97999684 A4838584 4082A840  |.;.h....Sample dump
produced by |
      +0000C0 265ECF50  83819393 89958740 C3C5C5F3 C4D4D740  40404040 40404040 40404040 40404040  |calling
CEE3DMP              |
      +0000E0 265ECF70  40404040 40404040 40404040 40404040  40404040 40404040 E3C8D9C5 C1C44DC1
|                    THREAD(A|
      +000100 265ECF90  D3D35D40 C2D3D6C3 D2E240E2 E3D6D9C1  C7C540C7 C5D5D6D7 E3E24040 40404040  |LL) BLOCKS STORAGE
GENOPTS      |
```

```
      +000120 265ECFB0  40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040
|                                |
      +000140 265ECFD0 - +0001DF 265ED06F             same as above
      +0001E0 265ED070  40404040 40404040 40404040 40404040  40404040 404040CC CCCCCCCC CCCCCCCC
|                       .........|
      +000200 265ED090  CCCCCCCC CCCCCCCC 25E0E438 CCCCCCCC  CCCCCCCC 265ECF38 CCCCCCCC CCCCCCCC
|..........U..........;..........|
      +000220 265ED0B0  CCCCCCCC CCCCCCCC 0000CCCC 265ECE90  265ED6E0 A5EF9240 A5EE99C8 265ED1F0
|............;...;O.v.k v.rH.;J0|
    DSA frame: 265ECDD8
      +000000 265ECDD8  10CCCCCC 265E9CE0 CCCCCCCC A5F972EC  2699A0C0 2660AB50 25E0E438 265EA5D8
|.....;......v9...r...-.&..U..;vQ|
      +000020 265ECDF8  26999CE8 265ECDD8 25ED009C CCCCCCCC  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC
|.r.Y.;.Q........................|
      +000040 265ECE18  CCCCCCCC CCCCCCCC 00000000 265ECE90  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC
|............;...................|
      +000060 265ECE38  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC
|................................|
      +000080 265ECE58 - +00009F 265ECE77             same as above
      +0000A0 265ECE78  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC  CCCCCCCC CCCCCCCC 10CCCCCC 265ECDD8
|.............................;.Q|
    DSA frame: 265E9208
      +000000 265E9208  10CCCCCC 265E90F0 265E92E8 A5E00A66  2641988C 25E011A4 265E92A0 265E92C5
|.....;.0.;kYv.....q....u.;k..;kE|
      +000020 265E9228  25E000FA 265E92C2 25E00ED0 265E92CC  265E92D0 00000030 80000000 A659CF62
|.....;kB.....;k..;k.........w...|
      +000040 265E9248  A5E92F60 25E16B48 00000000 265E92E8  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC  |
vZ.-..,......;kY................|
      +000060 265E9268  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC
|................................|
      +000080 265E9288  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC  CCCCCCCC CCCCCCCC 25E011A4 25E01195
|..........................u...n|
      +0000A0 265E92A8  00000003 25E00EDC 269997F0 00000000  26929210 2692A450 00000000 00000000
|.........rp0.....kk..ku&........|
      +0000C0 265E92C8  00000000 00000002 26999CE8 00000000  00000000 00000000 265E6148 CCCCCCCC
|.........r.Y.............;/.....|
    DSA frame: 265E90F0
      +000000 265E90F0  10CCCCCC 265E9030 CCCCCCCC A6999D58  A5E000C0 265E9208 265E61E8 A659D030
|.....;......wr..v....;k..;/Yw...|
      +000020 265E9110  00000002 A5E93046 25E157B0 25E039EC  25E04330 00000030 80000000 A659CF62
|....vZ......................w...|
      +000040 265E9130  A5E92F60 25E16B48 00000000 265E9208  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC  |
vZ.-..,......;k.................|
      +000060 265E9150  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC
|................................|
      +000080 265E9170 - +0000FF 265E91EF             same as above
      +000100 265E91F0  CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC  CCCCCCCC CCCCCCCC 10CCCCCC 265E90F0
|.............................;.0|

  [12]Control Blocks Associated with the Thread:

    CAA: 25E16B48
      +000000 25E16B48  00000800 00000000 265E9018 00000000  00000000 00000000 00000000 00000000
|.........;......................|
      +000020 25E16B68  00000000 00000000 25E12C28 00000000  00000000 00000000 00000000 00000000
|................................|
      +000040 25E16B88  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
      +000060 25E16BA8  00000000 00000000 00000000 00000000  00000000 80011420 00000000 00000000
|................................|
.
.
.
      +0003C0 25E16F08  00000000 00000000 A7F4FEE8 A7F40224  A5EBDBF0 A5FC2E58 A5F0E120 A5F8F8E8
|........x4.Yx4..v..0v...v0..v88Y|
      +0003E0 25E16F28  260D32E4 26999C28 00000000 00000000  00000000 00000000 00000000 00000000
|...U.r..........................|
    Thread Synchronization Queue Element (SQEL): 25E0F158
      +000000 25E0F158  00000000 00000000 00000000 00000000  2660A930 00000008 2671C9E0 00000000  |................-
z.......I.....|
      +000020 25E0F178  25E16B48 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|..,.............................|
    CEEDLLF: 26999C28
      +000000  EYE...... CEEDLLF   VERSION.. 01        FLAGS.... 00        SIZE..... 0060      SERVICE.. 04
      +00000D  REFTYPE.. 02        LOADTYPE. 00        reserved. 00        padding.. 00000000  PREV..... 26999BC8
      +000018  padding.. 00000000  NEXT..... 269998C8  FBTOK_A.. 00000DF6  FBTOK_B.. 41C3C5C5  FBTOK_C.. 00000000
      +00002C  padding.. 00000000  padding.. 00000000  DLLNAME.. 26999C90  padding.. 00000000  SYMNAME.. 26999CA0
```

```
      +000040  DLLNMLEN. 00000006  SYMNMLEN. 0000000F  RETCODE1. 00000000  RSNCODE1. 00000000  RETCODE2. 00000000
      +000054  RSNCODE2. 00000000  reserved. 00000000  reserved. 00000000  CEEDLLF_DLL_NAME(26999C90)
      +0000 26999C90  C3C5D3C4 D3D3AAAA 26998000 00000018  |CELDLL...r......|
    CEEDLLF_SYMBOL_NAME(26999CA0)
      +0000 26999CA0  95819485 6D9596A3 6D89956D 849393AA  |name_not_in_dll.|
    DUMMY DSA: 25E175F0
      +000000  FLAGS.... 0000      member... 0000      BKC...... 00006010  FWC...... 265E9030  R14...... A5E0451E
      +000010  R15...... A5E92F60  R0....... 7D000009  R1....... 265E61E8  R2....... 00000000  R3....... 00000000
      +000024  R4....... 00000000  R5....... 00000000  R6....... 00000000  R7....... A5E18000  R8....... 25E039E8
      +000038  R9....... 008E6B28  R10...... 00000000  R11...... A5E0444A  R12...... 25E16B48  reserved. 00000000
      +00004C  NAB...... 265E9030  PNAB..... 265E9030  reserved. 00000000  00000000
      +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 00000000
      +000078  reserved. 00000000  reserved. 00000000
.
```

```
.
.
  [6]Information for thread 2625970000000001

  Registers on Entry to CEE3DMP:
    PM....... 0100
    GPR0..... 00000000_00000001  GPR1..... 00000000_26935D78  GPR2..... 00000000_2671C43C  GPR3..... 00000000_26935D78
    GPR4..... 00000000_D96CA288  GPR5..... 00000000_00000000  GPR6..... 00000000_265E61A0  GPR7..... 00000000_2660A930
    GPR8..... 00000000_25E00ED0  GPR9..... 00000000_25F5F398  GPR10.... 00000000_8000D5D7  GPR11.... 00000000_8000C5D8
    GPR12.... 00000000_26936BD8  GPR13.... 00000000_26938090  GPR14.... 00000000_A6411BDE  GPR15.... 00000000_808E6648
    FPR0..... 4D000000  00000BD1            FPR2..... 00000000  00000000
    FPR4..... 00000000  00000000            FPR6..... 00000000  00000000
    GPREG STORAGE:
      Storage around GPR0 (00000001)
        -0001 00000000    Inaccessible storage.
        +001F 00000020    Inaccessible storage.
        +003F 00000040    Inaccessible storage.
.
.
.
  [7]Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod            Program Unit                   Service  Status
    1     CEEOPML2    +00000F90              CEEPLPKA            CEEOPML2                       HLE7770  Call
    2     EDCOWRP2    +00000F38              CEEEV003                                                    Call
    3     thread_func +000000AE  47          CELSAMP             CELSAMP                        1.1.D    Call
    4     CEEOPCMM    +00000986              CEEBINIT            CEEOPCMM                       HLE7770  Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date   Compile Attributes
    1     26938090   25F5E148   25F5E148   +00000F90  20100319   CEL       POSIX
    2     26937DE0   26410CA4   2640FA00   +000021DC  20100319   LIBRARY   POSIX
    3     26937D38   25E00D88   25E00D88   +000000AE  20070105   C/C++     POSIX EBCDIC  HFP
    4     2697DFF0   0000C5D8   0000C5D8   +00000986  20100319   CEL       POSIX

    Fully Qualified Names
    DSA   Entry       Program Unit                              Load Module
    3     thread_func //'POSIX.CRTL.C(CELSAMP)'                 CELSAMP

  [9]Parameters, Registers, and Variables for Active Routines:
    CEEOPML2 (DSA address 26938090):
      UPSTACK DSA
      Saved Registers:
        GPR0..... 00000001  GPR1..... 26935D78  GPR2..... 2671C43C  GPR3..... 26935D78
        GPR4..... D96CA288  GPR5..... 00000000  GPR6..... 265E61A0  GPR7..... 2660A930
.
.
.
    thread_func (DSA address 26937D38):
      UPSTACK DSA
      Parameters:
        parm             void *             0x25E00ED0
      Saved Registers:
        GPR0..... 00000001  GPR1..... 26935D78  GPR2..... 2671C43C  GPR3..... 26935D78
        GPR4..... D96CA288  GPR5..... 00000000  GPR6..... 265E61A0  GPR7..... 2660A930
.
.
.
```

```
  [10]Control Blocks for Active Routines:
    DSA for CEEOPML2: 26938090
      +000000  FLAGS.... 0000      member... CCCC      BKC...... 26937DE0  FWC...... 26938210  R14...... A5F5EF76
      +000010  R15...... A5F60090  R0....... 25F5F2D4  R1....... 26938114  R2....... 2671C43C  R3....... 26935D78
      +000024  R4....... 00000000  R5....... 2660A954  R6....... 265E61A0  R7....... 2660A930  R8....... 25E00ED0
.
.
.
  [11]Storage for Active Routines:
    DSA frame: 26937DE0
      +000000 26937DE0  10CCCCCC 26937D38 26938090 A6411BDE  A5F5E148 25F5F2D4 25E0F158 265E61A0
|.....l'..l..w...v5...52M..1..;/.|
      +000020 26937E00  25E00DC2 26937D38 25E00ED0 269378A0  26613128 00000000 00000080 CCCCCCCC
|...B.l'......l.../.............|
.
.
.
  [12]Control Blocks Associated with the Thread:
    CAA: 26936BD8
      +000000 26936BD8  00000800 00000000 26937D20 00000000  00000000 00000000 00000000 00000000
|.........l'.....................|
      +000020 26936BF8  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
.
.
.
  [13]Enclave variables:
    *.*.C(CELSAMP)':>mut
                    struct
     __m             unsigned long int
                                        643868976
    *.*.C(CELSAMP)':>thread[0]
                    struct
     __[0..6]        unsigned char      '\x26'  '\x25'     'p'  '\0'    '\0'    '\0'    '\0'
     __[7]           unsigned char      '\x01'
```

```
    *.*.C(CELSAMP)':>thread[1]
                     struct
     __[0..6]         unsigned char      '\x26'  '\x25'     'y'  '\0'    '\0'    '\0'    '\0'
     __[7]            unsigned char      '\x02'
    *.*.C(CELSAMP)':>threads_joined
                     signed int                   0
    *.*.C(CELSAMP)':>t1
                     unsigned char *    0x25E00ED0
    *.*.C(CELSAMP)':>t2
                     unsigned char *    0x25E00EDC
    *.*.C(CELSAMP)':>main
                     signed int (void)
                                        0x25E000C0
    *.*.C(CELSAMP)':>thread_func
                     void * ()          0x25E00D88
    *.*.C(CELSAMP)':>thread_cleanup
                     void ()            0x25E00B28
    *.*.C(CELDLL)':>wsa_array[0..6] unsigned char         'C'    'E'     'L'     'D'     'L'     'L'     ' '
    *.*.C(CELDLL)':>wsa_array[7..9]                       'W'    'S'     'A'
    *.*.C(CELDLL)':>dump_n_perc
                     void ()            0x2699A0C0

  [14]Enclave Control Blocks:

    EDB: 25E157B0
      +000000 25E157B0  C3C5C5C5 C4C24040 C7000001 25E16A08  25E15EB8 00000000 00000000 00000000  |CEEEDB
G........;.............|
      +000020 25E157D0  25E15CC0 25E15CF0 A5E18000 25E15300  00000000 00000000 25E158D0 00000000
|..*...*0v.......................|
      +000040 25E157F0  00000000 00000000 00006010 00000000  00000000 A5F38568 25E0C9E8 265E6190
|..........-.........v3e...IY.;/.|
      +000060 25E15810  0000D560 2671C000 25E13FC0 00001000  25E177F0 00000000 26008038 25E16B48
|..N-...............0..........,.|
      +000080 25E15830  90000000 0000DBFE 00000000 00000000  00000003 00000000 00006000 008FF078
|.........................-...0.|
      +0000A0 25E15850  00000001 00000100 25E0CAF0 25E15858  00000000 00000000 00000000 00000003
|..........0....................|
    MEML: 25E16A08
      +000000 25E16A08  00000000 00000000 25E94FD8 00000000  00000000 00000000 25E94FD8 00000000  |.........Z|
Q............Z|Q....|
      +000020 25E16A28  00000000 00000000 25E94FD8 00000000  25E11A98 00000000 A601B000 00000000  |.........Z|
Q......q....w.......|
      +000040 25E16A48  00000000 00000000 25E94FD8 00000000  00000000 00000000 25E94FD8 00000000  |.........Z|
Q............Z|Q....|
      +000060 25E16A68 - +00011F 25E16B27             same as above
    Mutex and Condition Variable Blocks (MCVB+MHT+CHT): 2671C018
      +000000 2671C018  00008F50 2671C044 000003F8 00001FC0  00000000 265E85D0 2671C444 000000F8
|...&.......8.........;e...D....8|
      +000020 2671C038  000007C0 00000000 265E85E8 00000000  00000000 00000000 00000000 00000000
|.........;eY....................|
      +000040 2671C058  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
```

```
.
.
.
      +0004A0 2671C4B8  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
      +0004C0 2671C4D8 - +00053F 2671C557             same as above
    Thread Synchronization Enclave Latch Table (EPALT): 2671C544
      +000000 2671C544  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
      +000020 2671C564 - +00009F 2671C5E3             same as above
      +0000A0 2671C5E4  00000000 00000000 00000000 00000000  00000000 DA1F0EA8 25E0F158 2671C850
|.......................y..1...H&|
.
.
.
      +000640 2671CB84  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
      +000660 2671CBA4 - +0009FF 2671CF43             same as above
    DLL Information:
    WSA Addr  Module Addr  Thread ID         Use Count  Name
    2660AB50  2699A000     2625860000000000  00000001   CELDLL
    HEAPCHK Option Control Block (HCOP): 265E50D0
      +000000 265E50D0  C8C3D6D7 00000048 00000001 00000000  00000000 0000000A 0000000A AAAAAAAA  |
HCOP............................|
      +000020 265E50F0  269E0028 265E5118 26727028 00000000  00000000 AAAAAAAA 00000400 00000000
|.....;..........................|
      +000040 265E5110  00000000 00000000 C8C3C6E3 00000200  00000000 AAAAAAAA AAAAAAAA AAAAAAAA
|........HCFT....................|
    HEAPCHK Element Table (HCEL) for Heapid 269D9F9C :
    Header: 269E0028
      +000000 269E0028  C8C3C5D3 2699D028 00000000 269D9F9C  000001F4 00000006 00000006 00000000  |
HCEL.r.............4...........|
                        Address  Seg Addr Length             Address  Seg Addr
Length
    Table: 269E0048
      +000000 269E0048  269DF020 269DF000 00000050 269A2878  269DF070 269DF000 00000028 269A29A0
|..0...0....&......0...0.........|
      +000020 269E0068  269DF098 269DF000 00000108 269A2AC8  269DF1A0 269DF000 00000050 269A2BF0
|..0q..0........H..1...0....&...0|
```

```
      +000040 269E0088  269DF1F0 269DF000 00000028 269A2D18  269E2020 269E2000 00000408 269A2E40
|..10..0........................ |
    HEAPCHK Element Table (HCEL) for Heapid 26999FCC :
    Header: 2699D028
      +000000 2699D028  C8C3C5D3 265E6228 269E0028 26999FCC  000001F4 00000001 00000001 00000000  |
HCEL.;.......r.....4............|
                        Address  Seg Addr Length             Address  Seg Addr
Length
    Table: 2699D048
      +000000 2699D048  2699C020 2699C000 000002A8 2698E0E0  00000000 00000000 00000000 00000000
|.r...r.....y.q..................|
    HEAPCHK Element Table (HCEL) for Heapid 00000000 :
    Header: 265E6228
      +000000 265E6228  C8C3C5D3 00000000 2699D028 00000000  000001F4 00000005 00000005 00000000  |
HCEL.....r.........4............|
                        Address  Seg Addr Length             Address  Seg Addr
Length
    Table: 265E6248
      +000000 265E6248  26609038 26609018 00001030 265E8190  2660A068 26609018 00000828 265E8258
|.-...-.......;a..-...-.......;b.|
      +000020 265E6268  2660A890 26609018 00000CD0 265E8330  2660B560 26609018 00002030 265E8460  |.-
y..-.......;c..-.-.-.......;d-|
      +000040 265E6288  2660D590 26609018 00000CD0 26999EB0  00000000 00000000 00000000 00000000  |.-
N..-.......r..................|

    WSA address.................265E6148

    Heap Storage Diagnostics
      Stg Addr  ID        Length      Entry         E Addr    E Offset   Load Mod
      269DF020  269D9F9C  00000050                  25FC9358  +00000000  CEEPLPKA
                                      CEEV#GTS      25FC9328  +0001E38C  CEEPLPKA
                                      CEEVGTST      25FD9BB0  +00000072  CEEPLPKA
                                      identify_cu   263903B0  +000005E4  CEEEV003
                                      SetDumpVars   263A2BC8  +00000210  CEEEV003
                                      __zdmpd       26584CB0  +000002E0  CEEEV003
                                      CEEKDMDR      25EE99C8  +00003CD6  CEEPLPKA
                                      CEEKDUMP      25EF8428  +00000E16  CEEPLPKA
                                      dump_n_perc   2699A0C0  +0000012E  CELDLL
                                      CEEPGTFN      25F97290  +0000005A  CEEPLPKA
      269DF070  269D9F9C  00000028                  25FC9358  +00000000  CEEPLPKA
                                      CEEV#GTS      25FC9328  +0001E38C  CEEPLPKA
                                      CEEVGTST      25FD9BB0  +00000072  CEEPLPKA
                                      identify_cu   263903B0  +000006FA  CEEEV003
                                      SetDumpVars   263A2BC8  +00000210  CEEEV003
                                      __zdmpd       26584CB0  +000002E0  CEEEV003
                                      CEEKDMDR      25EE99C8  +00003CD6  CEEPLPKA
                                      CEEKDUMP      25EF8428  +00000E16  CEEPLPKA
                                      dump_n_perc   2699A0C0  +0000012E  CELDLL
                                      CEEPGTFN      25F97290  +0000005A  CEEPLPKA
.
.
.
```

```
      2660D590  00000000  00000CD0                  25FC9358  +00000000  CEEPLPKA
                                      CEEV#GTS      25FC9328  +0001E38C  CEEPLPKA
                                      CEEVGQT       25FD68A0  +00000292  CEEPLPKA
                                      flocks        263BCCC0  +00000248  CEEEV003
                                      _fopen        261A6430  +00000224  CEEEV003
                                      fopen         261A6740  +0000006C  CEEEV003
                                      EDCOWRP3      26419874  +0000121A  CEEEV003
                                      main          25E000C0  +000007BC  CELSAMP
                                      EDCZMINV      2659CF6E  -FF87A878  CEEEV003
                                      CEEBBEXT      25E92F60  +000001B8  CEEPLPKA

    Language Environment Trace Table:

      Most recent trace entry is at displacement: 002980

          Displacement Trace Entry in Hexadecimal                                             Trace Entry in EBCDIC
          ------------ -----------------------------------------------------------------------
--------------------------------
            +000000    Time 15.25.14.872201    Date 2010.04.07   Thread ID...  2625860000000000
            +000010    Member ID.... 03    Flags..... 000000    Entry Type..... 00000001
            +000018    94818995 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |
main                           |
            +000038    60606E4D F0F8F55D 40979989 95A3864D  5D404040 40404040 40404040 40404040  |-->(085)
printf()          |
            +000058    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040
|                               |
            +000078    40404040 40404040
|                               |

            +000080    Time 15.25.14.998940    Date 2010.04.07   Thread ID... 2625860000000000
            +000090    Member ID.... 03    Flags..... 000000    Entry Type..... 00000002
            +000098    4C60604D F0F8F55D 40D9F1F5 7EF0F0F0  F0F0F0F0 C540C5D9 D9D5D67E F0F0F0F0  |<--(085) R15=0000000E
ERRNO=0000|
            +0000B8    F0F0F0F0 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |
0000............................|
            +0000D8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
            +0000F8    00000000 00000000
|........                       |
```

```
.
.
.
            +002900    Time 15.25.15.534529    Date 2010.04.07   Thread ID... 2625860000000000
            +002910    Member ID.... 03    Flags..... 000000    Entry Type..... 00000001
            +002918    84A49497 6D956D97 85998340 40404040  40404040 40404040 40404040 40404040  |
dump_n_perc                     |
            +002938    60606E4D F0F8F55D 40979989 95A3864D  5D404040 40404040 40404040 40404040  |-->(085)
printf()                |
            +002958    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040
|                                |
            +002978    40404040 40404040
|                                |

            +002980    Time 15.25.15.534533    Date 2010.04.07   Thread ID... 2625860000000000
            +002990    Member ID.... 03    Flags..... 000000    Entry Type..... 00000002
            +002998    4C60604D F0F8F55D 40D9F1F5 7EF0F0F0  F0F0F0F1 C440C5D9 D9D5D67E F0F0F0F0  |<--(085) R15=0000001D
ERRNO=0000|
            +0029B8    F0F0F0F0 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |
0000............................|
            +0029D8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
            +0029F8    00000000 00000000
|........                        |

  [15]Enclave Storage:
    Initial (User) Heap                                                  : 26609018
      +000000 26609018  C8C1D5C3 25E15C90 25E15C90 00000000  A6609018 2660E260 00008000 00002DB8  |
HANC..*...*.....w-...-S-........|
      +000020 26609038  26609018 00001030 C5E7F3F1 00000000  00000005 00000005 2660A070 2660A258
|.-......EX31............-...-s.|
      +000040 26609058  2660A295 2660A2D2 2660A30F 2660A34C  2660A389 2660A3C6 2660A403 2660A810  |.-sn.-sK.-t..-t<.-
ti.-tF.-u..-y.|
      +000060 26609078  2660A84D 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |.-
y(............................|
      +000080 26609098  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
      +0000A0 266090B8  00000000 2660A440 2660A47D 2660A4BA  2660A4F7 2660A534 2660A571 2660A5AE  |.....-u .-u'.-u..-
u7.-v..-v..-v.|
.
.
.
      +0045E0 2660D5F8 - +00523F 2660E257             same as above
      +005240 2660E258  AAAAAAAA AAAAAAAA 00000000 00000000  00000000 00000000 BBBBBBBB BBBBBBBB
|................................|
      +005260 2660E278  BBBBBBBB BBBBBBBB BBBBBBBB BBBBBBBB  BBBBBBBB BBBBBBBB BBBBBBBB BBBBBBBB
|................................|
      +005280 2660E298 - +007FFF 26611017             same as above
    LE/370 Anywhere Heap                                                 : 265E5000
      +000000 265E5000  C8C1D5C3 26612000 25E15CC0 25E15CC0  A65E5000 265E8850 00004000 000007B0  |
HANC./....*...*.w;&..;h&.. .....|
      +000020 265E5020  265E5000 00000018 D2C4C240 00000000  00000000 AAAAAAAA 265E5000 00000090
|.;&.....KDB ............;&.....|
      +000040 265E5040  E3E5C240 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |
TVB ............................|
.
.
.
      +003860 265E8860  BBBBBBBB BBBBBBBB BBBBBBBB BBBBBBBB  BBBBBBBB BBBBBBBB BBBBBBBB BBBBBBBB
|................................|
      +003880 265E8880 - +003FFF 265E8FFF             same as above
```

```
    LE/370 Anywhere Heap                                                 : 26612000
      +000000 26612000  C8C1D5C3 2671E000 265E5000 25E15CC0  26612000 00000000 00100028 00000000  |
HANC.....;&...*../..............|
      +000020 26612020  26612000 00100008 C5CB773F 719897EB  26258600 00000000 03000000 00000001
|./......E....qp...f............|
      +000040 26612040  94818995 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |
main                            |
.
.
.
    Additional Heap, heapid = 269D9F9C                                   : 269DF000
      +000000 269DF000  C8C1D5C3 269E2000 269D9F9C 269D9F9C  269DF000 269DF218 000003E8 000001D0  |
HANC..............0...2....Y....|
      +000020 269DF020  269DF000 00000050 00000000 2699AB48  2699A0C0 269DF0A0 25E12338 46F11000
|..0....&.....r...r....0......1..|
      +000040 269DF040  00000003 00000000 00040000 269DF078  00000000 2699A0A0 2699A0A0 00000000
|.............0......r...r......|
      +000060 269DF060  2699A4CC 2699A0A0 00000000 AAAAAAAA  269DF000 00000028 00186161 7DD7D6E2
|.ru..r............0.......//'POS|
.
.
.
  [16]File Status and Attributes:
.
.
.
  [17]Runtime Options Report:

   LAST WHERE SET                 OPTION
   -------------------------------------------------------------------------------
```

```
   IBM-supplied default              ABPERC(NONE)
   IBM-supplied default              ABTERMENC(ABEND)
   IBM-supplied default            NOAIXBLD
   IBM-supplied default              ALL31(ON)
   IBM-supplied default              ANYHEAP(16384,8192,ANYWHERE,FREE)
   IBM-supplied default            NOAUTOTASK
   IBM-supplied default              BELOWHEAP(8192,4096,FREE)
   IBM-supplied default              CBLOPTS(ON)
   IBM-supplied default              CBLPSHPOP(ON)
   IBM-supplied default              CBLQDA(OFF)
   DD:CEEOPTS                        CEEDUMP(0,SYSOUT=*,FREE=END,SPIN=UNALLOC)
   IBM-supplied default              CHECK(ON)
   IBM-supplied default              COUNTRY(US)
   IBM-supplied default            NODEBUG
   IBM-supplied default              DEPTHCONDLMT(10)
   DD:CEEOPTS                        DYNDUMP(POSIX.DEBUGG.HLE7770,DYNAMIC,)
   IBM-supplied default              ENVAR("")
   IBM-supplied default              ERRCOUNT(0)
   IBM-supplied default              ERRUNIT(6)
   IBM-supplied default              FILEHIST
   IBM-supplied default              FILETAG(NOAUTOCVT,NOAUTOTAG)
   Default setting                 NOFLOW
   IBM-supplied default              HEAP(32768,32768,ANYWHERE,KEEP,8192,4096)
   DD:CEEOPTS                        HEAPCHK(ON,1,0,10,10,1024,0,1024,0)
   DD:CEEOPTS                        HEAPPOOLS(ON,8,10,32,10,128,10,256,10,1024,10,2048,10,0,10,0,10,0,10,0,10,0,10,0,10)
   IBM-supplied default              HEAPZONES(0.ABEND,0,ABEND)
   IBM-supplied default              INFOMSGFILTER(OFF,,,,)
   IBM-supplied default              INQPCOPN
   IBM-supplied default              INTERRUPT(OFF)
   IBM-supplied default              LIBSTACK(4096,4096,FREE)
   IBM-supplied default              MSGFILE(SYSOUT,FBA,121,0,NOENQ)
   IBM-supplied default              MSGQ(15)
   IBM-supplied default              NATLANG(ENU)]
   Ignored                         NONONIPTSTACK(See THREADSTACK)
   IBM-supplied default              OCSTATUS
   IBM-supplied default              PAGEFRAMESIZE(4K,4K,4K)
   IBM-supplied default            NOPC
   IBM-supplied default              PLITASKCOUNT(20)
   Programmer default                POSIX(ON)
   IBM-supplied default              PROFILE(OFF,"")
   IBM-supplied default              PRTUNIT(6)
   IBM-supplied default              PUNUNIT(7)
   IBM-supplied default              RDRUNIT(5)
   IBM-supplied default              RECPAD(OFF)
   DD:CEEOPTS                        RPTOPTS(ON)
```

```
   DD:CEEOPTS                        RPTSTG(ON)
   IBM-supplied default            NORTEREUS
   IBM-supplied default            NOSIMVRD
   IBM-supplied default              STACK(131072,131072,ANYWHERE,KEEP,524288,131072)
   DD:CEEOPTS                        STORAGE(AA,BB,CC,0)
   DD:CEEOPTS                        TERMTHDACT(UADUMP,,96)
   IBM-supplied default            NOTEST(ALL,"*","PROMPT","INSPPREF")
   IBM-supplied default              THREADHEAP(4096,4096,ANYWHERE,KEEP)
   IBM-supplied default              THREADSTACK(OFF,4096,4096,ANYWHERE,KEEP,131072,131072)
   Programmer default                TRACE(ON,1048576,NODUMP,LE=1)
   IBM-supplied default              TRAP(ON,SPIE)
   IBM-supplied default              UPSI(00000000)
   IBM-supplied default            NOUSRHDLR(,)
   IBM-supplied default              VCTRSAVE(OFF)
   IBM-supplied default              XPLINK(OFF)
   IBM-supplied default              XUFLOW(AUTO)

[18]Process Control Blocks:

  PCB: 25E15300
    +000000 25E15300  C3C5C5D7 C3C24040 03030288 00000000  00000000 00000000 25E15538 A600AD00  |
CEEPCB  ...h................w...|
    +000020 25E15320  A6001AD0 A6008358 A6007F48 25E0ABF0  25E150D0 00000000 00000000 25E157B0  |
w...w.c.w."....0..&.............|
    +000040 25E15340  A60081F0 7FC00000 00000000 00011054  00000000 80000000 A5F72920 00000000  |
w.a0"...................v7......|

  MEML: 25E15538
    +000000 25E15538  00000000 00000000 25E94FD8 00000000  00000000 00000000 25E94FD8 00000000  |.........Z|
Q............Z|Q....|
    +000020 25E15558  00000000 00000000 25E94FD8 00000000  25E0FFD0 00000000 A601B000 265E4418  |.........Z|
Q...........w....;..|
    +000040 25E15578  00000000 00000000 25E94FD8 00000000  00000000 00000000 25E94FD8 00000000  |.........Z|
Q............Z|Q....|
    +000060 25E1598 - +00011F 25E15657             same as above

  Thread Synchronization Process Latch Table (PPALT): 2671CF44
    +000000 2671CF44  DA1F0EA8 25E0F158 2671C7EC 00000000  00000000 00000000 00000000 00000000
|...y..1...G.....................|
    +000020 2671CF64  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
    +000040 2671CF84  00000000 00000000 00000000 00000000  DA1F0EA8 25E0F158 2671CA44 00000000
|...................y..1.........|
    +000060 2671CFA4  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
    +000080 2671CFC4 - +0009FF 2671D943             same as above
```

```
[19]Additional Language Specific Information:

  errno information :
  Thread Id .... 2625860000000000 Errno ...... 0 Errnojr .... 00000000
[20]CEE3846I CEEDUMP Processing completed.
```

Sections of the Language Environment dump

The sections of the dump listed here appear independently of the Language Environment-conforming languages used. Each conforming language adds language-specific storage and file information to the dump. For a detailed explanation of language-specific dump output:

- For C/C++ routines, see "Finding C/C++ information in a Language Environment dump" on page 185.
- For COBOL routines, see "Finding COBOL information in a dump" on page 228.
- For Fortran routines, see "Finding Fortran information in a Language Environment dump" on page 252.
- For PL/I routines, see "Finding PL/I for MVS & VM information in a dump" on page 270.

Table 19. Contents of the Language Environment dump

Section Number and Heading	Contents
[1] Page Heading	The page heading section appears on the top of each page of the dump and contains the following information: • CEE3DMP identifier • Title: For dumps generated as a result of an unhandled condition, the title is "Condition processing resulted in the Unhandled condition." • Product abbreviation of Language Environment • Version number • Release number • Date • Time • Page number The contents of the second line of the page heading vary depending on the environment in which the CEEDUMP is issued. For CEEDUMPs produced under a batch environment, the following items are displayed: • ASID: Describes the address space ID. • Job ID: Describes the JES Job ID. • Job name: Describes the job name. • Step name: Describes the job's step name in which the CEEDUMP was produced. • UserID: Describes the TSO userid who issued the job. For jobs running with POSIX(ON), the following additional items are displayed: • PID: Displays the associated process ID. • Parent PID: Displays the associated parent PID. For CEEDUMPs produced under the z/OS UNIX shell, the following items are displayed: • ASID: Describes the address space ID. • PID: Displays the associated process ID. • Parent PID: Displays the associated parent PID. • User name: Contains the user ID associated to the CEEDUMP. For CEEDUMPs produced under CICS, the following items are displayed: • Transaction ID and task number.
[2] CEE3845I CEEDUMP Processing started.	Identifies the start of the Language Environment dump processing. Similarly, message CEE3846I identifies the end of the dump processing. Message number CEE3845I can be used to locate the start of the next CEEDUMP report when scanning forward in a data set that contains several CEEDUMP reports.
[3] Caller Program Unit and Offset	Identifies the routine name and offset in the calling routine of the call to the dump service.

Table 19. Contents of the Language Environment dump (continued)

Section Number and Heading	**Contents**
[4] Registers on Entry to CEE3DMP	Shows data at the time of the call to the dump service. • Program mask: The program mask contains the bits for the fixed-point overflow mask, decimal overflow mask, exponent underflow mask, and significance mask. • General purpose registers (GPRs) 0–15: On entry to CEE3DMP, the GPRs contain: **GPR 0** Working register **GPR 1** Pointer to the argument list **GPR 2–11** Working registers **GPR 12** Address of CAA **GPR 13** Pointer to caller's stack frame **GPR 14** Address of next instruction to run if the ALL31 runtime option is set to ON **GPR 15** Entry point of CEE3DMP • Floating point registers (FPRs) 0 through 15 • Vector registers (VRs) 0 through 31. • Storage pointed to by General Purpose Registers. Treating the contents of each register as an address, 32 bytes before and 64 bytes after the address are shown.
[5] - [17] Enclave Information. These sections show information that is specific to an enclave. When multiple enclaves are dumped, these sections will appear for each enclave. If multiple CEEPIPI main-DP environments exist, the dump service generates data and storage information for the most current Main-DP environment, followed by the previous (parent) Main-DP environments in a last-in-first-out (LIFO) order. Sections **[5] - [17]** will appear for each enclave in the most current Main-DP environment, and sections **[5]-[7]** will appear for enclaves in the previous (parent) Main-DP environments. When multiple nested Main-DP environments are present in the dump output, a line displaying the CEEPIPI token value for each dumped Main-DP environment will appear before the output for that environment.	
[5] Enclave Identifier	Names the enclave for which information in the dump is provided. If multiple enclaves exist, the dump service generates data and storage information for the most current enclave, followed by previous enclaves in a last-in-first-out (LIFO) order. For more information about dumps for multiple enclaves, see "Multiple enclave dumps" on page 79.
[6] - [12] Thread Information. These sections show information that is specific to a thread. When multiple threads are dumped, these sections will appear for each thread.	
[6] Information for thread	Shows the system identifier for the thread. Each thread has a unique identifier.

Table 19. Contents of the Language Environment dump (continued)

Section Number and Heading	Contents
[7] Traceback	In a multithread case, the traceback reflects only the current thread. For all active routines, the traceback section shows routine information in three parts. The first part contains: • DSA number: A number assigned to the information for this active routine by dump processing. The number is used to associate information from the first part of the traceback with information in the second and third parts of the traceback. • Entry: For COBOL, Fortran, PL/I, and Enterprise PL/I for z/OS routines, this is the entry point name. For C/C++ routines, this is the function name. If a function name or entry point was not specified for a particular routine, the string `'** NoName **'` will appear. • Entry point offset • Statement number: Refers to the line number in the source code (program unit) in which a call was made or an exception took place (see Status column). The statement number appears only if your routine was compiled with the options required to generate statement numbers. • Load module: The load module name displayed can be a partitioned data set member or an UNIX executable file. The load module name is also displayed in the third part of the traceback. • Program unit: For COBOL programs, program unit is the PROGRAM-ID name. For C, Fortran, and PL/I routines, program unit is the compile unit name. For Language Environment-conforming assemblers, program unit is either the EPNAME = value on the CEEPPA macro, or a fully qualified path name. If the program unit name is available to Language Environment (for example, for C/C++, the routine was compiled with TEST(SYM)), the program unit name will appear under this column, according to the following rules: – If your compiled routine is in a partitioned data set, only the member will be output. – If your compiled routine is in a sequential data set, only the last qualifier will be shown. – If your compiled routine is in an UNIX filename, only what fits of the filename will be displayed in a line. • Service level: The latest service level applied to the compile unit (for example, for IBM products, it would be the PTF number). – If the service level string is equal or less than 7 bytes, all of the string will be output. – If the service level string is longer than 7 bytes, the Service column will only show the first 7 bytes of the service string, and the full service string will be shown in section of Full Service Level with max length of 64 bytes. • Status: Routine status can be 'call' or 'exception'.

Section Number and Heading	Contents
[7] Traceback (continued)	The second part contains: • DSA number: A number assigned to the information for this active routine by dump processing. The number is used to associate information from the first part of the traceback with information in the second and third parts of the traceback. • Stack frame (DSA) address • Entry point address • Program unit address • Program unit offset: The offset of the last instruction to run in the routine. If the offset is a negative number, zero, or a very large positive number, the routine associated with the offset probably did not allocate a save area or could have been called using SVC-assisted linkage. Adding the program unit address to the offset gives the location of the current instruction in the routine. This offset is from the starting address of the routine. • Compile Date: Contains the year, month and day in which the routine was compiled. • Attributes: The available compilation attributes of the compile unit including: – A label identifying the LE-supported language such as COBOL, ENT PL/I, C/C++, and so on. – Compilation attributes such as EBCDIC, ASCII, IEEE or hexadecimal floating point (HFP). The compilation attributes will only be displayed if there is enough information available. – If the CEEDUMP was created under a POSIX environment, POSIX will be displayed. The third part of the traceback, which is also referred to as the "Fully Qualified Names" section, contains the following: • DSA number • Entry • Program unit: Similar to the Program Unit column in part 1 except that the server name and the complete program unit (PU) name will be displayed. A PU name will appear here only if it is available to Language Environment. • Load Module: The complete pathname of a load module name residing in an UNIX filename will be displayed here if available. The load module's full pathname will be displayed if the PATH environment variable is set such that the pathname of the load module's directory appears before the current directory (.). For load modules found in data sets, the same output shown in the traceback part 1 will also be displayed here. The fourth part of the traceback, which is also referred to as the "Full Service Level" section, contains the following: • DSA number • Entry • Service: The full service level string with max length of 64 bytes will be displayed here.

Table 19. Contents of the Language Environment dump (continued)

Table 19. Contents of the Language Environment dump (continued)

Section Number and Heading	Contents
[8] Condition Information for Active Routines	Displays the following information for all conditions currently active on the call chain: • Statement showing failing routine and stack frame address of routine • Condition information block (CIB) address • Current® condition, in the form of a Language Environment message for the condition raised or a Language Environment abend code, if the condition was caused by an abend • Location: For the failing routine, this is the program unit, entry routine, statement number, and offset. • Machine state, which shows: – Instruction length counter (ILC) – Interruption code – Program status word (PSW) – Contents of 64-bit GPRs 0–15. Note that when the high halves of the registers are not known, they are shown as ********. – Storage dump near condition (2 hex-bytes of storage near the PSW) – Storage pointed to by General Purpose Registers – Contents of access registers, if available This information shows the current values at the time the condition was raised. The high halves of the general registers are dumped, in case they are useful for debugging some applications. If the PSW associated with the condition indicates AMODE 24, the register content will be treated as 24-bit address.

Table 19. Contents of the Language Environment dump (continued)

Section Number and Heading	Contents
[9] Parameters, Registers, and Variables for Active Routines	For each active routine, this section shows: • Routine name and stack frame address • Arguments: For COBOL and Fortran, arguments are shown here rather than with the local variables. For COBOL, arguments are shown as part of local variables. PL/I arguments are not displayed in the Language Environment dump. • Saved registers: This lists the contents of GPRs 0–15 at the time the routine transferred control. • Storage pointed to by the saved registers: Treating the saved contents of each register as an address, 32 bytes before and 64 bytes after the address shown. • Local variables: This section displays the local variables and arguments for the routine. This section also shows the variable type. Variables are displayed only if the symbol tables are available. To generate a symbol table and display variables, use the following compile options: – For COBOL, use TEST(SYM). – For C/C++, use TEST. – For VS COBOL II, use FDUMP. – For COBOL/370, use TEST(SYM). – For COBOL for OS/390 & VM, use TEST(SYM). – For Enterprise COBOL for z/OS V4R2 and prior releases, use TEST(SYM). – For Enterprise COBOL for z/OS V5R1 and later releases, use TEST with any sub options or NOTEST(DWARF). **Note:** - LOW-VALUES (x'00') is the NUL character in EBCDIC, which is an unprintable character that cannot be displayed properly. - A NUL character in a data item in the "Local Variables" section is replaced by a double-quote when displayed in the CEEDUMP. – For Fortran, use SDUMP. – For PL/I, arguments and variables are not displayed.
[10] Control Blocks for Active Routines	For each active routine controlled by the STACKFRAME option, this section lists contents of related control blocks. The Language Environment-conforming language determines which language-specific control blocks appear. The possible control blocks are: • Stack frame • Condition information block • Language-specific control blocks
[11] Storage for Active Routines	Displays local storage for each active routine. The storage is dumped in hexadecimal, with EBCDIC translations on the right side of the page. There can be other information, depending on the language used. For C/C++ routines, this is the stack frame storage. For COBOL programs, this is language-specific information, WORKING-STORAGE, and LOCAL-STORAGE.

Table 19. Contents of the Language Environment dump (continued)

Section Number and Heading	Contents
[12] Control Blocks Associated with the Thread	Lists the contents of the Language Environment common anchor area (CAA), thread synchronization queue element (SQEL), DLL failure data, and dummy stack frame. Other language-specific control blocks can appear in this section. DLL failure data is described in "Using the DLL failure control block" on page 79.
[13] Enclave variables:	Displays language specific global variables. This section also shows the variable type. Variables are displayed only if the symbol tables are available.
[14] Enclave Control Blocks	Lists the contents of the Language Environment enclave data block (EDB) and enclave member list (MEML). The information presented may vary depending on which runtime options are set. • If the POSIX runtime option is set to ON, this section lists the contents of the mutex and condition variable control blocks, the enclave level latch table, and the thread synchronization trace block and trace table. • If DLLs have been loaded, this section shows information for each DLL including the DLL name, load address, use count, writeable static area (WSA) address, and the thread id of the thread that loaded the DLL. • If the HEAPCHK runtime option is set to ON, this section shows the contents of the HEAPCHK options control block (HCOP) and the HEAPCHK element tables (HCEL). A HEAPCHK element table contains the location and length of all allocated storage elements for a heap in the order that they were allocated. • When the *call-level* suboption of the HEAPHCK runtime option is set, any unfreed storage, which would indicate a storage leak, would be displayed in this area. The traceback could then be used to identify the program which did not free the storage. • If the TRACE runtime option is set to ON, this section shows the contents of the Language Environment trace table. Other language-specific control blocks can appear in this section.
[15] Enclave Storage	Shows the Language Environment heap storage. For C/C++ and PL/I routines, heap storage is the dynamically allocated storage. For COBOL programs, it is the storage used for WORKING-STORAGE data items. This section also shows the writeable static area (WSA) storage for program objects. Other language-specific storage can appear in this section.
[16] File Status and Attributes	Contains additional information about the file.
[17] Runtime Options Report	Lists the Language Environment runtime options in effect when the routine was executed.
[18] Process Control Blocks	Lists the contents for the Language Environment process control block (PCB), process member list (MEML), and if the POSIX runtime option is set to ON, the process level latch table. Other language-specific control blocks can appear in this section.
[19] Additional Language Specific Information	Displays any additional information not included in other sections. For C/C++, it shows the thread ID of the thread that generated the dump and the settings of the errno and errnojr variables for that thread.

Table 19. Contents of the Language Environment dump (continued)

Section Number and Heading	Contents
[20] CEE3846I CEEDUMP Processing completed.	Identifies the end of the Language Environment dump processing. Similarly, message CEE3845I identifies the start of the dump processing. Message CEE3846I can be used to locate the end of the previous CEEDUMP report when scanning backward in a data set that contains several CEEDUMP reports.

Debugging with specific sections of the Language Environment dump

The following sections describe how you can use particular blocks of the dump to help you debug errors.

Tracebacks, condition information, and data values section

The CEE3DMP call with dump options TRACEBACK, CONDITION, and VARIABLES generates output that contains a traceback, information about any conditions, and a list of arguments, registers, and variables. The traceback, condition, and variable information provided in the Language Environment dump can help you determine the location and context of the error without any additional information. The traceback section includes a sequential list for all active routines and the routine name, statement number, and offset where the exception occurred. The condition information section displays a message describing the condition and the address of the condition information block. The arguments, registers, and variables section shows the values of your arrays, structures, arguments, and data during the sequence of calls in your application. Static data values do not appear. Single quotes indicate character fields. These sections of the dump are shown here.

Upward-growing (non-XPLINK) stack frame section

The stack frame, also called dynamic save area (DSA), for each active routine is listed in the full dump.

A stack frame chain is associated with each thread in the runtime environment and is acquired every time a separately compiled procedure or block is entered. A stack frame is also allocated for each call to a Language Environment service. All stack frames are back-chained with a stopping stack frame (also called a dummy DSA) as the first stack frame on the stack. Register 13 addresses the recently active stack frame or a standard register save area (RSA). The standard save area back chain must be initialized, and it holds the address of the previous save area. Not all Language Environment-conforming compilers set the forward chain; thus, it cannot be guaranteed in all instances. Calling routines establish the member-defined fields.

When a routine makes a call, registers 0–15 contain the following values:

- R1 is a pointer to parameter list or 0 if no parameter list passed.
- R0, R2–R11 is unreferenced by Language Environment. Caller’s values are passed transparently.
- R12 is the pointer to the CAA if entry to an external routine.
- R13 is the pointer to caller’s stack frame.
- R14 is the return address.
- R15 is the address of the called entry point.

With an optimization level other than 0, C/C++ routines save only the registers used during the running of the current routine. Non-Language Environment RSAs can be in the save area chain. The length of the save area and the saved register contents do not always conform to Language Environment conventions. For more information about stack frames in Language Environment storage management, see The stack frame model in *z/OS Language Environment Programming Guide*. Figure 12 on page 63 shows the format of the upward-growing stack frame.

Note: The *Member-defined* fields are reserved for the specific higher level language.

00	Flags	Member-defined
04	CEEDSABACK - Standard Save Area Back Chain	
08	CEEDSAFWD - Standard Save Area Forward Chain	
0C	CEEDSASAVE - GPRs 14, 15, 0-12	
≈		
48	Member-defined	
4C	CEEDSANAB - Current Next Available Byte (NAB) in Stack	
50	CEEDSAPNAB - End of Prolog NAB	
54	Member-defined	
58	Member-defined	
5C	Member-defined	
60	Member-defined	
64	Reserved for Debugging	
68	Member-defined	
6C	CEESAMODE - Return Address of the Module That Caused the Last Mode Switch	
70	Member-defined	
74	Member-defined	
78	Reserved for Future Condition Handling	
7C	Reserved for Future Use	

Figure 12. Upward-growing (non-XPLINK) stack frame format

Downward-growing (XPLINK) stack frame section

Figure 13 on page 64 shows the format of the downward-growing stack frame. For detailed information about the downward-growing stack, register conventions and parameter passing conventions, see The XPLINK stack in *z/OS Language Environment Programming Guide*.

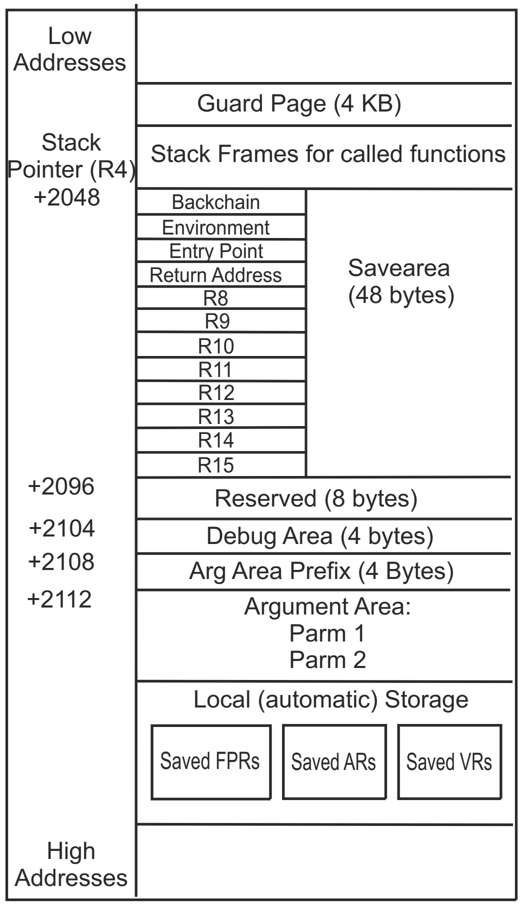


Figure 13. Downward-growing (XPLINK) stack frame format

Common Anchor Area

Each thread is represented by a common anchor area (CAA), which is the central communication area for Language Environment. All thread- and enclave-related resources are anchored, provided for, or can be obtained through the CAA. The CAA is generated during thread initialization and deleted during thread termination. When calling Language Environment-conforming routines, register 12 points to the address of the CAA.

Use CAA fields as described. Do not modify fields and do not use routine addresses as entry points, except as specified. Fields marked 'Reserved' exist for migration of specific languages, or internal use by Language Environment. Language Environment defines their location in the CAA, but not their use. Do not use or reference them except as specified by the language that defines them.

Table 20 on page 65 describes the CAA fields. For more information about the CAA and other structures to which it refers (for example, the DLL failure control block, CEEDLLF), see Language Environment common anchor area in *z/OS Language Environment Vendor Interfaces*.

Table 20. Description of CAA fields

Hex Offset	Type	Len	CAA Field	Explanation
0	Bit	1	CEECAAFLAG0	CAA flag bits, defined as follows: **0–5** Reserved **6** CEECAAXHDL. A flag used by the condition handler. If the flag is set to 1, the application requires immediate return/percolation to the system on any interrupt or condition handler event. **7** Reserved
1	Bit	1	Reserved	
2	Bit	1	CEECAALANGP	PL/I language compatibility flags external to Language Environment. The bits are defined as follows: **0–3** Reserved **4** CEECAATHFN. A flag set by PL/I to indicate a PL/I FINISH ON-unit is active. If the flag is set to 1, no PL/I FINISH ON-unit is active. If the flag is set to 0, a PL/I FINISH ON-unit could be active. **5–7** Reserved
3	Char	5	Reserved	
8	Address	4	CEECAABOS	Start of the current storage segment. This field is initially set during thread initialization. It indicates the start of the current stack storage segment. It is altered when the current stack storage segment is changed.
C	Address	4	CEECAAEOS	This field is used to determine if a stack overflow routine must be called when allocating storage from the user stack. Normally, the value of this field will represent the end of the current user stack segment. However, its value can also be zero to force the call of a stack overflow routine for every allocation of storage from the user stack. This field is used by function prologs that do not use FASTLINK linkage conventions.
10	Char	52	Reserved	
44	Signed	2	CEECAATORC	Thread level return code. The thread level return code set by CEESRC callable service.
46	Signed	2	CEECAATURC	
48	Char	44	Reserved	
74	Address	4	CEECAATOVF	Address of stack overflow routine.
78	Char	168	Reserved	
120	Address	4	CEECAAATTN	Address of the Language Environment attention handling routine. The address of the Language Environment attention handling routine supports common runtime environment's polling code convention for attention processing.

Hex Offset	Type	Len	CAA Field	Explanation
124	Char	56	Reserved	
15C	Address	4	CEECAAHLLEXIT	Address of the Exit List Control Block set by the HLL user exit CEEBINT.
160	Char	56	Reserved	
198	Bit (96)	12	CEECAAHOOK	Code to pass control to the debugger.
1A4	Address	4	CEECAADIMA	A(debugger entry)
1A8	Char	68	CEECAAHOOKS	Hook area. This is the start of 18 fullword execute hooks. Language Environment initializes each fullword to X'07000000'. The hooks can be altered to support various debugging hook mechanisms.
1A8	Char	4	CEECAAALLOC	ALLOCATE descr. built
1AC	Char	4	CEECAASTATE	New statement begins
1B0	Char	4	CEECAAENTRY	Block entry
1B4	Char	4	CEECAAEXIT	Block exit
1B8	Char	4	CEECAAMEXIT	Multiple block exit
1BC	Char	32	CEECAAPATHS	PATH hooks
1BC	Char	4	CEECAALABEL	At a label constant
1C0	Char	4	CEECAABCALL	Before CALL
1C4	Char	4	CEECAAACALL	After CALL
1C8	Char	4	CEECAADO	DO block starting
1CC	Char	4	CEECAAIFTRUE	True part of IF
1D0	Char	4	CEECAAIFFALSE	False part of IF
1D4	Char	4	CEECAAWHEN	WHEN group starting
1D8	Char	4	CEECAAOTHER	OTHERWISE group
1DC	Char	4	CEECAACGOTO	GOTO hook for C
1E0	Char	4	CEECAARSVDH1	Reserved hook
1E4	Char	4	CEECAARSVDH2	Reserved hook
1E8	Char	4	CEECAAMULTEVT	Multiple Event Hook
1EC	Bit (32)	4	CEECAAMEVMASK	Muliple Event Hook Mask -End of Debug
1F0	Char	80	CEECAAMEMBER_AREA	
1F0	Address	4	CEECAACGENE	C/370 CGENE
1F4	Address	4	CEECAACRENT	C/370 writable static
1F8	Char	8	CEECAACFLTINIT	Used to convert fixed to float cfltini
200	Address	4	CEECAACPRMS	Address of parameters passed to main module
204	Signed	4	CEECAAC_RTL	Combination of 24 unique C/370 trc typ

Table 20. Description of CAA fields (continued)

Table 20. Description of CAA fields (continued)				
Hex Offset	**Type**	**Len**	**CAA Field**	**Explanation**
208	Address	4	CEECAACTHD	
20C	Address	4	CEECAACURRFECB	
210	Address	4	CEECAAEDCV	C/370 vector table
214	Address	4	CEECAACPCB	Reserved
218	Address	4	CEECAACEDB	C/370 CEDB
21C	Char	3	Reserved	
21F	Char	1	CEECAASPCFLAG3	Used for SPC
220	Address	4	CEECAACIO	Address of cio
224	Char	4	CEECAAFDSETFD	Used by FD_* macros
228	Char	2	CEECAAFCBMUTEXOK	
22A	Char	2	Reserved	
22C	Char	4	CEECAATC16	
230	Signed	4	CEECAATC17	
234	Address	4	CEECAAEDCOV	C/370 Open Libvec
238	Signed	4	CEECAACTOFSV	
23C	Address	4	CEECAATRTSPACE	C/370 Open Libvec
240	Char	24	Reserved	
258	Address	4	CEECAA_TCASRV_USERWORD	TCA Service Rtn Vctr
25C	Address	4	CEECAA_TCASRV_WORKAREA	
260	Address	4	CEECAA_TCASRV_GETMAIN	
264	Address	4	CEECAA_TCASRV_FREEMAIN	
268	Address	4	CEECAA_TCASRV_LOAD	
26C	Address	4	CEECAA_TCASRV_DELETE	
270	Address	4	CEECAA_TCASRV_EXCEPTION	
274	Address	4	CEECAA_TCASRV_ATTENTION	
278	Address	4	CEECAA_TCASRV_MESSAGE	

Table 20. Description of CAA fields (continued)				
Hex Offset	**Type**	**Len**	**CAA Field**	**Explanation**
27C	Char	4	Reserved	
280	Address	4	CEECAALWS	Addr of PL/I LWS
284	Address	4	CEECAASAVR	Register save
288	Char	36	Reserved	
2AC	Bit	1	CEECAASYSTM	Underlying operating system. The value indicates the operating system supporting the active environment. **0** Undefined. This value should not appear after Language Environment is initialized. **1** Unsupported **3** z/OS
2AD	Bit (8)	1	CEECAAHRDWR	Underlying hardware. This value indicates the type of hardware on which the routine is running. **0** Undefined. This value should not appear after Language Environment is initialized. **1** Unsupported **2** System/370, non-XA **3** System/370, XA **4** System/370, ESA
2AE	Bit (8)	1	CEECAASBSYS	Underlying subsystem. This value indicates the subsystem (if any) on which the routine is running. **0** Undefined. This value should not occur after Language Environment is initialized. **1** Unsupported **2** None. The routine is not running under a Language Environment-recognized subsystem. **3** TSO **4** IMS **5** CICS

Table 20. Description of CAA fields (continued)				
Hex Offset	**Type**	**Len**	**CAA Field**	**Explanation**
2AF	Bit (8)	1	CEECAAFLAG2	CAA Flag 2, defined as follows: **0** Bimodal addressing is available. **1** Vector hardware is available. **2** Thread terminating. **3** Initial thread **4** Library trace is active. The TRACE runtime option was set. **5** Reserved **6** CEECAA_ENQ_Wait_Interruptible. Thread is in an enqueue wait. **7** Reserved
2B0	Unsign	1	CEECAALEVEL	Language Environment level identifier. This contains a unique value that identifies each release of Language Environment. This number is incremented for each new release of Language Environment.
2B1	Bit (8)	1	CEECAA_PM	Image of current program mask.
2B2	Bit (16)	2	CEECAA_INVAR	Field that is at the same fixed offset in 31-bit and 64-bit CAAs
2B3	Bit	1	Reserved	
2B4	Address	4	CEECAAGETLS	Address of stack overflow for library routines.
2B8	Address	4	CEECAACELV	Address of the Language Environment library vector. This field is used to locate dynamically loaded Language Environment routines.
2BC	Address	4	CEECAAGETS	Address of the Language Environment prolog stack overflow routine. The address of the Language Environment get stack storage routine is included in prolog code for fast reference.
2C0	Address	4	CEECAALBOS	Start of the library stack storage segment. This field is initially set during thread initialization. It indicates the start of the library stack storage segment. It is altered when the library stack storage segment is changed.
2C4	Address	4	CEECAALEOS	This field is used to determine if a stack overflow routine must be called when allocating storage from the library stack. Normally, the value of this field will represent the end of the current library stack segment. However, its value can also be zero to force the call of a stack overflow routine for every allocation of storage from the library stack. This field is used by function prologs that do not use FASTLINK linkage conventions.

Table 20. Description of CAA fields (continued)				
Hex Offset	**Type**	**Len**	**CAA Field**	**Explanation**
2C8	Addres s	4	CEECAALNAB	Next available library stack storage byte. This contains the address of the next available byte of storage on the library stack. It is modified when library stack storage is obtained or released.
2CC	Addres s	4	CEECAADMC	Language Environment shunt routine address. Its value is initially set to 0 during thread initialization. If it is nonzero, this is the address of a routine used in specialized exception processing.
2D0	Signed	4	CEECAAACD	Most recent CAASHAB abend code.
2D0	Signed	4	CEEAAABCODE	Most recent abend completion code.
2D4	Signed	4	CEECAAARS	Most recent CAASHAB reason code.
2D4	Signed	4	CEECAAARSNCODE	Most recent abend reason code.
2D8	Addres s	4	CEECAAERR	Address of the current condition information block. After completion of initialization, this always points to a condition information block. During exception processing, the current condition information block contains information about the current exception being processed. Otherwise, it indicates no exception being processed.
2DC	Addres s	4	CEECAAGETSX	Address of the user stack extender routine. This routine is called to extend the current stack frame in the user stack. Its address is in the CEECAA for performance reasons.
2E0	Addres s	4	CEECAADDSA	Address of the Language Environment dummy DSA. This address determines whether a stack frame is the dummy DSA, also known as the zeroth DSA.
2E4	Signed	4	CEECAASECTSIZ	Vector section size. This field is used by the vector math services.
2E8	Signed	4	CEECAAPARTSUM	Vector partial sum number. This field is used by the vector math services.
2EC	Signed	4	CEECAASSEXPNT	Log of the vector section size. This field is used by the vector math services.
2F0	Addres s	4	CEECAAEDB	Address of the Language Environment EDB. This field points to the encompassing EDB.
2F4	Addres s	4	CEECAAPCB	Address of the Language Environment PCB. This field points to the encompassing PCB.
2F8	Addres s	4	CEECAAEYEPTR	Address of the CAA eye catcher. The CAA eye catcher is CEECAA. This field can be used for validation of the CAA.
2FC	Addres s	4	CEECAAPTR	Address of the CAA. This field points to the CAA itself and can be used in validation of the CAA.
300	Addres s	4	CEECAAGETS1	Non-DSA stack overflow. This field is the address of a stack overflow routine, which cannot guarantee that the current register 13 is pointing at a stack frame. Register 13 must point, at a minimum, to a save area.
304	Addres s	4	CEECAASHAB	ABEND shunt routine. Its value is initially set to zero during thread initialization. If it is nonzero, this is the address of a routine used in specialized exception processing for ABENDs that are intercepted in the ESTAE exit.

Table 20. Description of CAA fields (continued)				
Hex Offset	**Type**	**Len**	**CAA Field**	**Explanation**
308	Address	4	CEECAAPRGCK	Routine interrupt code for CEECAADMC. If CEECAADMC is nonzero, and a routine interrupt occurs, this field is set to the routine interrupt code and control is passed to the address in CEECAAMDC.
30C	Bit (8)	1	CEECAAFLAG1	CAA flag bits, defined as follows: **0** CEECAASORT. A call to DFSORT is active. **1** CEECAA_USE_OLD_STK. Use the old stack. **2** CEECAA_CICS_EXT_REG . ERTLI CICS extended register interface is in effect **3** CEECAASHAB_RECOVER_IN_ESTAE _MODE. When on, the Language Environment ESTAE resumes to the abend shunt in the mode and key in which the Language Environment ESTAE was established **4 - 5** Reserved **6** CEECAA_CICS_VR_SPT . ERTLI CICS vector register interface is in effect. **7** Reserved
30D	Char	1	CEECAASHAB_KEY	IPK result when CEECAASHAB is set.
30E	Char	2	Reserved	
310	Signed	4	CEECAAURC	Thread level return code. This is the common place for members to set the return codes for subroutine-to-subroutine return code processing.
314	Address	4	CEECAAESS	Determine if a stack overflow routine must be called when allocating storage from the user stack. Normally, the value of this field will represent the end of the current user stack segment. However, its value can also be zero to force the call of a stack overflow routine for every allocation of storage from the user stack. This field is used by function prologs that use FASTLINK linkage conventions.
318	Address	4	CEECAALESS	Determine if a stack overflow routine must be called when allocating storage from the library stack. Normally, the value of this field will represent the end of the current library stack segment. However, its value can also be zero to force the call of a stack overflow routine for every allocation of storage from the library stack. This field is used by function prologs that use FASTLINK linkage conventions.
31C	Address	4	CEECAAOGETS	Overflow from user stack allocations.
320	Address	4	CEECAAOGETLS	Overflow from library stack allocations.

Table 20. Description of CAA fields (continued)

Hex Offset	Type	Len	CAA Field	Explanation
324	Address	4	CEECAAPICICB	Address of the preinitialization compatibility control block.
328	Address	4	CEECAAOGETSX	User DSA exit from OPLINK.
32C	Signed	2	CEECAAGOSMR	Go some more—Used CEEHTRAV multiple.
32E	Signed	2	Reserved	
330	Address	4	CEECAALEOV	This field is the address of the Language Environment library vector for z/OS UNIX support.
334	Signed	4	CEECAA_SIGSCTR	SIGSAFE counter.

Table 20. Description of CAA fields (continued)				
Hex Offset	**Type**	**Len**	**CAA Field**	**Explanation**
338	Bit (32)	4	CEECAA_SIGSFLG	SIGSAFE flags indicate the signal safety of the library and are defined, as follows. **0** CEECAA_SIGPUTBACK. The signal cannot be delivered, therefore the signal is put back to the kernel. **1** CEECAA_SA_RESTART. Indicates that a signal registered with the SA_RESTART flag interrupted the last kernel call, and the signal catcher returned. **2** Reserved **3** CEECAA_SIGSAFE. It is safe to deliver the signal, while in library code. **4** CEECAA_CANCELSAFE. It is safe to deliver the cancel signal, while in library code. **5** CEECAA_SIGRESYNCH. CEECAA_sigputsynch flag was on last time CEEOSIGR resolicited a signal. **6** CEECAA_FRZ_UNSAFE. This thread is in an unsafe state to be frozen. **7** CEECAA_NOAPPREGS. User application registers may be saved in a nonstandard place. **8** CEECAA_EINTR_RSOL. Secondary Signal resolicitation is in progress, after EINTR errno from inner function. **9** CEECAA_EINTR_PUTB. Secondary resolicited signal has been put back. **10** CEECAA_EINTR_REST. User signal catcher returned after catching secondary resolicited signal with SA_RESTART in effect. **11** CEECAA_EINTR_SIGG. Stray signal interrupted CEEOSIGG while secondary signal resolicitation was in progress.
33A	Bit (16)	2	Reserved	
33C	Char	8	CEECAATHDID	This field is the thread identifier
344	Address	4	CEECAA_DCRENT	Reserved
348	Address	4	CEECAA_DANCHOR	Reserved
34C	Address	4	CEECAA_CTOC	TOC anchor for CRENT.

Table 20. Description of CAA fields (continued)				
Hex Offset	**Type**	**Len**	**CAA Field**	**Explanation**
354	Signed	4	CEECAACICSRSN	CICS reason code from member language.
358	Address	4	CEECAAMEMBR	Address of thread-level member list.
35C	Address	4	CEECAA_SIGNAL_STATUS	Signal status of the terminating thread member list.
360	Address	4	CEECAA_HCOM_REG7	HCOM saved R7.
360	Address	4	CEECAA_HCOM_REG14	HCOM saved R14.
364	Address	4	CEECAA_STACKFLOOR	Lowest usable address in XP stack.
368	Address	4	CEECAAHPGETS	XP stack extension rtn.
36C	Address	4	CEECAAEDCHPXV	C/C++ XPLINK libvec.
370	Address	4	CEECAAFOR1	Reserved for FORTRAN.
374	Address	4	CEECAAFOR2	Reserved for FORTRAN.
378	Address	4	CEECAATHREADHEAPID	Thread heap ID.
37C	Signed	4	CEECAA_SYS_RTNCODE	System (kernel) return code.
380	Signed	4	CEECAA_SYS_RSNCODE	System (kernel) reason code.
384	Address	4	CEECAAGETFN	Address of the WSA swap routine.
388	Address	4	CEECAA_JIT1	Reserved.
38C	Address	4	CEECAA_JIT2	Reserved.
390	Address	4	CEECAASIGNGPTR	Pointer to 'signam' external variable in a C application.
394	Signed	4	CEECAASIGNG	Value of sign of lgamma() -1 - negative sign 0 - zero +1 - positive sign.
398	Address	4	CEECAA_FORDBG	Ptr to AFHDBHIM - FORTRAN hook interface.
39C	Bit (8)	1	CEECAAAB_STATUS	Validity flags.
39D	Unsign	1	CEECAA_STACKDIRECTION	Stack direction.
39E	Bit	2	Reserved	
3A0	Signed	4	CEECAAAB_GR0	Reg 0 at the time of abend.
3A4	Signed	4	CEECAAAB_ICD1	SDWAICD1.
3A8	Signed	4	CEECAAAB_ABCC	SDWAABCC.
3AC	Signed	4	CEECAAAB_CRC	SDWACRC.

Table 20. Description of CAA fields (continued)				
Hex Offset	**Type**	**Len**	**CAA Field**	**Explanation**
3B0	Address	4	CEECAAAGTS	Entry point of CEEVAGTS routine.
3B4	Address	4	CEECAA_LER5N1	Reserved.
3B8	Address	4	CEECAAHERP	Address of CEEHERP routine.
3BC	Address	4	CEECAAUSTKBOS	Start of user stack segment.
3C0	Address	4	CEECAAUSTKEOS	End of user stack segment.
3C4	Address	4	CEECAAUSERRTN@	Address of thread start routine. Undefined on IPT or prior to thread init event.
3C8	Bit	8	CEECAAUDHOOK	Hook swapping XPLINK.
3D0	Address	4	CEECAACEL_HPXV_B	Address of XPLINK compat vector for Base library.
3D4	Address	4	CEECAACEL_HPXV_M	Address of XPLINK compat vector for Math library.
3D8	Address	4	CEECAACEL_HPXV_L	Address of XPLINK compat vector for Locale library.
3DC	Address	4	CEECAACEL_HPXV_O	Address of XPLINK compat vector for Open library.
3E0	Address	4	CEECAACEL4VEC3	Address of 3rd C-RTL library vector.
3E4	Address	4	CEECAA_CEEDLLF	Address of the newest CEEDLLF control block.
3E8	Address	4	CEECAA_SAVSTACK	Zero or saved stack pointer. This field can be used to save the stack pointer before calling a routine with OS_NOSTACK linkage. After the call returns, this field must be set back to zero.
3EC	Char	4	Reserved	
3F0	Char	4	CEECAA_USER_WORD	4-byte user field available for application use. In pre-initialization (CEEPIPI) environments, this field is initialized in the IPT CAA from the CEEPIPI set_user_word function. This field is initialized to 0 in non-CEEPIPI environments (including all nested enclaves), and for all non-IPT CAAs in CEEPIPI environments. This field is not otherwise accessed by Language Environment.
3F4	Address	4	CEECAA_SAVSTACK_ASYNC	Zero or address of field that is zero or saved stack pointer. An application that has large sections of code that do not require access to the Language Environment stack but could benefit from having an additional register available can use this field.
3F8	Char	4	CEECAA_STACK_GUARD	Zero or Stack Guard token.

Condition information block

Figure 14 on page 76 shows the condition information block. The Language Environment condition manager creates a condition information block (CIB) for each condition that is encountered in the

Language Environment environment. The CIB holds data required by the condition handling facilities and pointers to locations of other data. The address of the current CIB is in the CAA.

For COBOL, Fortran, and PL/I applications, Language Environment provides macros (in the SCEESAMP data set) that map the CIB. For C/C++ applications, the macros are in `leawi.h`.

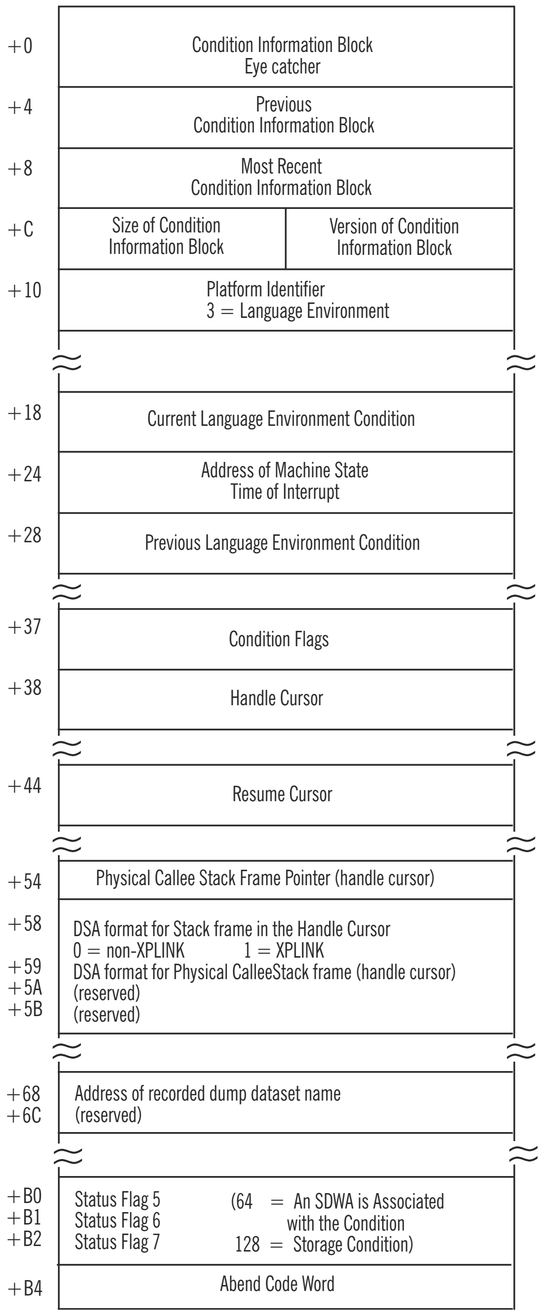


Figure 14. Condition information block (Part A)

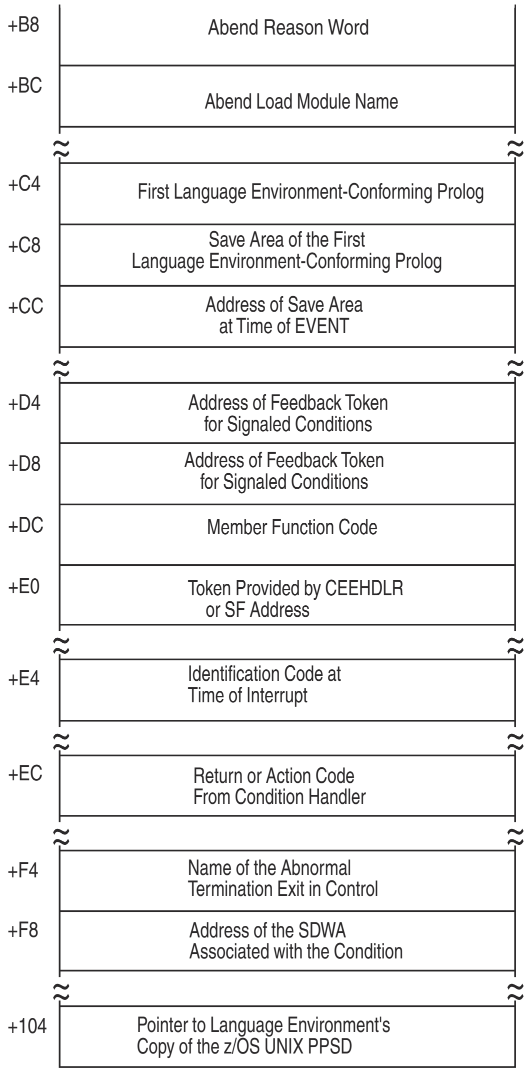


Figure 15. Condition information block (Part B)

The flags for Condition Flag 4:

2
: The resume cursor was moved.

4
: The message service processed the condition.

8
: The resume cursor was explicitly moved.

The flags for Status Flag 5, Language Environment events:

1
: Caused by an attention interrupt.

2
: Caused by a signaled condition.

4
: Caused by a promoted condition.

8
: Caused by a condition management raised TIU.

32
Caused by a condition signaled via CEEOKILL The signaled-via-CEEOKILL flag is always set with the signaled flag; thus, a signaled condition can have a value of either 2 or 34. (The value is 2 if the signaled condition does not come through CEEOKILL. If it comes through CEEOKILL, its value is 2+32=34.)

64
Caused by a program check.

128
Caused by an abend.

The flags for Status Flag 6, Language Environment actions:

2
Doing stack frame zero scan.

4
H-cursor pointing to owning SF.

8
Enable only pass (no condition pass).

16
MRC type 1.

32
Resume allowed.

64
Math service condition.

128
Abend reason code valid.

Address of recorded dump data set name: If this address is not 0, then it points to a 44-byte fixed-length character string. If the length of the data set name is less than 44, the character string is EBCDIC-encoded and is padded by blanks.

The language-specific function codes for the CIB:

X'1'
For condition procedure.

X'2'
For enablement.

X'3'
For stack frame zero conditions.

Using the machine state information block

The Language Environment machine state information block contains condition information pertaining to the hardware state at the time of the error. Figure 16 on page 79 shows the machine state information block.

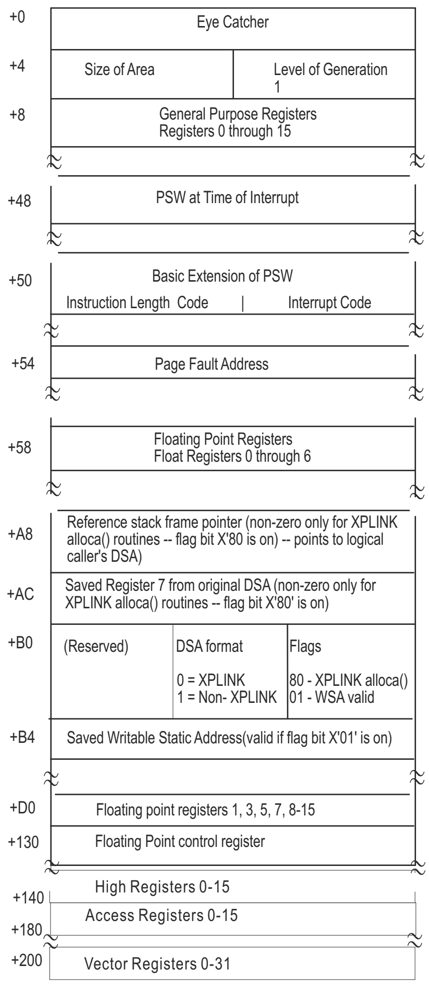


Figure 16. Machine state information block

Using the DLL failure control block

The CEEDLLF control block contains error diagnostics corresponding to an implicit or explicit DLL failure. Diagnostics describing up to 10 of the most recent DLL failures are available in a circular list of CEEDLLF control blocks. When viewing a dump, the in-use CEEDLLF control blocks are displayed from newest to oldest. See "Understanding the Language Environment IPCS VERBEXIT LEDATA output" on page 88 for the contents of CEEDLLF fields.

Multiple enclave dumps

Figure 17 on page 80 illustrates the information available in the Language Environment dump and the order of information for multiple enclaves. If multiple enclaves are used, the dump service generates data and storage information for the most current enclave and moves up the chain of enclaves to the starting enclave in a LIFO order. For example, if two enclaves are used, the dump service first generates output for the most current enclave. Then the service creates output for the previous enclave. A thread terminating in a non-POSIX environment is analogous to an enclave terminating because Language Environment Version 1 supports only single threads.

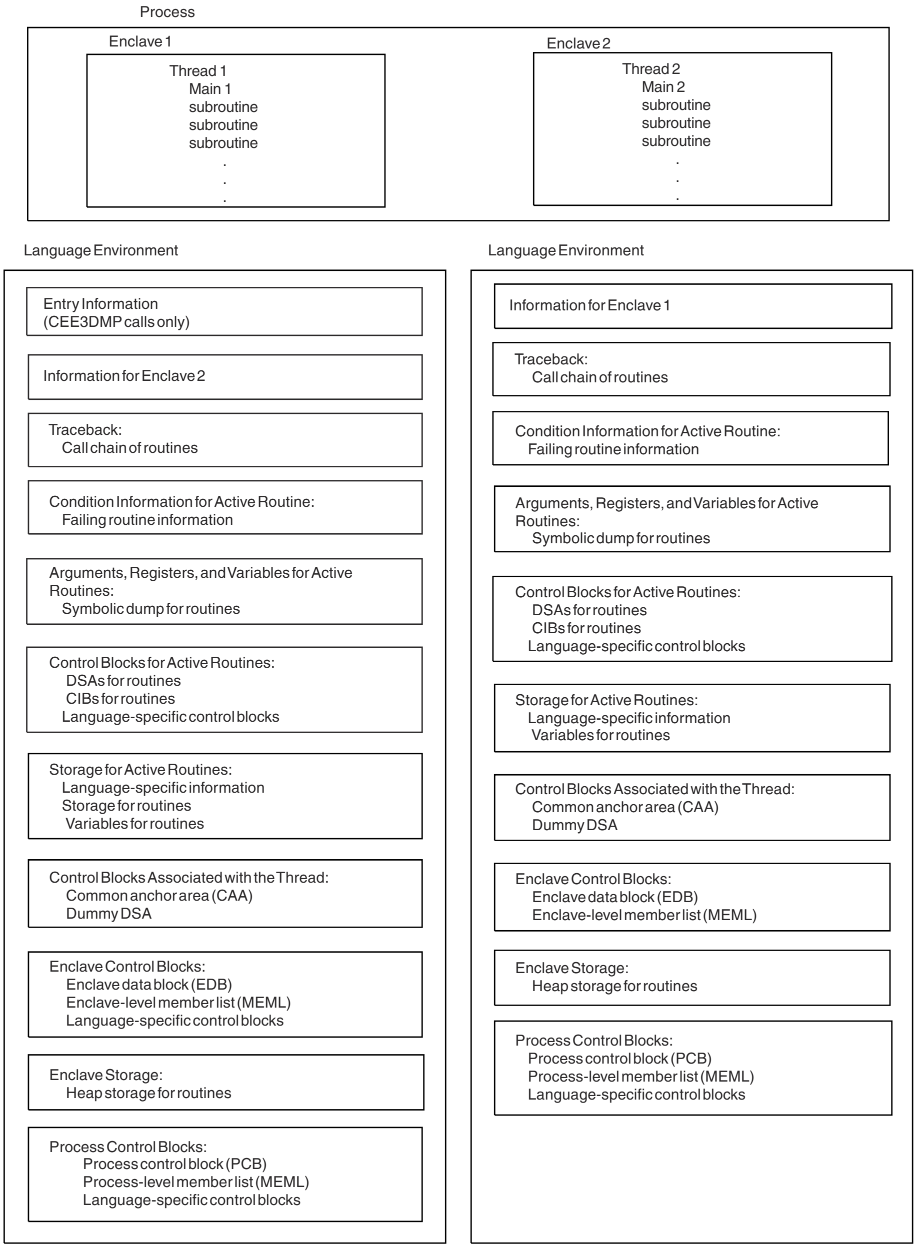


Figure 17. Language Environment dump of multiple enclaves

If multiple nested CEEPIPI Main-DP environments are present, the dump service generates data and storage information for the most current Main-DP environment and moves up the chain of Main-DP environments to the starting Main-DP environment in LIFO order.

When multiple nested CEEPIPI Main-DP environments are present in the dump output, the information in Figure 17 on page 80 appears for the most current Main-DP environment. For the other chained Main-DP environments, only the traceback section appears. The following is an example:

```
**** Information for CEEPIPI token xxxxxxxx ****

information for newest enclave
information for next older enclave
information for oldest enclave
Other information

**** Information for CEEPIPI token xxxxxxxx ****

traceback for newest enclave
```

```
traceback for next older enclave
traceback for next older enclave
traceback for next older enclave
traceback for oldest enclave

**** Information for CEEPIPI token xxxxxxxx ****

traceback for newest enclave
traceback for next older enclave
traceback for next older enclave
traceback for oldest enclave
```

Generating a system dump

A system dump contains the storage information needed to diagnose errors. You can use Language Environment to generate a system dump through any of the following methods:

DYNDUMP(*hlq*,DYNAMIC,TDUMP)
: You can use the DYNDUMP runtime option to obtain IPCS-readable dumps of user applications that would ordinarily be lost due to the absence of a SYSMDUMP, SYSUDUMP, or SYSABEND DD statement.

TERMTHDACT(UAONLY, UATRACE, or UADUMP)
: You can use these runtime options, with TRAP(ON), to generate a system dump if an unhandled condition of severity 2 or greater occurs. For more details about the level of dump information produced by each of the TERMTHDACT suboptions, see "Generating a Language Environment dump with TERMTHDACT" on page 36.

TRAP(ON,NOSPIE) TERMTHDACT(UAIMM)
: TRAP(ON,NOSPIE) TERMTHDACT(UAIMM) generates a system dump of the user address space of the original abend or program interrupt prior to the Language Environment condition manager processing the condition.

ABPERC(*abcode*)
: The ABPERC runtime option specifies one abend code that is exempt from the Language Environment condition handler. The Language Environment condition handler percolates the specified abend code to the operating system. The operating system handles the abend and generates a system dump. ABPERC is ignored under CICS.

Abend Codes in Initialization Assembler User Exit
: Abend codes listed in the initialization assembler user exit are passed to the operating system. The operating system can then generate a system dump.

CEE3ABD
: You can use the CEE3ABD callable service to cause the operating system to handle an abend.

See system or subsystem documentation for detailed system dump information.

The method for generating a system dump varies for each of the Language Environment runtime environments. The following sections describe the recommended steps needed to generate a system dump in a batch, IMS, CICS, and z/OS UNIX shell runtime environments. Other methods may exist, but these are the recommended steps for generating a system dump.

For information about Language Environment runtime options, see Using runtime options in *z/OS Language Environment Programming Guide*.

Steps for generating a system dump in a batch runtime environment

Perform the following steps to generate a system dump in a batch runtime environment. When you are done, you will have generated a system dump in a batch runtime environment.

1. Specify runtime options TERMTHDACT(UAONLY, UADUMP, UATRACE, or UAIMM), and TRAP(ON). If you specify the suboption UAIMM then you must set TRAP(ON,NOSPIE). The TERMTHDACT suboption determines the level of detail of the Language Environment formatted dump. For further details on the TERMTHDACT suboptions, see "Generating a Language Environment dump with TERMTHDACT" on page 36.
2. Decide whether to include a SYSMDUMP DD card or use the DYNDUMP runtime option.

- Include a SYSMDUMP DD card with the desired data set name and DCB information:

```
LRECL=4160, BLKSIZE=4160, and RECFM=FBS.
```

- Specify the DYNDUMP runtime option with the following information:

```
DYNDUMP (hlq,DYNAMIC,TDUMP)
```

3. Rerun the program.

Steps for generating a system dump in an IMS runtime environment

Perform the following steps to generate a system dump in an IMS runtime environment. When you are done, you will have generated system dump in an IMS runtime environment.

1. Specify runtime options TERMTHDACT(UAONLY, UADUMP, UATRACE, or UAIMM), ABTERM(ABEND), and TRAP(ON). If you specify the suboption UAIMM, then you must set TRAP(ON,NOSPIE). The TERMTHDACT suboption determines the level of detail of the Language Environment formatted dump. For further details on the TERMTHDACT suboptions, see "Generating a Language Environment dump with TERMTHDACT" on page 36.
2. Decide whether to include a SYSMDUMP DD card or use the DYNDUMP runtime option.
   - Include a SYSMDUMP DD card with the data set name and DCB information:

   ```
   LRECL=4160, BLKSIZE=4160, and RECFM=FBS.
   ```

   - Specify the DYNDUMP runtime option with the following information:

   ```
   DYNDUMP (hlq,DYNAMIC,TDUMP)
   ```

3. Rerun the program.

Steps for generating a system dump in a CICS runtime environment

Before you begin: Under CICS, a system dump provides the most useful information for diagnosing problems. However, if you have a Language Environment U4038 abend, CICS will not generate a system dump. To generate diagnostic information for a CICS runtime environment with a Language Environment U4038 abend, you must create a Language Environment U4039 abend. For instructions on how to create a Language Environment U4039 abend, see "Steps for generating a Language Environment U4039 abend" on page 83.

Note: DYNDUMP is ignored in a CICS environment.

Perform the following steps to generate a system dump in a CICS runtime environment. When you are done, you will have generated a system dump in a CICS runtime environment.

1. Specify runtime options TERMTHDACT(UAONLY, UADUMP, or UATRACE), ABTERM(ABEND), and TRAP(ON). The TERMTHDACT suboption determines the level of detail of the Language Environment formatted dump. For more details on the TERMTHDACT suboptions, see "Generating a Language Environment dump with TERMTHDACT" on page 36.
2. Update the transaction dump table with the CICS-supplied CEMT command:

   ```
   CEMT SET TRD(40XX) SYS ADD
   ```

   Result
      You will see CEMT output.

   Example

   ```
   STATUS: RESULTS - OVERTYPE TO MODIFY
   Trd(4088)  Sys    Loc Max( 999 )  Cur(0000)
   ```

3. Rerun the program.

Steps for generating a Language Environment U4039 abend

If you have a Language Environment U4038 abend, CICS will not generate a system dump. To generate diagnostic information, you must create a Language Environment U4039 abend by performing the following steps. By setting these runtime options, a Language Environment U4039 abend occurs which generates a system dump.

1. Specify DUMP=YES in CICS DFHSIT.
2. Specify runtime options TERMTHDACT(UAONLY, UATRACE, or UADUMP), ABTERM(ABEND), and TRAP(ON)
3. Rerun the program.

Steps for generating a system dump in a z/OS UNIX shell

Perform the following steps to generate a system dump from a z/OS UNIX shell:

- Using _BPXK_MDUMP
  1. Specify where to write the system dump
     - To write the system dump to a z/OS data set, issue the following command, where *filename* is a fully qualified data set name with DCB information: LRECL=4160, BLKSIZE=4160, and RECFM=FBS.

       ```
       export _BPXK_MDUMP=filename
       ```

       Example
       `export _BPXK_MDUMP=hlq.mydump`
     - To write the system dump to a z/OS UNIX file, issue the following command, where *filename* is a fully qualified z/OS UNIX file name.

       ```
       export _BPXK_MDUMP=filename
       ```

       Example
       `export _BPXK_MDUMP=/tmp/mydump.dmp`
  2. Specify Language Environment runtime options, where *suboption* is UAONLY, UADUMP, UATRACE, or UAIMM.

     ```
     export _CEE_RUNOPTS="termthdact(suboption)"
     ```

     If UAIMM is set, TRAP(ON,NOSPIE) must also be set. The TERMTHDACT suboption determines the level of detail of the Language Environment formatted dump. For more details about the TERMTHDACT suboptions, see "Generating a Language Environment dump with TERMTHDACT" on page 36.
  3. Rerun the program.

  When you are done, the system dump is written to the data set name or z/OS UNIX file name that was specified. For additional _BPXK_MDUMP information see _BPXK environment variables in *z/OS UNIX System Services Planning*.
- Using DYNDUMP
  1. Specify Language Environment runtime options:

     ```
     export _CEE_RUNOPTS="termthdact(suboption),DYNDUMP(hlq,DYNAMIC,TDUMP)"
     ```

     suboption
     is UAONLY, UADUMP, UATRACE, or UAIMM. If UAIMM is set, TRAP(ON,NOSPIE) must also be set. The TERMTHDACT suboption determines the level of detail of the Language Environment formatted dump. For more details about the TERMTHDACT suboptions, see "Generating a Language Environment dump with TERMTHDACT" on page 36.

hlq
the high level qualifier for the dump data set to be created.

2. Rerun the program.

When you are done, the system dump is written to the name generated by the DYNDUMP runtime option. For more information about DYNDUMP, see DYNDUMP in *z/OS Language Environment Programming Reference*.

You can also specify the signal SIGDUMP on the **kill** command to generate a system dump of the user address space. For more information about the **kill** command and the SIGDUMP signal, see kill - End a process or job, or send it a signal in *z/OS UNIX System Services Command Reference*.

Formatting and analyzing system dumps

You can use the interactive problem control system (IPCS) to format and analyze system dumps. Language Environment provides an IPCS VERBEXIT LEDATA that can be used to format Language Environment control blocks. For more information about IPCS, see *z/OS MVS IPCS User's Guide*.

Preparing to use the Language Environment support for IPCS

Use the following guidelines before you use IPCS to format Language Environment control blocks:

- Ensure that your IPCS job can find the CEEIPCSP member.

  IPCS provides an exit control table with imbed statements to enable other products to supply exit control information. The IPCS default table, BLSCECT, normally in the SYS1.PARMLIB library, has the following entry for Language Environment:

  ```
  IMBED MEMBER(CEEIPCSP) ENVIRONMENT(IPCS)
  ```

  The Language Environment-supplied CEEIPCSP member, installed in the SYS1.PARMLIB library, contains the Language Environment-specific entries for the IPCS exit control table.
- Provide an IPCSPARM DD statement to specify the libraries containing the IPCS control tables.

  Example
  `//IPCSPARM DD DSN=SYS1.PARMLIB,DISP=SHR`
- Ensure that your IPCS job can find the Language Environment-supplied ANALYZE exit routines installed in the SYS1.MIGLIB library.
- To aid in debugging system or address space hang situations, Language Environment mutexes, latches and condition variables can be displayed if the CEEIPCSP member you are using is updated to identify the Language Environment ANALYZE exit, by including the following statement:

  ```
  EXIT EP(CEEEANLZ) ANALYZE
  ```

Understanding Language Environment IPCS VERBEXIT – LEDATA

Purpose

Use the LEDATA verb exit to format data for Language Environment. This VERBEXIT provides information about the following topics:

- A summary of Language Environment at the time of the dump
- Runtime Options
- Storage Management Control Blocks
- Condition Management Control Blocks
- Message Handler Control Blocks

- C/C++ Control Blocks
- COBOL Control Blocks
- PL/I Control Blocks

Format

```
VERBEXIT LEDATA [ 'parameter[,parameter]...']

Report Type Parameters:
 [  SUM  ]
 [  HEAP  |  STACK  | SM  ]
 [  HPT(number) [ HPTTCB (address) ] [ HPTCELL(address) ] [ HPTLOC(location) ] ]
 [  CM  ]
 [  MH  ]
 [  CEEDUMP  ]
 [  COMP(value) ]
 [  PTBL(value)  ]
 [  SW3164  ]
 [  ALL  ]

Data Selection Parameters:
 [  DETAIL  |  EXCEPTION  ]

Control Block Selection Parameters:

 [  CAA(caa-address)  ]
 [  DSA(dsa-address)  ]
 [  TCB(tcb-address)  ]
 [  ASID(address-space-id)  ]
 [  NTHREADS(value)  ]
```

Parameters

The following sections describe the different types of supported parameters. Note that only hexadecimal characters can be specified as addresses provided in LEDATA parameters. Special characters cause the formatter to fail. Therefore, to specify a 64–bit address as a parameter, it must be in the form like 123456789 instead of 1_23456789.

Report type parameters

Use the following parameters to select the type of report. You can specify as many reports as you want. If you omit these parameters, the default is SUMMARY.

SUMmary
Requests a summary of the Language Environment at the time of the dump. The following information is included:

- TCB address
- Address Space Identifier
- Language Environment Release
- Active members
- Formatted CAA, PCB, RCB, EDB, and PMCB
- Runtime Options in effect

HEAP | STACK | SM

HEAP
Requests a report on Storage Management control blocks pertaining to HEAP storage, as well as a detailed report on heap segments. The detailed report includes information about the free storage tree in the heap segment, and information about each allocated storage element. It also specifies a heap pools report with information useful to find potential damaged cells. Note that Language Environment does not support alternative Vendor Heap Manager (VHM) data.

STACK
Requests a report on Storage Management control blocks pertaining to STACK storage.

SM
Requests a report on Storage Management control blocks. This is the same as specifying both HEAP and STACK.

HPT(*number*) [HPTTCB (*address*)] [HPTCELL(*address*)] [HPTLOC(*location*)]

HPT(*number*)
Requests that the HEAPPOOLS trace, if available, be formatted. If the value is 0 or *, the trace for every HEAPPOOLS pool ID is formatted. If the value is a single number (1-12), the trace for the specific HEAPPOOLS pool ID is formatted. If only the HPT keyword is specified with no value, the trace behaves similar to when the value is *. If no filter is specified, all of the entries are formatted for the specific pool ID.

HPTTCB (*address*)
Filters the HEAPPOOLS trace table, if available, printing only those entries for a given TCB address (*address*).

HPTCELL(*address*)
Filters the HEAPPOOLS trace table, if available, printing only those entries for a given cell address (*address*).

HPTLOC(*location*)
Filters the HEAPPOOLS trace table, if available, printing only those entries for a given virtual storage location (*location*). The following values are valid:

31
Display entries that are located in virtual storage below the bar.

64
Display entries that are located in virtual storage above the bar.

ALL
Display entries that are located in virtual storage below or above the bar.

Note:

1. Filter options without specifying HPT implies HPT(*).
2. You can specify multiple options together, like HPTTCB and HPTCELL. All pieces of information must match the trace entry for it to be formatted. If location and cell contradict each other, such as HPTLOC(31) and HPTCELL(64bit addr), an error will be displayed.

CM
Requests a report on Condition Management control blocks.

MH
Requests a report on Message Handler control blocks.

CEEdump
Requests a CEEDUMP-like report. The report includes the traceback, the Language Environment trace, and thread synchronization control blocks at process, enclave, and thread levels.

If the dump output has multiple nested enclaves or multiple nested CEEPIPI Main-DP environments, tracebacks will appear for each enclave in each Main-DP environment. This is similar to how the tracebacks appear in the CEEDUMP output. See the section "Multiple enclave dumps" on page 79 for a description of CEEDUMP output when multiple enclave and Main-DP environments are present.

PTBL(*value*)
Requests that PreInit tables be formatted according to the following values:,

CURRENT
If current is specified, the PreInit table that is associated with the current or specified TCB is displayed.

address
If an address is specified, the PreInit table at that address is specified.

*****
All active and dormant PreInit tables within the current address space are displayed; this option is time-consuming.

ACTIVE
The PreInit tables for all TCBs in the address space are displayed.

COMP(*value*)
Requests component control blocks to be formatted according to the following values:

C
Requests a report on C/C++ runtime control blocks.

CIO
Requests a report on C/C++ I/O control blocks.

COBOL
Requests a report on COBOL-specific control blocks.

PLI
Requests a report on PL/I-specific control blocks.

ALL
Requests a report on all the preceding control blocks.

If the value specified in COMP is not one of the values (C, CIO, COBOL, PL/I, or ALL), a message is displayed and it continues executing as if COMP(ALL) was specified.

Note: The ALL parameter for LEDATA also generates a report that includes all the component control blocks.

SW3164
Requests a report on AMODE 31 and AMODE 64 interoperability. The following information is included:

- Formatted SW3164 structure.

ALL
Requests all reports, as well as C/C++, COBOL, and PL/I reports.

Data selection parameters

Data selection parameters limit the scope of the data in the report. If no data selection parameter is selected, the default is DETAIL.

DETail
Requests formatting all control blocks for the selected components. Only significant fields in each control block are formatted. For the Heap and Storage Management Reports, the DETAIL parameter will provide a detailed heap segment report for each heap segment in the dump. The detailed heap segment report includes information on the free storage tree in the heap segments, and all allocated storage elements. This report will also identify problems that are detected in the heap management data structures. For more information about the Heap Reports, see "Understanding the HEAP LEDATA output" on page 107.

EXCeption
Requests validating all control blocks for the selected components. Output is only produced naming the control block and its address for the first control block in a chain that is invalid. Validation consists of control block header verification at the very least.

For the Summary, CEEDUMP, C/C++, COBOL, and PL/I reports, the EXCEPTION parameter has not been implemented. For these reports, DETAIL output is always produced.

Control block selection parameters

Use these parameters to select the control blocks used as the starting points for formatting.

CAA(*caa-address*)
: Specifies the address of the CAA. If not specified, the CAA address is obtained from the TCB.

DSA(*dsa-address*)
: Specifies the address of the DSA. If not specified, the DSA address is assumed to be the register 13 value for the TCB.

TCB(*tcb-address*)
: Specifies the address of the TCB. If not specified, the TCB address of the current TCB from the CVT is used.

ASID(*address-space-id*)
: Specifies the hexadecimal address space ID. If not specified, the IPCS default address space ID is used. This parameter is not needed when the dump only has one address space.

NTHREADS(*value*)
: Specifies the number of TCBs for which the traceback will be displayed. If NTHREADS is not specified, *value* will default to (1). If *value* is specified as asterisk (*), all TCBs will be displayed.

Examples

For examples of the output that is produced by LEDATA and explanation of the content, refer to "Understanding the Language Environment IPCS VERBEXIT LEDATA output" on page 88.

Understanding the Language Environment IPCS VERBEXIT LEDATA output

The Language Environment IPCS VERBEXIT LEDATA generates formatted output of the Language Environment runtime environment control blocks from a system dump. The following example illustrates the output produced when the LEDATA VERBEXIT is invoked with the ALL parameter. (Ellipses are used to summarize some sections of the dump.) The system dump being formatted was obtained by specifying the TERMTHDACT(UADUMP) runtime option when running the program CELSAMP in Figure 8 on page 41.

"Sections of the Language Environment LEDATA VERBEXIT formatted output" on page 103 describes the information contained in the formatted output. For reference, the sections of the sample dump are numbered to correspond with the descriptions of the formatted output.

```
     ALL
     ********************************************************************************
                                LANGUAGE ENVIRONMENT DATA
     ********************************************************************************

      Language Environment Product 04 V02 R04.00

[1]  TCB: 008E6968              LE Level: 19                  ASID: 01A9

[2]  Active Members: C/C++

[3]     CEECAA: 21616BB8
        +000000 FLAG0:00 LANGP:08    BOS:21D71018      EOS:00000000
        +000044 TORC:00000000  TOVF:80011410     ATTN:2160CF80
        +00015C HLLEXIT:00000000     HOOK:50C0D064 0DC058C0 C0060DCC
        +0001A4 DIMA:000092A4  ALLOC:0700C3C8    STATE:0700C3C8
        +0001B0 ENTRY:0700C3C8 EXIT:0700C3C8     MEXIT:0700C3C8
        +0001BC LABEL:0700C3C8 BCALL:0700C3C8    ACALL:0700C3C8
        +0001C8 DO:0700C3C8    IFTRUE:0700C3C8   IFFALSE:0700C3C8
        +0001D4 WHEN:0700C3C8  OTHER:0700C3C8    CGOTO:0700C3C8
        +0001F0 CGENE:216127E8 CRENT:21D6E148    CTHD:216109F0
        +000210 EDCV:A1BD931C  CEDB:21611AB8     EDCOV:21BD0614
        +000258 TCASRV_USERWORD:00000000   TCASRV_WORKAREA:2160C760
        +000260 TCASRV_GETMAIN:00000000    TCASRV_FREEMAIN:00000000
        +000268 TCASRV_LOAD:8000DDA0 TCASRV_DELETE:8000DCC0
        +000270 TCASRV_EXCEPTION:00000000  TCASRV_ATTENTION:00000000
        +000278 TCASRV_MESSAGE:00000000    LWS:00000000      SAVR:A1BDB2CA
        +0002AC SYSTM:03 HRDWR:03    SBSYS:02    FLAG2:B0    LEVEL:19
        +0002B1 PM:04    GETLS:8000F0F0    CELV:A1618000     GETS:8000F198
```

Figure 18. Example of formatted output from LEDATA VERBEXIT (Part 1 of 18)

```
         +0002C0 LBOS:00015000  LEOS:00000000     LNAB:00015018
         +0002CC DMC:00000000   ABCODE:00000000   RSNCODE:00000000
         +0002D8 ERR:21D72618   GETSX:80010900    DDSA:21617660
         +0002E4 SECTSIZ:00000000     PARTSUM:00000000
         +0002EC SSEXPNT:00000000     EDB:216157D0      PCB:21615320
         +0002F8 EYEPTR:21616BA0 PTR:21616BB8     GETS1:800109A8
         +000304 SHAB:00000000  PRGCK:00000004    FLAG1:00    URC:00000000
         +000314 ESS:00000000   LESS:00000000     OGETS:80010F88
         +000320 OGETLS:00000000 PICICB:00000000  GETSX:00000000    GOSMR:0000
         +000330 LEOV:A17372F0  SIGSCTR:00000000        SIGSFLG:00000000
         +00033C THDID:27ACD200 00000000    DCRENT:00000000
         +000348 DANCHOR:00000000     CTOC:00000000     RCB:216150F0
         +000354 CICSRSN:00000000     MEMBR:21617700
         +00035C SIGNAL_STATUS:00000008     HCOM_REG7:00000000
         +000364 STACKFLOOR:7FFFFFFF  HPGETS:00000000   EDCHPXV:00000000
         +000370 FOR1:00000000  FOR2:00000000     THREADHEAPID:2161753C
         +00037C SYS_RTNCODE:00000000 SYS_RSNCODE:00000000    GETFN:A1796030
         +000390 SIGNGPTR:21D6E170    SIGNG:00000001    FORDBG:00000000
         +00039C AB_STATUS:00   STACKDIRECTION:00       AB_GR0:00000000
         +0003A4 AB_ICD1:00000000     AB_ABCC:00000000        AB_CRC:00000000
         +0003B0 GTS:8000EA48   LERN5N1:00000000        HERP:A16CF3D8
         +0003BC USTKBOS:00000000     USTKEOS:00000000
         +0003C4 USERRTN:00000000     UDHOOK:A7F4FEE8 A7F40224
         +0003D0 HPXV_B:A16BC790 HPXV_M:A17C1BD8  HPXV_L:A170CE90
         +0003DC HPXV_O:A178E650 4VEC3:218D235C   DLLF:22128D80
         +0003E8 SAVSTACK:00000000    USER_WORD:00000000
         +0003F4 SAVSTACK_ASYNC:00000000    STACK_GUARD:00000000
         +000400 FVEC:A1E180E0      SMCB:21617428     ERRCM:2160CF38
         +000538 MIB_PTR:00000000     STV:00      A_ISA:00000000
         +000544 ISA_SIZE:00000000    PTATPTR:00000000        SIGSSDSA1:00
         +00054D SIGSSDSA2:00   STACKUNSTABLE:00  STACK_FLAG:00
         +000550 SQELADDR:2160F178    VBA:21D6D040      TCS:22128978
         +000564 THDSTATUS:00000000   TICB_PTR:2160E428
         +0005AC FWD_CHAIN:21616BB8   BKWD_CHAIN:21616BB8     TCB@:008E6968
         +000804 SS_TOP_D:7FFFFFFF    SS_DSA_U:00000000       DLLFFLAG:00
         +000858 ANCHOR3164:00000000

[4]     CEEDLLF: 22128D80
         +000000 EYE:CEEDLLF    VERSION:01  FLAGS:00    SIZE:0060   SERVICE:04
         +00000D REFERENCE_TYPE:02    LOAD_TYPE:00      PREV:22128D20
         +00001C NEXT:22128A20  FBTOK:00000DF6 41C3C5C5 00000000 (CEE3574I)
         +000034 DLL_NAME:22128DE8    SYMBOL_NAME:22128DF8
         +000040 DLL_NAME_LEN:00000006 SYMBOL_NAME_LEN:0000000F
         +000048 RETCODE_1:00000000   RSNCODE_1:00000000
         +000050 RETCODE_2:00000000   RSNCODE_2:00000000


        CEEDLLF_DLL_NAME: 22128DE8

         +000000 22128DE8 C3C5D3C4 D3D3AAAA 22127000 00000018 95819485 6D9596A3 6D89956D 849393AA |CELDLL..........name_not_in_dll.|


        CEEDLLF_SYMBOL_NAME: 22128DF8

         +000000 22128DF8 95819485 6D9596A3 6D89956D 849393AA 22127000 00000018 95819485 6D9596A3 |name_not_in_dll.........name_not|
```

Figure 19. Example of formatted output from LEDATA VERBEXIT (Part 2 of 18)

```
[5]     CEEPCB: 21615320
         +000000 PCBEYE:CEEPCB  SYSTM:03    HRDWR:03    SBSYS:02    FLAG2:88
         +00000C DBGEH:00000000 DMEMBR:21615558   ZLOD:A1809A80
         +000020 ZDEL:A1800858  ZGETST:A18070E0   ZFREEST:A1806CD0
         +00002C LVTL:2160ABF0  RCB:216150F0      SYSEIB:00000000
         +000038 PSL:00000000   PSA:216157D0      PSRA:A1806F78
         +000044 OMVS_LEVEL:7FC00000  PCB_CHAIN:00000000
         +00004C PCB_VSSFE:00011044   PCB_PRFEH:00000000
         +000056 HABD_CLEANUP:0000    LPKA_LODTYP:00000003    IMS:00000000
         +00008C ABENDCODE:00000000   REASON:00000000   F3456:000080C2
         +000098 MEML:21615540  MEMBR:21615558    PCB_EYE:00000000
         +0000A4 PCB_BKC:00006010     PCB_FWC:00000000
         +0000AC PCB_R14:A160451E     PCB_R15:00007000        PCB_R0:7D000009
         +0000B8 PCB_R1:00006000 PCB_R2:21604328  PCB_R3:00000000
         +0000C4 PCB_R4:00000000 PCB_R5:00000000  PCB_R6:00000000
         +0000D0 PCB_R7:00000000 PCB_R8:216039E8  PCB_R9:008E6B30
         +0000DC PCB_R10:00000000     PCB_R11:A160444A
         +0000E4 PCB_R12:00000000     CELV24:00000000   CELV31:A1618000
         +0000F0 SLDR:8000DE90  SECTSIZ:00000000        PARTSUM:00000000
         +0000FC SSEXPNT:00000000     BMPS:216190F0     BMPE:21691850
         +000108 BLEHL:2160A6C8 BCMXB:216151A0    BSTV:02     PM_BYTE:00
         +000112 INI_AMODE:00   FLAGS1:28   ISA:21605000
         +000118 ISA_SIZ:00012860     SRV_CNT:00000000
         +000120 SRV_UWORD:00000000   WORKAR:00000000   LOAD:0000E320
         +00012C DELETE:0000E080 GETSTOR:8000EFB0       FREESTOR:8000EC78
         +000138 EXCEPT:00000000 ATTN:00000000    MSGS:00000000
         +000144 ABEND:00008830 MSGOU:0000A9C0    GLAT:A1735528
         +000150 RLAT:A177D9D8  ELAT:A172BCE0     1PTQ:A178FF48
         +00015C 1ENV:A178F5D0  DBG_LODTYP:FFFFFFFF     DUMMY_STK:21605010
         +000168 DUMMY_LIB:00000000   DUMMY_CAA:21609018
         +000170 TST_LVL:FFFFFFFF     GETCAA:21615300   SETCAA:21615308
         +00017C LLTPTR:21609FA8 AUE:00000000     RC:00000000
         +000188 REASON:00000000 RC_MOD:00000000  AUE_UWORD:00000000
         +000194 FB_TOKEN:............ EOV:A17372F0     PPA:21EA4F44
         +0001A8 PPA_SIZ:00000A00     BELOW:21614FE0    BELOW_LEN:00002880
         +0001B4 PICB:2160C5B8  UTL1:00000008     ZINA:A18082A0
         +0001C0 ZINB:800115E0  XPLINKFLAGS:00    FLAGS5:80
         +0001D4 LANGINIT:00000001 00000000 00000000 00000000 0000
         +0001E8 NUMINIT:00000001     LASTINIT:00000003
         +0001F0 LANGREUSE:00000000 00000000 00000000 00000000 0000
         +000202 REUSEMEMS:00000000 00000000 00000000 00000000 0000

        CEEMEML: 21615558
         +000000 MEMLDEF:........ EXIT:21694FC8   LLVTL:00000000

[6]     CEERCB: 216150F0
         +000000 EYE:CEERCB     SYSTM:03    HRDWR:03    SBSYS:02    FLAGS:88
         +000014 DMEMBR:21609E80 ZLOD:A180B590    ZDEL:A18025E8
         +000020 ZGETST:A18070E0 ZFREEST:A1806CD0       VERSION_ID:04010D00
         +00003C PMADDR:00000000

[7]     CEEEDB: 216157D0
         +000000 EYE:CEEEDB     FLAG1:D7    BIPM:00     BPM:00
         +00000B CREATOR_ID:01  MEMBR:21616A78    OPTCB:21615F18
         +000014 URC:00000000   RSNCD:00000000    DBGEH:00000000
         +000020 BANHP:21615D20 BBEHP:21615D50    BCELV:A1618000
         +00002C PCB:21615320   ELIST:00000000    PL_ASTRPTR:00000000
         +000038 DEFPLPTR:216158F0    CXIT_PAGE:00000000
         +000040 DEBUG_TERMID:00000000 PARENT:00000000  R13_PARENT:00006010
         +000050  NXHP:21615F38     LEOV: A17372F0     ENVAR: 2160CA08
         +00005C  ENVIRON:21D6E190        CEEOSIGR: 0000D590       OTRB: 21EA4000
         +000068  PSA31:21613FE0    PSL31:00001000    PSA24:2161786
         +000074  PSL24:00000000    PSRA: 21806DC0       CAACHAIN@: 21616BB8
         +000080  FLAG1A:90   CEEOSGR1: 0000DC2E       MEMBERCOMPAT1:00
         +000090 THREADSACTIVE:00000001     CURMSGFILEDCBPTR:00012060
         +000098 CEEINT_INPUT_R1:00006000   LAST_RBADDR:008E68E0
         +0000A0 LAST_RBCNT:00000001

        CEEMEML: 21616A78
         +000000 MEMLDEF:........ EXIT:21694FC8   LLVTL:00000000

[8]       PMCB: 2160C730
         +000000 EYE:PMCB PREV$:00000000    NEXT$:00000000
         +000010 LVT_CURR$:A1618000   LLT_CURR$:221281A8      FLAGS:20000000
```

Figure 20. Example of formatted output from LEDATA VERBEXIT (Part 3 of 18)

```
[9]  Language Environment Runtime Options in effect.

     LAST WHERE SET          Override   OPTIONS
     ****************************************************************************
     IBM-SUPPLIED DEFAULT    OVR        ABPERC(NONE)
     IBM-SUPPLIED DEFAULT    OVR        ABTERMENC(ABEND)
     IBM-SUPPLIED DEFAULT    OVR      NOAIXBLD
     IBM-SUPPLIED DEFAULT    OVR        ALL31(ON)
     IBM-SUPPLIED DEFAULT    OVR        ANYHEAP(0000016384,0000008192,ANY  ,FREE)
     IBM-SUPPLIED DEFAULT    OVR      NOAUTOTASK
     IBM-SUPPLIED DEFAULT    OVR        BELOWHEAP(00008192,00004096,FREE)
     IBM-SUPPLIED DEFAULT    OVR        CBLOPTS(ON)
     IBM-SUPPLIED DEFAULT    OVR        CBLPSHPOP(ON)
     IBM-SUPPLIED DEFAULT    OVR        CBLQDA(OFF)
     DD:CEEOPTS              OVR         CEEDUMP(0000000000,SYSOUT=*,
                                                FREE=END,SPIN=UNALLOC)
     IBM-SUPPLIED DEFAULT    OVR        CHECK(ON)
     IBM-SUPPLIED DEFAULT    OVR        COUNTRY(US)
     IBM-SUPPLIED DEFAULT    OVR      NODEBUG
     IBM-SUPPLIED DEFAULT    OVR        DEPTHCONDLMT(0000000010)
     DD:CEEOPTS              OVR        DYNDUMP(POSIX.DEBUGG.HLE7780,
                                               DYNAMIC,TDUMP)
     IBM-SUPPLIED DEFAULT    OVR        ENVAR("")
     IBM-SUPPLIED DEFAULT    OVR        ERRCOUNT(0000000000)
     IBM-SUPPLIED DEFAULT    OVR        ERRUNIT(00000006)
     IBM-SUPPLIED DEFAULT    OVR        FILEHIST
     IBM-SUPPLIED DEFAULT    OVR        FILETAG(NOAUTOCVT,NOAUTOTAG)
     DEFAULT SETTING         OVR      NOFLOW
     IBM-SUPPLIED DEFAULT    OVR        HEAP(0000032768,0000032768,ANY  ,
                                             KEEP,00008192,00004096)
     DD:CEEOPTS              OVR        HEAPCHK(ON,0000000001,0000000000,0000000010,
                                                0000000010,
                                                00001024,00,00001024,00)
     DD:CEEOPTS              OVR        HEAPPOOLS(ON,
                                                  00000008,00000010,
                                                  00000032,00000010,
                                                  00000128,00000010,
                                                  00000256,00000010,
                                                  00001024,00000010,
                                                  00002048,00000010,
                                                  00000000,00000010,
                                                  00000000,00000010,
                                                  00000000,00000010,
                                                  00000000,00000010,
                                                  00000000,00000010,
                                                  00000000,00000010)

     IBM-SUPPLIED DEFAULT    OVR        HEAPZONES(0000,ABEND,0000,ABEND)
     IBM-SUPPLIED DEFAULT    OVR        INFOMSGFILTER(OFF)
     IBM-SUPPLIED DEFAULT    OVR        INQPCOPN
     IBM-SUPPLIED DEFAULT    OVR        INTERRUPT(OFF)
     IBM-SUPPLIED DEFAULT    OVR        LIBSTACK(0000004096,0000004096,FREE)
     IBM-SUPPLIED DEFAULT    OVR        MSGFILE(SYSOUT  ,FBA ,00000121,00000000,
                                                NOENQ)
     IBM-SUPPLIED DEFAULT    OVR        MSGQ(0000000015)
     IBM-SUPPLIED DEFAULT    OVR        NATLANG(ENU)
     IGNORED                 OVR      NONONIPTSTACK(See THREADSTACK)
     IBM-SUPPLIED DEFAULT    OVR        OCSTATUS
     IBM-SUPPLIED DEFAULT    OVR        PAGEFRAMESIZE(4K,4K,4K)
     IBM-SUPPLIED DEFAULT    OVR      NOPC
     IBM-SUPPLIED DEFAULT    OVR        PLITASKCOUNT(0000000020)
     PROGRAMMER DEFAULT      OVR        POSIX(ON)
     IBM-SUPPLIED DEFAULT    OVR        PROFILE(OFF,"")
     IBM-SUPPLIED DEFAULT    OVR        PRTUNIT(00000006)
     IBM-SUPPLIED DEFAULT    OVR        PUNUNIT(00000007)
     IBM-SUPPLIED DEFAULT    OVR        RDRUNIT(00000005)
     IBM-SUPPLIED DEFAULT    OVR        RECPAD(OFF)
     DD:CEEOPTS              OVR        RPTOPTS(ON)
     DD:CEEOPTS              OVR        RPTSTG(ON)
     IBM-SUPPLIED DEFAULT    OVR      NORTEREUS
     IBM-SUPPLIED DEFAULT    OVR      NOSIMVRD
     IBM-SUPPLIED DEFAULT    OVR        STACK(0000131072,0000131072,ANY  ,KEEP,
                                              0000524288,0000131072)
     DD:CEEOPTS              OVR        STORAGE(AA,BB,CC,0000000000)
     DD:CEEOPTS              OVR        TERMTHDACT(UADUMP,CESE,00000096)
     IBM-SUPPLIED DEFAULT    OVR      NOTEST(ALL,*,PROMPT,INSPPREF)
     IBM-SUPPLIED DEFAULT    OVR        THREADHEAP(0000004096,0000004096,ANY  ,KEEP)
     IBM-SUPPLIED DEFAULT    OVR        THREADSTACK(OFF,0000004096,0000004096,ANY  ,
                                                    KEEP,0000131072,0000131072)
```

Figure 21. Example of formatted output from LEDATA VERBEXIT (Part 4 of 18)

```
     PROGRAMMER DEFAULT      OVR        TRACE(ON,0001048576,NODUMP,LE=00000001)
     IBM-SUPPLIED DEFAULT    OVR        TRAP(ON,SPIE)
     IBM-SUPPLIED DEFAULT    OVR        UPSI(00000000)
     IBM-SUPPLIED DEFAULT    OVR      NOUSRHDLR()
     IBM-SUPPLIED DEFAULT    OVR        VCTRSAVE(OFF)
     IBM-SUPPLIED DEFAULT    OVR        XPLINK(OFF)
     IBM-SUPPLIED DEFAULT    OVR        XUFLOW(AUTO)

[10] Heap  Storage Control Blocks

      Heappools trace available. To display: IP VERBX LEDATA 'HPT(*) CAA(21616BB8)'


          ENSM: 21615CD8
        +000000 EYE_CATCHER:ENSM ST_HEAP_ALLOC_FLAG:00000001
        +000008 ST_HEAP_ALLOC_VAL:AA000000 ST_HEAP_FREE_FLAG:00000001
        +000010 ST_HEAP_FREE_VAL:BB000000  REPORT_STORAGE:21615DB4
        +000018 UHEAP:C8D7C3C2 21D91018 21D91018 00008000 00008000 00002000 00001000 00000000 00
        +000048 AHEAP:C8D7C3C2 21D6D000 22177000 00004000 00002000 00002000 00001000 00000000 00
        +000078 BHEAP:C8D7C3C2 21615D50 21615D50 00002000 00001000 00002000 00001000 80000000 00
        +0000A8 ENSM_ADDL_HEAPS:22118238
        +000260 NXHEAP:C8D7C3C2 265174C8 265174C8 00001000 00001000 00001000 00001000 00000000 00

          STSB: 21615DB4
        +000000 EYE_CATCHER:STSB CRHP_REQ:00000002     DSHP_REQ:00000001
        +00000C IPT_INIT_SIZE:00020000     NONIPT_INIT_SIZE:00020000
        +000014 IPT_INCR_SIZE:00020000     NONIPT_INCR_SIZE:00020000
        +00001C THEAP_MAX_STOR:00000000

        Enclave Level Stack Statistics

          SKSB: 21615E4C
        +000000 MAX_ALLOC:00009E90   CURR_ALLOC:00003EA0
        +000008 LARGEST:00009E90     GETMAINS:00000001
        +000010 FREEMAINS:00000000

          SKSB: 21615E74
        +000000 MAX_ALLOC:000013C0   CURR_ALLOC:00000000
        +000008 LARGEST:00000E00     GETMAINS:00000002
        +000010 FREEMAINS:00000000

          SKSB: 21615E60
        +000000 MAX_ALLOC:000000D0   CURR_ALLOC:000000D0
        +000008 LARGEST:000000D0     GETMAINS:00000001
        +000010 FREEMAINS:00000000

        User Heap Control Blocks

          HPCB: 21615CF0
        +000000 EYE_CATCHER:HPCB FIRST:21D91018  LAST:21D91018

          HPSB: 21615DD4
        +000000 BYTES_ALLOC:00005248 CURR_ALLOC:00005248
        +000008 GET_REQ:00000005     FREE_REQ:00000000
        +000010 GETMAINS:00000001    FREEMAINS:00000000

          HPSB: 21615E88
        +000000 BYTES_ALLOC:00000000 CURR_ALLOC:00000000
        +000008 GET_REQ:00000000     FREE_REQ:00000000
        +000010 GETMAINS:00000000    FREEMAINS:00000000

          HANC: 21D91018
        +000000 EYE_CATCHER:HANC NEXT:21615CF0   PREV:21615CF0
        +00000C HEAPID:00000000 SEG_ADDR:A1D91018      ROOT_ADDR:21D96260
        +000018 SEG_LEN:00008000     ROOT_LEN:00002DB8

        This is the last heap segment in the current heap.
```

Figure 22. Example of formatted output from LEDATA VERBEXIT (Part 5 of 18)

```
  Free Storage Tree for Heap Segment 21D91018

         Node  Node     Parent     Left      Right     Left     Right
Depth Address Length     Node      Node      Node     Length    Length
    0 21D96260 00002DB8 00000000 00000000  00000000  00000000  00000000


  Map of Heap Segment 21D91018

To display entire segment: IP LIST 21D91018 LEN(X'00008000') ASID(X'01A9')

21D91038: Allocated storage element, length=00001030. To display: IP LIST 21D91038 LEN(X'00001030') ASID(X'01A9')
21D91040: C5E7F3F1 00000000 00000005 00000005 21D92070 21D92258 21D92295 21D922D2 |EX31.............R...R...R.n.R.K|

21D92068: Allocated storage element, length=00000828. To display: IP LIST 21D92068 LEN(X'00000828') ASID(X'01A9')
21D92070: 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |................................|

21D92890: Allocated storage element, length=00000CD0. To display: IP LIST 21D92890 LEN(X'00000CD0') ASID(X'01A9')
21D92898: C5E7F3F1 00000000 00000003 00000003 C3C4D3D3 00000000 40000000 00000000 |EX31............CDLL.... .......|

21D93560: Allocated storage element, length=00002030. To display: IP LIST 21D93560 LEN(X'00002030') ASID(X'01A9')
21D93568: C5E7F3F1 00000000 00000006 00000006 00000000 21D703CC 70004000 00000000 |EX31.................P.... .....|

21D95590: Allocated storage element, length=00000CD0. To display: IP LIST 21D95590 LEN(X'00000CD0') ASID(X'01A9')
21D95598: C5E7F3F1 00000000 00000001 00000001 21D92BD8 AAAAAAAA 00000001 00000001 |EX31.............R.Q............|

21D96260: Free storage element, length=00002DB8. To display: IP LIST 21D96260 LEN(X'00002DB8') ASID(X'01A9')

Summary of analysis for Heap Segment 21D91018:
   Amounts of identified storage: Free:00002DB8 Allocated:00005228 Total:00007FE0
   Number of identified areas : Free:      1  Allocated:       5  Total:       6
   00000000 bytes of storage were not accounted for.
   No errors were found while processing this heap segment.
   This is the last heap segment in the current heap.


  Anywhere Heap Control Blocks

    HPCB: 21615D20
  +000000 EYE_CATCHER:HPCB FIRST:21D6D000  LAST:22177000

    HPSB: 21615E04
  +000000 BYTES_ALLOC:0037B788 CURR_ALLOC:0031EE68
  +000008 GET_REQ:00000DCA     FREE_REQ:00000D75
  +000010 GETMAINS:00000013    FREEMAINS:00000005

    HANC: 21D6D000
  +000000 EYE_CATCHER:HANC NEXT:21D9A000   PREV:21615D20
  +00000C HEAPID:21615D20 SEG_ADDR:A1D6D000      ROOT_ADDR:21D70620
  +000018 SEG_LEN:00004000     ROOT_LEN:000009E0


  Free Storage Tree for Heap Segment 21D6D000

         Node  Node     Parent     Left      Right     Left     Right
Depth Address Length     Node      Node      Node     Length    Length
    0 21D70620 000009E0 00000000 00000000  00000000  00000000  00000000
```

Figure 23. Example of formatted output from LEDATA VERBEXIT (Part 6 of 18)

```
  Map of Heap Segment 21D6D000

To display entire segment: IP LIST 21D6D000 LEN(X'00004000') ASID(X'01A9')

21D6D020: Allocated storage element, length=00000018. To display: IP LIST 21D6D020 LEN(X'00000018') ASID(X'01A9')
21D6D028: D2C4C240 00000000 00000000 AAAAAAAA                                  |KDB ............                |
⋮
  Below Heap Control Blocks

    HPCB: 21615D50
  +000000 EYE_CATCHER:HPCB FIRST:21615D50  LAST:21615D50

           ** NO SEGMENTS ALLOCATED **

    HPSB: 21615E1C
  +000000 BYTES_ALLOC:00000000 CURR_ALLOC:00000000
  +000008 GET_REQ:00000000     FREE_REQ:00000000
  +000010 GETMAINS:00000000    FREEMAINS:00000000

 Non-exectable Heap Control Blocks

    HPCB:  21615F38
  +000000  EYE_CATCHER:HPCB  FIRST: 21615F38    LAST: 21615F38

           ** NO SEGMENTS ALLOCATED **

    HPSB:  21615ED8
  +000000  BYTES_ALLOC:00000000    CURR_ALLOC:00000000
  +000008  GET_REQ:00000000        FREE_REQ:00000000
  +000010  GETMAINS:00000000       FREEMAINS:00000000


  Additional Heap Control Blocks

    HPSB: 21615E34
  +000000 BYTES_ALLOC:00000908 CURR_ALLOC:00000908
  +000008 GET_REQ:00000007     FREE_REQ:00000000
  +000010 GETMAINS:00000003    FREEMAINS:00000002

    ADHP: 22118238
  +000000 EYE_CATCHER:ADHP NEXT:F0F00000   HEAPID:22118244

    HPCB: 22118244
  +000000 EYE_CATCHER:HPCB FIRST:2212B000  LAST:2212B000

    HANC: 2212B000
  +000000 EYE_CATCHER:HANC NEXT:22118244   PREV:22118244
  +00000C HEAPID:22118244 SEG_ADDR:2212B000      ROOT_ADDR:2212B2C8
  +000018 SEG_LEN:00001000     ROOT_LEN:00000D38

  This is the last heap segment in the current heap.


  Free Storage Tree for Heap Segment 2212B000

         Node  Node     Parent     Left      Right     Left     Right
Depth Address Length     Node      Node      Node     Length    Length
    0 2212B2C8 00000D38 00000000 00000000  00000000  00000000  00000000


  Map of Heap Segment 2212B000

To display entire segment: IP LIST 2212B000 LEN(X'00001000') ASID(X'01A9')

2212B020: Allocated storage element, length=000002A8. To display: IP LIST 2212B020 LEN(X'000002A8') ASID(X'01A9')
2212B028: D7C3C9C2 00000000 00000000 000102A0 00000000 00000000 00000000 00000000 |PCIB............................|

2212B2C8: Free storage element, length=00000D38. To display: IP LIST 2212B2C8 LEN(X'00000D38') ASID(X'01A9')

Summary of analysis for Heap Segment 2212B000:
   Amounts of identified storage: Free:00000D38 Allocated:000002A8 Total:00000FE0
   Number of identified areas : Free:      1  Allocated:       1  Total:       2
   00000000 bytes of storage were not accounted for.
   No errors were found while processing this heap segment.
   This is the last heap segment in the current heap.
```

Figure 24. Example of formatted output from LEDATA VERBEXIT (Part 7 of 18)

```
       Heap Pool Report
          QPCB:  21D6DA00
         +000000  EYECATCHER:QPCB   LENGTH:00000800   NUMPOOLS:00000006
         +00000C  LARGEST_CELL_SIZE:00000800    BIG_REQUESTS:00000001
         +000014  STORAGE_HITS_ADDR:21FD0028    FLAGS:E400  NUMGETARRAYS:00
         +00001B  NUMCELLSIZES:06   GET_POOLINFO_ARRAYS_PTR:21D6DA28

         Data for pool 1:
       POOLDATA:  21D6DB00
         +000000  POOL_INDEX:00000001     INPUT_CELL_SIZE:00000008
         +000008  CELL_SIZE:00000010      INPUT_PERCENT:0000000A
         +000010  CELL_POOL_SIZE:00000CC0       CELL_POOL_NUM:000000CC
         +000018  POOL_LATCH_ADDR:21EA4BD4      POOL_EXTENTS:00000001
         +000020  LAST_CELL:21D96250      NEXT_CELL:21D955C0
         +000028  Q_CONTROL_INFO:00000000       Q_FIRST_CELL:00000000
         +000030  POOL_NUM_GET_TOTAL:00000002   POOL_NUM_FREE:00000000
         +000038  POOL_EXTENTS_ANCHOR:21D95598        POOL_INDEX_SAME_SIZE:01
         +00003D  POOL_INDEX_SIZE:01      POOL_NUM_SAME_SIZE:01
         +000040  POOL_TRACE_TABLE:21EAF050

           Heap Pool Extent Mapping
         EXTENT:  21D95598
         +000000  EYE_CATCHER:EX31  NEXT_EXTENT:00000000

           To display entire pool extent: IP LIST 21D95598 LEN(X'00000CC8') ASID(X'01A9')

           21D955A0: Allocated storage cell. To display: IP LIST 21D955A0 LEN(X'00000010') ASID(X'01A9')
           21D955A8: 21D92BD8 AAAAAAAA 00000001 00000001 21D92C60 AAAAAAAA 00000000 00000000|.R.Q.............R.-............|

           21D955B0: Allocated storage cell. To display: IP LIST 21D955B0 LEN(X'00000010') ASID(X'01A9')
           21D955B8: 21D92C60 AAAAAAAA 00000000 00000000 00000000 00000000 00000000 00000000|.R.-............................|

           Summary of analysis for Pool 1:
              Number of cells:  Unused:       202  Free:       0  Allocated:       2  Total Used:       204
              00000000 free cells were not accounted for.
              No errors were found while processing this Pool.

         Data for pool 2:
       POOLDATA:  21D6DC00
         +000000  POOL_INDEX:00000002     INPUT_CELL_SIZE:00000020
         +000008  CELL_SIZE:00000028      INPUT_PERCENT:0000000A
         +000010  CELL_POOL_SIZE:00000CA8       CELL_POOL_NUM:00000051
         +000018  POOL_LATCH_ADDR:21EA4BE8      POOL_EXTENTS:00000000
         +000020  LAST_CELL:00000000      NEXT_CELL:00000000
         +000028  Q_CONTROL_INFO:00000000       Q_FIRST_CELL:00000000
         +000030  POOL_NUM_GET_TOTAL:00000000   POOL_NUM_FREE:00000000
         +000038  POOL_EXTENTS_ANCHOR:00000000        POOL_INDEX_SAME_SIZE:01
         +00003D  POOL_INDEX_SIZE:02      POOL_NUM_SAME_SIZE:01
         +000040  POOL_TRACE_TABLE:21EDF070

           There are no extents for this pool.

.
.
.

         Data for pool 6:
       POOLDATA:  21D6E000
         +000000  POOL_INDEX:00000006     INPUT_CELL_SIZE:00000800
         +000008  CELL_SIZE:00000808      INPUT_PERCENT:0000000A
         +000010  CELL_POOL_SIZE:00002020       CELL_POOL_NUM:00000004
         +000018  POOL_LATCH_ADDR:21EA4C38      POOL_EXTENTS:00000001
         +000020  LAST_CELL:21D94D88      NEXT_CELL:21D93D78
         +000028  Q_CONTROL_INFO:00000000       Q_FIRST_CELL:00000000
         +000030  POOL_NUM_GET_TOTAL:00000001   POOL_NUM_FREE:00000000
         +000038  POOL_EXTENTS_ANCHOR:21D93568        POOL_INDEX_SAME_SIZE:01
         +00003D  POOL_INDEX_SIZE:06      POOL_NUM_SAME_SIZE:01
         +000040  POOL_TRACE_TABLE:21F9F0F0

           Heap Pool Extent Mapping
         EXTENT:  21D93568
         +000000  EYE_CATCHER:EX31  NEXT_EXTENT:00000000

           To display entire pool extent: IP LIST 21D93568 LEN(X'00002028') ASID(X'01A9')

           21D93570: Allocated storage cell. To display: IP LIST 21D93570 LEN(X'00000808') ASID(X'01A9')
           21D93578: 00000000 21D703CC 70004000 00000000 21D9359C 00000000 00000000 00000000|.....P.... ......R..............|

           Summary of analysis for Pool 6:
              Number of cells:  Unused:       3  Free:       0  Allocated:       1  Total Used:       4
              00000000 free cells were not accounted for.
              No errors were found while processing this Pool.
```

Figure 25. Example of formatted output from LEDATA VERBEXIT (Part 8 of 18)

```
[11] Stack Storage Control Blocks

          SMCB: 21617428
        +000000 EYE_CATCHER:SMCB US_EYE_CATCHER:USTK   USFIRST:21D71018
        +00000C USLAST:21D71018 USBOS:21D71018   USEOS:21D91018
        +000018 USNAB:21D74E18 USINITSZ:00020000       USINCRSZ:00020000
        +000024 USANYBELOW:00000000  USKEEPFREE:00000000     USPOOL:00000002
        +000030 USPREALLOC:00000001  US_BYTES_ALLOC:00009E90
        +000038 US_CURR_ALLOC:00003EA0     US_GETMAINS:00000000
        +000040 US_FREEMAINS:00000000 US_OPLINK:00     LS_THIS_IS:LSTK
        +00004C LSFIRST:00015000     LSLAST:00015000   LSBOS:00015000
        +000058 LSEOS:00016000 LSNAB:00000000    LSINITSZ:00001000
        +000064 LSINCRSZ:00001000    LSANYBELOW:80000000
        +00006C LSKEEPFREE:00000001  LSPOOL:80000001   LSPREALLOC:00000000
        +000078 LS_BYTES_ALLOC:000000D0    LS_CURR_ALLOC:000000D0
        +000080 LS_GETMAINS:00000000 LS_FREEMAINS:00000000   LS_OPLINK:00
        +00008C RSBOS:21D71000 RSEOS:21D71018    RSIZE:00000018
        +000098 RSACTIVE:00000001    SA_REG00:21D74EB8
        +0000A0 SA_REG01:21D74E18    SA_REG02:216157D0
        +0000A8 SA_REG03:00000794    SA_REG04:216CEAB8
        +0000B0 SA_REG05:2160CF38    SA_REG06:00000000
        +0000B8 SA_REG07:2160E430    SA_REG08:A16CD9AE
        +0000C0 SA_REG09:21D73D1E    SA_REG10:21D72D1F
        +0000C8 SA_REG11:A16D9B58    SA_REG12:21616BB8
        +0000D0 SA_REG13:21D71D20    SA_REG14:A16D9B8E
        +0000D8 SA_REG15:00000000
        +0000DC SAVEREG_XINIT:21D71018 00000180 21617428 A17705D8
        +0000EC CEEVGTSI:8000F240    ST_DSA_ALLOC_FLAG:00000001
        +0000F4 ST_DSA_ALLOC_VAL:CC000000  ALLOCSEG:00000000
        +0000FC BELOW16M_FLAG:00000000     LOCAL_ALLOC:FFFFFF08
        +00010C LOCAL_GETMAINS:00000000    LOCAL_FREEMAINS:00000000
        +00015C MOREFLAGS:00000000   DS_THIS_IS:....   DSFIRST:21617588
        +000168 DSLAST:21617588 DSBOS:21617588   DSINITSZ:00000000
        +00017C DSINCRSZ:00000000    DSGUARDSZ:00000000
        +000184 DSKEEPFREE:00000000  DSPOOL:00000000   DSPREALLOC:00000000
        +000190 DS_BYTES_ALLOC:00000000    DS_CURR_ALLOC:00000000
        +000198 DS_GETMAINS:00000000 DS_FREEMAINS:00000000
        +0001A0 DS_FLAGS:00000000

        DSA backchain

           DSA: 21D74E18
        +000000 FLAGS:0000 MEMD:CCCC BKC:21D71D20      FWC:CCCCCCCC
        +00000C R14:CCCCCCCC   R15:CCCCCCCC      R0:CCCCCCCC
        +000018 R1:CCCCCCCC    R2:CCCCCCCC       R3:CCCCCCCC
        +000024 R4:CCCCCCCC    R5:CCCCCCCC       R6:CCCCCCCC
        +000030 R7:CCCCCCCC    R8:CCCCCCCC       R9:CCCCCCCC
        +00003C R10:CCCCCCCC   R11:CCCCCCCC      R12:CCCCCCCC
        +000048 LWS:CCCCCCCC   NAB:21D74EB8      PNAB:CCCCCCCC
        +000064 RENT:CCCCCCCC  CILC:CCCCCCCC     MODE:CCCCCCCC
        +000078 RMR:CCCCCCCC        Contents of DSA at location 21D74E18:

        +00000000 0000CCCC 21D71D20 CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC |.....P..........................|
        +00000020 CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC |................................|
        +00000040 CCCCCCCC CCCCCCCC CCCCCCCC 21D74EB8 CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC |............P+..................|
        +00000060 CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC |................................|
        +00000080 21D721AC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC |.P..............................|

           DSA: 21D71D20
        +000000 FLAGS:0808 MEMD:CEE1 BKC:21D71248      FWC:21D74E18
        +00000C R14:A16CDB84   R15:A16D9B58      R0:21D721AC
        +000018 R1:21D7217C    R2:216157D0       R3:00000794
        +000024 R4:216CEAB8    R5:2160CF38       R6:00000000
        +000030 R7:2160E430    R8:A16CD9AE       R9:21D73D1E
        +00003C R10:21D72D1F   R11:A16C9CC8      R12:21616BB8
        +000048 LWS:00000000   NAB:21D74E18      PNAB:CCCCCCCC
        +000064 RENT:CCCCCCCC  CILC:CCCCCCCC     MODE:CCCCCCCC
        +000078 RMR:CCCCCCCC

        Contents of DSA at location 21D71D20:

        +00000000 0808CEE1 21D71248 21D74E18 A16CDB84 A16D9B58 21D721AC 21D7217C 216157D0 |.....P...P+..%.d._...P...P.@./..|
        +00000020 00000794 216CEAB8 2160CF38 00000000 2160E430 A16CD9AE 21D73D1E 21D72D1F |...m.%...-.......-U..%R..P...P..|
        +00000040 A16C9CC8 21616BB8 00000000 21D74E18 CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC |.%.H./,......P+.................|
        +00000060 CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC |................................|
        +00000080 21D721E8 21D721F8 21D722C6 216CEBDC 216CEBE0 21D721FC 21D722C7 216CEBDC |.P.Y.P.8.P.F.%...%...P...P.G.%..|
        +000000A0 216CEBDC 216CEBDC 216CEBDC A16CA1A6 216CAD0C 21D72728 21D7217C 21D71248 |.%...%...%...%.w.%...P...P.@.P..|
        +000000C0 21D740F0 216CEAB8 21D72618 21D72618 2160E71C 21D73D1E 21D72D1F A16C9CC8 |.P 0.%...P...P...-X..P...P...%.H|
        +000000E0 21616BB8 2160E71C A16CBE54 216CC15C 21D72254 216CEBC4 216CEBE4 216CEAB8 |./,..-X..%...%A*.P...%.D.%.U.%..|
```

Figure 26. Example of formatted output from LEDATA VERBEXIT (Part 11 of 18)

```
To display entire DSA: IP LIST 21D71D20 LEN(X'000030F8') ASID(X'01A9')

   DSA: 21D71248
+000000 FLAGS:10CC MEMD:CCCC BKC:21D71130      FWC:21D71328
+00000C R14:A1600A66   R15:21BDA45C      R0:216011A4
+000018 R1:21D712E0    R2:21D71305       R3:216000FA
+000024 R4:21D71302    R5:21600ED0       R6:21D7130C
+000030 R7:21D71310    R8:00000030       R9:80000000
+00003C R10:A1D2E8B2   R11:A1692F48      R12:21616BB8
+000048 LWS:00000000   NAB:21D71328      PNAB:CCCCCCCC
+000064 RENT:CCCCCCCC  CILC:CCCCCCCC     MODE:CCCCCCCC
+000078 RMR:CCCCCCCC

Contents of DSA at location 21D71248:

+00000000 10CCCCCC 21D71130 21D71328 A1600A66 21BDA45C 216011A4 21D712E0 21D71305 |.....P...P...-....u*.-.u.P...P..|
+00000020 216000FA 21D71302 21600ED0 21D7130C 21D71310 00000030 80000000 A1D2E8B2 |.-...P...-...P...P...........KY.|
+00000040 A1692F48 21616BB8 00000000 21D71328 CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC |...../,......P..................|
+00000060 CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC |................................|
+00000080 CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC 216011A4 21601195 |........................-.u.-.n|
+000000A0 00000003 21600EDC 22128948 00000000 220B1178 220B23B8 00000000 00000000 |.....-....i.....................|
+000000C0 00000000 00000002 22128E40 00000000 00000000 00000000 21D6E148 CCCCCCCC |........... .............O......|

   DSA: 21D71130
+000000 FLAGS:10CC MEMD:CCCC BKC:21D71030      FWC:CCCCCCCC
+00000C R14:A2128EB0   R15:A16000C0      R0:21D71248
+000018 R1:21D6E1E8    R2:A1D2E980       R3:00000002
+000024 R4:A169303A    R5:216157D0       R6:216039EC
+000030 R7:21604330    R8:00000030       R9:80000000
+00003C R10:A1D2E8B2   R11:A1692F48      R12:21616BB8
+000048 LWS:00000000   NAB:21D71248      PNAB:CCCCCCCC
+000064 RENT:CCCCCCCC  CILC:CCCCCCCC     MODE:CCCCCCCC
+000078 RMR:CCCCCCCC

Contents of DSA at location 21D71130:

+00000000 10CCCCCC 21D71030 CCCCCCCC A2128EB0 A16000C0 21D71248 21D6E1E8 A1D2E980 |.....P......s....-...P...O.Y.KZ.|
+00000020 00000002 A169303A 216157D0 216039EC 21604330 00000030 80000000 A1D2E8B2 |........./...-...-...........KY.|
+00000040 A1692F48 21616BB8 00000000 21D71248 CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC |...../,......P..................|
+00000060 CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC |................................|
+00000080 CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC |................................|
+000000A0 CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC |................................|
+000000C0 CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC |................................|
+000000E0 CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC |................................|

To display entire DSA: IP LIST 21D71130 LEN(X'00000118') ASID(X'01A9')

   DSA: 21D71030
+000000 FLAGS:0000 MEMD:CCCC BKC:21617660      FWC:CCCCCCCC
+00000C R14:A169310E   R15:21D2E8BE      R0:7D000009
+000018 R1:21D710B0    R2:21604328       R3:00000002
+000024 R4:A169303A    R5:216157D0       R6:216039EC
+000030 R7:21604330    R8:00000030       R9:00000008
+00003C R10:A1D2E8B2   R11:A1692F48      R12:21616BB8
+000048 LWS:00000000   NAB:21D71130      PNAB:CCCCCCCC
+000064 RENT:CCCCCCCC  CILC:CCCCCCCC     MODE:CCCCCCCC
+000078 RMR:CCCCCCCC        Contents of DSA at location 21D71030:

+00000000 0000CCCC 21617660 CCCCCCCC A169310E 21D2E8BE 7D000009 21D710B0 21604328 |...../.-.........KY.'....P...-..|
+00000020 00000002 A169303A 216157D0 216039EC 21604330 00000030 00000008 A1D2E8B2 |........./...-...-...........KY.|
+00000040 A1692F48 21616BB8 00000000 21D71130 CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC |...../,......P..................|
+00000060 CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC |................................|
+00000080 216931F4 216039EC 21D710E0 21615908 21D710D0 21D710D8 21D710D4 CCCCCCCC |...4.-...P.../...P...P.Q.P.M....|
+000000A0 21D6E1E8 00000000 00000000 CCCCCCCC 00000001 CCCCCCCC CCCCCCCC CCCCCCCC |.O.Y............................|
+000000C0 CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC |................................|
+000000E0 CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC CCCCCCCC |................................|

User Stack Control Blocks

  STKH: 21D71018
+000000 EYE_CATCHER:STKU NEXT:2161742C   PREV:2161742C
+00000C SEGMENT_LEN:00020000
```

Figure 27. Example of formatted output from LEDATA VERBEXIT (Part 12 of 18)

```
  Library Stack Control Blocks

    STKH: 00015000
  +000000 EYE_CATCHER:STKL NEXT:21617470   PREV:21617470
  +00000C SEGMENT_LEN:00001000

[12] Condition Management Control Blocks

    HCOM: 2160CF38
  +000000 PICA_AREA:00000000 00000000 EYES:HCOM  CAA_PTR1:21616BB8
  +000014 CVTDCB:9B FLAG:60F0C000    EXIT_STK:22128EB0
  +000020 RSM_PTR:00000000     HDLL_STK:22128E68
  +000028 SRP_TOKEN:00000000   CSTK:22130E48     CIBH:21D72B28
  +000084 COND_LOG:2212E028    DSA_4083:00000000
  +00009C HCHK5_RESULTS:00001100     SHUNT_VALIDFLAG:00000001
  +000480 SHUNT_COUNTER:00000048     SHUNT_ADDR:216FB7C4
  +000488 SHUNT_PSW:078D2000 A16FB7CA
  +000490 SHUNT_REG0:00000001  SHUNT_REG1:21D77050
  +000498 SHUNT_REG2:5DF3B2C8  SHUNT_REG3:00000000
  +0004A0 SHUNT_REG4:00000000  SHUNT_REG5:00001000
  +0004A8 SHUNT_REG6:00000001  SHUNT_REG7:00000008
  +0004B0 SHUNT_REG8:00000000  SHUNT_REG9:216FB7C4
  +0004B8 SHUNT_REG10:00000000 SHUNT_REG11:A16FAD58
  +0004C0 SHUNT_REG12:21616BB8 SHUNT_REG13:21D76EF8
  +0004C8 SHUNT_REG14:A16FB6D6 SHUNT_REG15:00000000
  +0004D0 SHUNT_CODE1:00000000 SHUNT_CODE2:00000004
  +000514 SIGNAL_LOG:21EA6028

    CIBH: 21D72B28
  +000000 EYE:CIBH BACK:2160E430     FRWD:00000000
  +000010 PTR_CIB:00000000     FLAG1:00    ERROR_LOCATION_FLAGS:00
  +000018 HDLQ:00000000  STATE:00000000    PRM_DESC:00000000
  +000024 PRM_PREFIX:00000000
  +000028 PRM_LIST:00000000 00000000 00000000 00000000
  +000038 PARM_DESC:00000000   PARM_PREFIX:00000000
  +000040 PARM_LIST:00000000 00000000 00000000 00000000 FUN:00000000
  +000054 CIB_SIZ:0000   CIB_VER:0000      FLG_5:00    FLG_6:00
  +00005A FLG_7:00 FLG_8:00    FLG_1:00    FLG_2:00    FLG_3:00
  +00005F FLG_4:00 ABCD:00000000     ABRC:00000000
  +000068 OLD_COND_64:00000000 00000000
  +000070 OLD_MIB:00000000     COND_64:00000000 00000000
  +00007C MIB:00000000   PL:00000000       SV2:00000000
  +000088 SV1:00000000   INT:00000000      MID:00000000
  +000094 HDL_SF:00000000 HDL_EPT:00000000       HDL_RST:00000000
  +0000A0 RSM_SF:00000000 RSM_POINT:00000000     RSM_MACHINE:00000000
  +0000B0 COND_DEFAULT:00000000 Q_DATA_TOKEN:00000000  FDBK:00000000
  +0000BC ABNAME:........ BBRANCH_OFFSET:00000000
  +000220 BBRANCH_STMTID:........    BBRANCH_STMTLEN:0000
           Machine State
  +000248 MCH_EYE:....
  +000250 GPR00:00000000 GPR01:00000000
  +000258 GPR02:00000000 GPR03:00000000
  +000260 GPR04:00000000 GPR05:00000000
  +000268 GPR06:00000000 GPR07:00000000
  +000270 GPR08:00000000 GPR09:00000000
  +000278 GPR10:00000000 GPR11:00000000
  +000280 GPR12:00000000 GPR13:00000000
  +000288 GPR14:00000000 GPR15:00000000
  +000290 PSW:00000000 00000000
  +000298 ILC:0000 IC1:00      IC2:00      PFT:00000000
  +0002A0 FLT_0:00000000 00000000    FLT_2:00000000 00000000
  +0002B0 FLT_4:00000000 00000000    FLT_6:00000000 00000000
  +0002EC INT_SF:00000000 FLAGS:00   EXT:00000000      BEA:00000000
  +000308 SAVSTACK_ASYNC_PTR:00000000
  +000318 FLT_1:00000000 00000000
  +000320 FLT_3:00000000 00000000
  +000328 FLT_5:00000000 00000000
  +000330 FLT_7:00000000 00000000
  +000338 FLT_8:00000000 00000000    FLT_9:00000000 00000000
  +000348 FLT_10:00000000 00000000   FLT_11:00000000 00000000
  +000358 FLT_12:00000000 00000000   FLT_13:00000000 00000000
  +000368 FLT_14:00000000 00000000   FLT_15:00000000 00000000
```

Figure 28. Example of formatted output from LEDATA VERBEXIT (Part 13 of 18)

```
+000378 FPC:00000000   APF_FLAGS:00
+000388 GPR_H00:00000000     GPR_H01:00000000
+000390 GPR_H02:00000000     GPR_H03:00000000
+000398 GPR_H04:00000000     GPR_H05:00000000
+0003A0 GPR_H06:00000000     GPR_H07:00000000
+0003A8 GPR_H08:00000000     GPR_H09:00000000
+0003B0 GPR_H10:00000000     GPR_H11:00000000
+0003B8 GPR_H12:00000000     GPR_H13:00000000
+0003C0 GPR_H14:00000000     GPR_H15:00000000
+0003C8 AR00:00000000  AR01:00000000
+0003D0 AR02:00000000  AR03:00000000
+0003D8 AR04:00000000  AR05:00000000
+0003E0 AR06:00000000  AR07:00000000
+0003E8 AR08:00000000  AR09:00000000
+0003F0 AR10:00000000  AR11:00000000
+0003F8 AR12:00000000  AR13:00000000
+000400 AR14:00000000  AR15:00000000

+000408 VR_0:00000000 00000000 00000000 00000000
+000418 VR_1:00000000 00000000 00000000 00000000
+000428 VR_2:00000000 00000000 00000000 00000000
+000438 VR_3:00000000 00000000 00000000 00000000
+000448 VR_4:00000000 00000000 00000000 00000000
+000458 VR_5:00000000 00000000 00000000 00000000
+000468 VR_6:00000000 00000000 00000000 00000000
+000478 VR_7:00000000 00000000 00000000 00000000
+000488 VR_8:00000000 00000000 00000000 00000000
+000498 VR_9:00000000 00000000 00000000 00000000
+0004A8 VR_10:00000000 00000000 00000000 00000000
+0004B8 VR_11:00000000 00000000 00000000 00000000
+0004C8 VR_12:00000000 00000000 00000000 00000000
+0004D8 VR_13:00000000 00000000 00000000 00000000
+0004E8 VR_14:00000000 00000000 00000000 00000000
+0004F8 VR_15:00000000 00000000 00000000 00000000
+000508 VR_16:00000000 00000000 00000000 00000000
+000518 VR_17:00000000 00000000 00000000 00000000
+000528 VR_18:00000000 00000000 00000000 00000000
+000538 VR_19:00000000 00000000 00000000 00000000
+000548 VR_20:00000000 00000000 00000000 00000000
+000558 VR_21:00000000 00000000 00000000 00000000
+000568 VR_22:00000000 00000000 00000000 00000000
+000578 VR_23:00000000 00000000 00000000 00000000
+000588 VR_24:00000000 00000000 00000000 00000000
+000598 VR_25:00000000 00000000 00000000 00000000
+0005A8 VR_26:00000000 00000000 00000000 00000000
+0005B8 VR_27:00000000 00000000 00000000 00000000
+0005C8 VR_28:00000000 00000000 00000000 00000000
+0005D8 VR_29:00000000 00000000 00000000 00000000
+0005E8 VR_30:00000000 00000000 00000000 00000000
+0005F8 VR_31:00000000 00000000 00000000 00000000
+000CE0 ABCC:00000000     HRC:00000000      RSM_SF_FMT:00
+000CE9 RSM_PH_CALLEE_FMT:00    SV1_FMT:00  RSM_PH_CALLEE:00000000
+000CF0 INT_FCN_EP:00000000     HDL_SF_FMT:00     HDL_PH_CALLEE_FMT:00
+000CF6 SV2_FMT:00  HDL_PH_CALLEE:00000000

  CIBH: 2160E430
+000000 EYE:CIBH BACK:00000000     FRWD:21D72B28
+000010 PTR_CIB:21D72618     FLAG1:C5    ERROR_LOCATION_FLAGS:3F
+000018 HDLQ:00000000  STATE:00000000    PRM_DESC:00000000
+000024 PRM_PREFIX:00000000
+000028 PRM_LIST:21D72630 21D726F8 21D72704 2160EA7C
+000038 PARM_DESC:00000000   PARM_PREFIX:00000000
+000040 PARM_LIST:21D726F4 21D72618 21D72704 2160EA7C FUN:00000067
+000054 CIB_SIZ:010C   CIB_VER:0004      FLG_5:48    FLG_6:23
+00005A FLG_7:04 FLG_8:00    FLG_1:00    FLG_2:00    FLG_3:00
+00005F FLG_4:05 ABCD:940C9000     ABRC:00000009
+000068 OLD_COND_64:00030C89 59C3C5C5 (CEE3209S)
+000070 OLD_MIB:00000002     COND_64:00030C89 59C3C5C5 (CEE3209S)
+00007C MIB:00000002   PL:216012E0       SV2:21D71248
+000088 SV1:21D71248   INT:21600A7A      MID:00000003
+000094 HDL_SF:21617660 HDL_EPT:21694FC8       HDL_RST:00000000
+0000A0 RSM_SF:21D71248 RSM_POINT:21600A7C     RSM_MACHINE:2160E878
+0000B0 COND_DEFAULT:00000003 Q_DATA_TOKEN:2160E568  FDBK:00000000
+0000BC ABNAME:........ BBRANCH_OFFSET:00000000
+000220 BBRANCH_STMTID:........    BBRANCH_STMTLEN:0000
```

Figure 29. Example of formatted output from LEDATA VERBEXIT (Part 14 of 18)

```
         Machine State
+000248 MCH_EYE:ZMCH
+000250 GPR00:00000000 GPR01:A1C37730
+000258 GPR02:21D71305 GPR03:216000FA
+000260 GPR04:21D71302 GPR05:21600ED0
+000268 GPR06:00000000 GPR07:00000001
+000270 GPR08:00000030 GPR09:80000000
+000278 GPR10:A1D2E8B2 GPR11:A1692F48
+000280 GPR12:21616BB8 GPR13:21D71248
+000288 GPR14:A1600A66 GPR15:00000012
+000290 PSW:078D2400 A1600A7C
+000298 ILC:0002 IC1:00      IC2:09      PFT:00000000
+0002A0 FLT_0:4DC5E627 A27BCEFF    FLT_2:00000000 00000000
+0002B0 FLT_4:00000000 00000000    FLT_6:00000000 00000000
+0002EC INT_SF:21D71248 FLAGS:60   EXT:00000000      BEA:21BDB818
+000308 SAVSTACK_ASYNC_PTR:00000000
+000318 FLT_1:00000000 00000000
+000320 FLT_3:00000000 00000000
+000328 FLT_5:00000000 00000000
+000330 FLT_7:00000000 00000000
+000338 FLT_8:00000000 00000000    FLT_9:00000000 00000000
+000348 FLT_10:00000000 00000000   FLT_11:00000000 00000000
+000358 FLT_12:00000000 00000000   FLT_13:00000000 00000000
+000368 FLT_14:00000000 00000000   FLT_15:00000000 00000000
+000378 FPC:00000000   APF_FLAGS:00
+000388 GPR_H00:00000000     GPR_H01:00000000
+000390 GPR_H02:00000000     GPR_H03:00000000
+000398 GPR_H04:00000000     GPR_H05:00000000
+0003A0 GPR_H06:00000000     GPR_H07:00000000
+0003A8 GPR_H08:00000000     GPR_H09:00000000
+0003B0 GPR_H10:00000000     GPR_H11:00000000
+0003B8 GPR_H12:00000000     GPR_H13:00000000
+0003C0 GPR_H14:00000000     GPR_H15:00000011
+0003C8 AR00:00000000  AR01:00000000
+0003D0 AR02:00000000  AR03:00000000
+0003D8 AR04:00000000  AR05:00000000
+0003E0 AR06:00000000  AR07:00000000
+0003E8 AR08:00000000  AR09:00000000
+0003F0 AR10:00000000  AR11:00000000
+0003F8 AR12:00000000  AR13:00000000
+000400 AR14:00000000  AR15:00000000
+000408 VR_0:00000000 00000000 00000000 00000000
+000418 VR_1:00000000 00000000 00000000 00000000
+000428 VR_2:00000000 00000000 00000000 00000000
+000438 VR_3:00000000 00000000 00000000 00000000
+000448 VR_4:00000000 00000000 00000000 00000000
+000458 VR_5:00000000 00000000 00000000 00000000
+000468 VR_6:00000000 00000000 00000000 00000000
+000478 VR_7:00000000 00000000 00000000 00000000
+000488 VR_8:00000000 00000000 00000000 00000000
+000498 VR_9:00000000 00000000 00000000 00000000
+0004A8 VR_10:00000000 00000000 00000000 00000000
+0004B8 VR_11:00000000 00000000 00000000 00000000
+0004C8 VR_12:00000000 00000000 00000000 00000000
+0004D8 VR_13:00000000 00000000 00000000 00000000
+0004E8 VR_14:00000000 00000000 00000000 00000000
+0004F8 VR_15:00000000 00000000 00000000 00000000
+000508 VR_16:00000000 00000000 00000000 00000000
+000518 VR_17:00000000 00000000 00000000 00000000
+000528 VR_18:00000000 00000000 00000000 00000000
+000538 VR_19:00000000 00000000 00000000 00000000
+000548 VR_20:00000000 00000000 00000000 00000000
+000558 VR_21:00000000 00000000 00000000 00000000
+000568 VR_22:00000000 00000000 00000000 00000000
+000578 VR_23:00000000 00000000 00000000 00000000
+000588 VR_24:00000000 00000000 00000000 00000000
+000598 VR_25:00000000 00000000 00000000 00000000
+0005A8 VR_26:00000000 00000000 00000000 00000000
+0005B8 VR_27:00000000 00000000 00000000 00000000
+0005C8 VR_28:00000000 00000000 00000000 00000000
+0005D8 VR_29:00000000 00000000 00000000 00000000
+0005E8 VR_30:00000000 00000000 00000000 00000000
+0005F8 VR_31:00000000 00000000 00000000 00000000
+000CE0 ABCC:00000000     HRC:00000000      RSM_SF_FMT:00
+000CE9 RSM_PH_CALLEE_FMT:00    SV1_FMT:00  RSM_PH_CALLEE:00000000
+000CF0 INT_FCN_EP:00000000     HDL_SF_FMT:00     HDL_PH_CALLEE_FMT:00
+000CF6 SV2_FMT:00  HDL_PH_CALLEE:271D71030

   CIB: 21D72618
+000000 EYE:CIB  BACK:00000000     FRWD:00000000     SIZ:010C
+00000E VER:0004 PLAT_ID:00000000        COND_64:000300C6 59C3C5C5 (CEE0198S)
+000020 MIB:00000000   MACHINE:21D72728        OLD_COND_64:00030C89 59C3C5C5 (CEE3209S)
+000030 OLD_MIB:00000002     FLG_1:00    FLG_2:00    FLG_3:00
+000037 FLG_4:04 HDL_SF:21D71030   HDL_EPT:21694FC8
+000040 HDL_RST:00000000     RSM_SF:21D71248   RSM_POINT:21600A7C
+00004C RSM_MACHINE:2160E878 COND_DEFAULT:00000003
+000054 PH_CALLEE_SF:21D71130 HDL_SF_FMT:00    PH_CALLEE_SF_FMT:00
+00005A BBRANCH_STMTLEN:0000 BBRANCH_OFFSET:00000000
+000060 BBRANCH_STMTID:........    VSR:00000000 00000000
+000098 VSTOR:00000000 VRPSA:00000000    MCB:00000000
+0000A4 MRN:00000000 00000000 MFLAG:00   FLG_5:48    FLG_6:23
+0000B2 FLG_7:04 FLG_8:00    ABCD:940C9000     ABRC:00000009
+0000BC ABNAME:00000000 00000000   PL:216012E0       SV2:21D71248
+0000CC SV1:21D71248   INT:21600A7A      Q_DATA_TOKEN:00000000
+0000D8 FDBK:00000000  FUN:00000067      TOKE:21D71030
+0000E4 MID:00000003   STATE:00000000    RTCC:FFFFFFFC
+0000F0 PPAV:00000003  AB_TERM_EXIT:00000000 00000000
+0000FC SDWA_PTR:00000000    SIGNO:00000008    PPSD:2160EA90
```

Figure 30. Example of formatted output from LEDATA VERBEXIT (Part 15 of 18)

```
[13] Message Processing Control Blocks

          CMXB: 216151A0
        +000000 EYE:CMXB SIZE:0148   FLAGS:8000  DHEAD1:00016000
        +00000C DHEAD2:00012000

        MDST forward chain from CMXBDHEAD(1)

          MDST: 00016000
        +000000 EYE:MDST SIZE:0100   CTL:40      CEEDUMPLOC:00
        +000008 NEXT:00012000  PREV:00000000     DDNAM:CEEDUMP

          MDST: 00012000
        +000000 EYE:MDST SIZE:0100   CTL:40      CEEDUMPLOC:00
        +000008 NEXT:00000000  PREV:00016000     DDNAM:SYSOUT

        MDST back chain from CMXBDHEAD(2)

          MDST: 00012000
        +000000 EYE:MDST SIZE:0100   CTL:40      CEEDUMPLOC:00
        +000008 NEXT:00000000  PREV:00016000     DDNAM:SYSOUT

          MDST: 00016000
        +000000 EYE:MDST SIZE:0100   CTL:40      CEEDUMPLOC:00
        +000008 NEXT:00012000  PREV:00000000     DDNAM:CEEDUMP

          TMXB: 2160F048
        +000000 EYE:TMXB MIB_CHAIN_PTR:22167028

           MGF: 22167028
        +000000 EYE:CMIB PREV:22131780     NEXT:22118380     SEQ:00000005
        +000010 CTOK:00000BF7 41C3C5C5 (CEE3063I)

           MGF: 22118380
        +000000 EYE:CMIB PREV:22167028     NEXT:2160F080     SEQ:00000002
        +000010 CTOK:00030C89 59C3C5C5 (CEE3209S)

           MGF: 2160F080
        +000000 EYE:CMIB PREV:22118380     NEXT:221315C0     SEQ:00000001
        +000010 CTOK:00000DF6 41C3C5C5 (CEE3574I)

           MGF: 221315C0
        +000000 EYE:CMIB PREV:2160F080     NEXT:22131780     SEQ:00000003
        +000010 CTOK:000301CE 59C3C5C5 (CEE0462S)

           MGF: 22131780
        +000000 EYE:CMIB PREV:221315C0     NEXT:22167028     SEQ:00000004
        +000010 CTOK:000101C7 49C3C5C5 (CEE0455W)

[14]  Information for enclave main

[15]    Information for thread 27ACD20000000000
        PCB Address: 21615320
        TCB Address: 008E6968

[16]    Registers and PSW:
        GPR0..... 00000000_84000000 GPR1..... 00000000_84000FC7 GPR2..... 00000000_21D72618 GPR3..... 00000000_00020009
        GPR4..... 00000000_216CEAB8 GPR5..... 00000000_216D9C32 GPR6..... 00000000_21615320 GPR7..... 00000000_2160E430
        GPR8..... 00000000_21D72618 GPR9..... 00000000_21D721AC GPR10.... 00000000_21D72D1F GPR11.... 00000000_A16D9B58
        GPR12.... 00000000_21616BB8 GPR13.... 00000000_21D74E18 GPR14.... 00000000_A16D9B8E GPR15.... 00000000_00000000
        PSW..... 078D1400 A16D9C32
```

Figure 31. Example of formatted output from LEDATA VERBEXIT (Part 16 of 18)

```
[17]    Traceback:
          DSA  Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status

          1    CEEHSDMP    +000000DA                                   CEEHSDMP                       D1D04    Call
          2    CEEHDSP     +00003EBA                                   CEEHDSP                        D1D04    Call
          3    main        +000009BA                                                                           Exception
          4    EDCZMINV    +000000C0                                                                           Call
          5    CEEBBEXT    +000001C4                                   CEEBBEXT                       D1D04    Call

          DSA DSA Addr E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
          1 21D74E18   216D9B58   216D9B58   +000000DA  20100324   CEL       POSIX
          2 21D71D20   216C9CC8   216C9CC8   +00003EBA  20100324   CEL       POSIX
          3 21D71248   216000C0   216000C0   +000009BA  20070105   C/C++     POSIX EBCDIC  HFP
          4 21D71130   21D2E8BE   21D2E8BE   +000000C0  20100324   LIBRARY  POSIX
          5 21D71030   21692F48   21692F48   +000001C4  20100324   CEL       POSIX

[18]    Control Blocks Associated with the Thread:
          Thread Synchronization Queue Element (SQEL): 2160F178
            +000000 2160F178 00000000 DDF18288 00000000 00000000 00000000 00000000 00000000 00000000 |.....1bh........................|
            +000020 2160F198 21616BB8 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |./,.............................|

[19]    Enclave Control Blocks:
          Mutex and Condition Variable Blocks (MCVB+MHT+CHT): 21EA4018
            +000000 21EA4018 00008F50 21EA4044 000003F8 00001FC0 00000000 21D705D0 21EA4444 000000F8 |...&.. ....8.........P.........8|
            +000020 21EA4038 000007C0 00000000 21D705E8 00000000 00000000 00000000 00000000 00000000 |.........P.Y....................|
            +000040 21EA4058 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |................................|
⋮
          Thread Synchronization Enclave Latch Table (EPALT): 21EA4544
            +000000 21EA4544 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |................................|
            +000020 21EA4564 - +00055F 21EA4AA3         same as above
            +000560 21EA4AA4 00000000 00000000 00000000 00000000 A1796F08 00000000 00000000 00000000 |..................?.............|
            +000580 21EA4AC4 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |................................|
            +0005A0 21EA4AE4 - +00061F 21EA4B63         same as above
            +000620 21EA4B64 00000000 00000000 00000000 00000000 00000000 00000000 A1796F08 00000000 |..........................?.....|
            +000640 21EA4B84 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |................................|
            +000660 21EA4BA4 - +0009FF 21EA4F43         same as above
          Thread Synchronization Trace Block (OTRB): 21EA4000
            +000000 21EA4000 21E9C000 00000018 000007FF 21E9C000 A0000000 A0000000 00008F50 21EA4044 |.Z...........Z.............&.. .|

          Thread Synchronization Trace Table (OTRTBL): 21E9C000
            +000000 21E9C000 0000C7D3 40E2F140 21EA49E0 00000001 220C5BD8 40404040 00000000 DE9F0E88 |..GL S1 ..........$Q  .......h|
            +000020 21E9C020 0002D9D3 40E2F240 21EA49E0 00000000 21616BB8 220C4D78 808E66C0 DE9F0E88 |..RL S2 ........./,...(........h|
            +000040 21E9C040 0004C7D3 40C1F140 21EA49E0 00000001 220C5BD8 220C4D78 40000001 DE9F0E88 |..GL A1 ..........$Q..(. .......h|
            +000060 21E9C060 0006C7D3 40E2F140 21EA49E0 00000000 21616BB8 40404040 00000000 DDF18288 |..GL S1 ........./,.  .....1bh|
            +000080 21E9C080 0008D9D3 40E2F240 21EA49E0 00000002 220E8BD8 2160F178 808E68E0 DDF18288 |..RL S2 ...........Q.-1......1bh|
            +0000A0 21E9C0A0 000AC7D3 40E2F140 21EA49E0 00000002 220E8BD8 40404040 00000000 DDF18288 |..GL S1 ...........Q  .....1bh|
            +0000C0 21E9C0C0 000CC7D3 40C1F140 21EA49E0 00000000 21616BB8 2160F178 40000201 DDF18288 |..GL A1 ........./,..-1. ....1bh|
            +0000E0 21E9C0E0 000ED9D3 40E2F240 21EA49E0 00000000 21616BB8 220E7D78 808E64A0 DDF18288 |..RL S2 ........./,...'......1bh|
            +000100 21E9C100 0010C7D3 40E2F140 21EA49E0 00000000 21616BB8 40404040 00000000 DDF18288 |..GL S1 ........./,.  .....1bh|
            +000120 21E9C120 0012C7D3 40C1F140 21EA49E0 00000002 220E8BD8 220E7D78 40000001 DDF18288 |..GL A1 ...........Q..'. ....1bh|
            +000140 21E9C140 0014D9D3 40E2F240 21EA49E0 00000002 220E8BD8 2160F178 808E68E0 DDF18288 |..RL S2 ...........Q.-1......1bh|
            +000160 21E9C160 0016C7D3 40C1F140 21EA49E0 00000000 21616BB8 2160F178 40000201 DDF18288 |..GL A1 ........./,..-1. ....1bh|
            +000180 21E9C180 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |................................|
            +0001A0 21E9C1A0 - +007FFF 21EA3FFF         same as above
          HEAPCHK Option Control Block (HCOP): 21D6D0D0
            +000000 21D6D0D0 C8C3D6D7 00000048 00000001 00000000 00000000 0000000A 0000000A AAAAAAAA |HCOP............................|
            +000020 21D6D0F0 2212C028 21D6D118 21EAF028 00000000 00000000 AAAAAAAA 00000400 00000000 |.....OJ...0.....................|
            +000040 21D6D110 00000000 00000000 C8C3C6E3 00000200 00000000 AAAAAAAA AAAAAAAA AAAAAAAA |........HCFT....................|
          HEAPCHK Element Table (HCEL) for Heapid 22118244 :
          Header: 2212C028
            +000000 2212C028 C8C3C5D3 21D6E228 00000000 22118244 000001F4 00000001 00000001 00000000 |HCEL.OS.......b....4............|
                              Address Seg Addr Length           Address  Seg Addr Length
          Table: 2212C048
            +000000 2212C048 2212B020 2212B000 000002A8 22118280 00000000 00000000 00000000 00000000 |...........y..b.................|
          HEAPCHK Element Table (HCEL) for Heapid 00000000 :
          Header: 21D6E228
            +000000 21D6E228 C8C3C5D3 00000000 2212C028 00000000 000001F4 00000005 00000005 00000000 |HCEL...............4............|
                              Address Seg Addr Length           Address  Seg Addr Length
          Table: 21D6E248
            +000000 21D6E248 21D91038 21D91018 00001030 21D70190 21D92068 21D91018 00000828 21D70258 |.R...R.......P...R...R.......P..|
            +000020 21D6E268 21D92890 21D91018 00000CD0 21D70330 21D93560 21D91018 00002030 21D70460 |.R...R.......P...R.-.R.......P.-|
            +000040 21D6E288 21D95590 21D91018 00000CD0 22118128 00000000 00000000 00000000 00000000 |.R...R........a.................|
```

Figure 32. Example of formatted output from LEDATA VERBEXIT (Part 17 of 18)

```
[20]    Language Environment Trace Table:

          Most recent trace entry is at displacement: 004C80

              Displacement Trace Entry in Hexadecimal                                                Trace Entry in EBCDIC
              ------------ ---------------------------------------------------------------------- --------------------------------
                +000000 Time 20.52.49.708056   Date 2010.04.28    Thread ID...  27ACD20000000000
                +000010 Member ID.... 03   Flags..... 000000    Entry Type..... 00000001
                +000018 94818995 40404040 40404040 40404040 40404040 40404040 40404040 40404040  |main                            |
                +000038 60606E4D F0F8F55D 40979989 95A3864D 5D404040 40404040 40404040 40404040  |-->(085) printf()               |
                +000058 40404040 40404040 40404040 40404040 40404040 40404040 40404040 40404040  |                                |
                +000078 40404040 40404040                                                        |                                |

                +000080 Time 20.52.49.714771   Date 2010.04.28    Thread ID... 27ACD20000000000
                +000090 Member ID.... 03   Flags..... 000000    Entry Type..... 00000002
                +000098 4C60604D F0F8F55D 40D9F1F5 7EF0F0F0 F0F0F0F0 C540C5D9 D9D5D67E F0F0F0F0  |<--(085) R15=0000000E ERRNO=0000|
                +0000B8 F0F0F0F0 00000000 00000000 00000000 00000000 00000000 00000000 00000000  |0000............................|
                +0000D8 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000  |................................|
                +0000F8 00000000 00000000                                                        |........                        |

                +000100 Time 20.52.49.714774   Date 2010.04.28    Thread ID... 27ACD20000000000
                +000110 Member ID.... 03   Flags..... 000000    Entry Type..... 00000003
                +000118 94818995 40404040 40404040 40404040 40404040 40404040 40404040 40404040  |main                            |
                +000138 60606E4D F1F5F55D 4097A388 99858184 6D94A4A3 85A76D89 9589A34D 5D404040  |-->(155) pthread_mutex_init()    |
                +000158 40404040 40404040 40404040 40404040 40404040 40404040 40404040 40404040  |                                |
                +000178 40404040 40404040                                                        |                                |
                +000180 Time 20.52.49.714781   Date 2010.04.28    Thread ID... 27ACD20000000000
                +000190 Member ID.... 03   Flags..... 000000    Entry Type..... 00000004
                +000198 4C60604D F1F5F55D 40D9F1F5 7EF0F0F0 F0F0F0F0 F040C5D9 D9D5D67E F0F0F0F0  |<--(155) R15=00000000 ERRNO=0000|
                +0001B8 F0F0F0F0 40C5D9D9 D5D6F27E F0F0F0F0 F0F0F0F0 00000000 00000000 00000000  |0000 ERRNO2=00000000............|
                +0001D8 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000  |................................|
                +0001F8 00000000 00000000                                                        |........                        |
⋮
                +004B80 Time 20.52.52.593917   Date 2010.04.28    Thread ID... 27ACD20000000000
                +004B90 Member ID.... 03   Flags..... 000000    Entry Type..... 00000002
                +004B98 4C60604D F0F8F55D 40D9F1F5 7EF0F0F0 F0F0F0F2 F140C5D9 D9D5D67E F0F0F0F0  |<--(085) R15=00000021 ERRNO=0000|
                +004BB8 F0F0F0F0 00000000 00000000 00000000 00000000 00000000 00000000 00000000  |0000............................|
                +004BD8 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000  |................................|
                +004BF8 00000000 00000000                                                        |........
|
                +004C00 Time 20.52.52.593918   Date 2010.04.28    Thread ID... 27ACD20000000000
                +004C10 Member ID.... 03   Flags..... 000000    Entry Type..... 00000001
                +004C18 A3889985 81846D83 93858195 A4974040 40404040 40404040 40404040 40404040  |thread_cleanup                  |
                +004C38 60606E4D F0F8F55D 40979989 95A3864D 5D404040 40404040 40404040 40404040  |-->(085) printf()               |
                +004C58 40404040 40404040 40404040 40404040 40404040 40404040 40404040 40404040  |                                |
                +004C78 40404040 40404040                                                        |                            |

                +004C80 Time 20.52.52.593920   Date 2010.04.28    Thread ID... 27ACD20000000000
                +004C90 Member ID.... 03   Flags..... 000000    Entry Type..... 00000002
                +004C98 4C60604D F0F8F55D 40D9F1F5 7EF0F0F0 F0F0F0F2 C140C5D9 D9D5D67E F0F0F0F0  |<--(085) R15=0000002A ERRNO=0000|
                +004CB8 F0F0F0F0 00000000 00000000 00000000 00000000 00000000 00000000 00000000  |0000............................|
                +004CD8 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000  |................................|
                +004CF8 00000000 00000000                                                        |........                        |

[21]  Process Control Blocks:

        Thread Synchronization Process Latch Table (PPALT): 21EA4F44
          +000000 21EA4F44 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 |................................|
          +000020 21EA4F64 - +0009FF 21EA5943         same as above

[22]  No PIPICB associated with CAA at address : 21616BB8

⋮
     Exiting Language Environment Data
```

Figure 33. Example of formatted output from LEDATA VERBEXIT (Part 18 of 18)

Sections of the Language Environment LEDATA VERBEXIT formatted output

The sections of the output listed in Table 21 on page 103 appear independently of the Language Environment-conforming languages used.

Table 21. Contents of the LEDATA VERBEXIT formatted output

Section number and heading	**Contents**
[1] - [9] Summary:	The following sections are included when the SUMMARY parameter is specified on the LEDATA invocation.
[1] Summary Header	Contains the following information: • Address of Thread control block (TCB) • Release number • Address Space ID (ASID)
[2] Active Members List	List of active members is extracted from the enclave member list (MEML)
[3] CEECAA	Formats the contents of the Language Environment common anchor area (CAA). See "Common Anchor Area" on page 64 for a description of the fields in the CAA.
[4] CEEDLLF	Formats the contents of all Language Environment CEEDLLF (DLLF) control blocks that are in use. See CEEDLLF — DLL failure control block in *z/OS Language Environment Vendor Interfaces* for more information about the CEEDLLF control block chain.
[5] CEEPCB	Formats the contents of the Language Environment process control block (PCB), and the process level member list.
[6] CEERCB	Formats the contents of the Language Environment region control block (RCB).
[7] CEEEDB	Formats the contents of the Language Environment enclave data block (EDB), and the enclave level member list.

Table 21. Contents of the LEDATA VERBEXIT formatted output (continued)

Section number and heading	Contents
[8] PMCB	Formats the contents of the Language Environment program management control block (PMCB).
[9] Runtime Options	Lists the runtime options in effect at the time of the dump, and indicates where they were set.
[10] Heap Storage Control Blocks	This section is included when the HEAP or SM parameter is specified on the LEDATA invocation. It formats the Enclave-level storage management control block (ENSM) and for each different type of heap storage: • Heap control block (HPCB) • Chain of heap anchor blocks (HANC). A HANC immediately precedes each segment of heap storage. This section includes a detailed heap segment report for each segment in the dump. For more information about the detailed heap segment report, see “Understanding the HEAP LEDATA output” on page 107. When HEAPPOOLS is ON, this section also includes a detailed heap pools report. For more information about the detailed heap pools report, see “Understanding the heap pools LEDATA output” on page 111.
[11] Stack Storage Control Blocks	This section is included when the STACK or SM parameter is specified on the LEDATA invocation; it formats: • Storage management control block (SMCB) • Chain of dynamic save areas (DSA). See “Upward-growing (non-XPLINK) stack frame section” on page 62 or “Downward-growing (XPLINK) stack frame section” on page 63 for a description of the fields in the DSA. • Chain of stack segment headers (STKH). An STKH immediately precedes each segment of stack storage.
[12] Condition Management Control Blocks	This section is included when the CM parameter is specified on the LEDATA invocation; it formats the chain of Condition Information Block Headers (CIBH) and Condition Information Blocks. The Machine State Information Block is contained with the CIBH starting with the field labeled MCH_EYE. See “Condition information block” on page 75 for a description of fields in these control blocks.
[13] Message Processing Control Blocks	This section is included when the MH parameter is specified on the LEDATA invocation.
[14]-[17] NTHREADS information:	One or more instances of these sections are included when the NTHREADS() parameter is specified on the LEDATA invocation. For a description of NTHREADS, see “Report type parameters” on page 85.
[14] - [21] CEEDUMP Formatted Control Blocks:	These sections are included when the CEEDUMP parameter is specified on the LEDATA invocation.
[14] Enclave Identifier	Names the enclave for which information is provided.
[15] Information for thread	Shows the system identifier for the thread. Each thread has a unique identifier.
[16] Registers and PSW	Displays the register and program status word (PSW) values that were used to create the traceback. These values may come from the TCB, the RTM2 work area, a linkage stack entry or output from the BPXGMSTA service. This section is not displayed when the DSA() parameter is specified on the LEDATA invocation.

Table 21. Contents of the LEDATA VERBEXIT formatted output (continued)

Section number and heading	Contents
[17] Traceback	For all active routines in a particular thread, the traceback section shows routine information in two parts. The first part contains the following items: • DSA number: A number assigned to the information for this active routine by dump processing. The number is used to associate information from the first part of the traceback with information in the second part of the traceback. • Entry: For COBOL, Fortran, and PL/I routines, this is the entry point name. For C/C++ routines, this is the function name. If a function name or entry point was not specified for a particular routine, the string '** NoName **' will appear. • Entry point offset • Statement number: This field contains no Language Environment data. • Load module • Program unit: The primary entry point of the external procedure. For COBOL programs, this is the PROGRAM-ID name. For C, Fortran, and PL/I routines, this is the compile unit name. For Language Environment-conforming assemblers, this is the EPNAME = value on the CEEPPA macro. • Service level: The latest service level applied to the compile unit (for example, for IBM products, it would be the PTF number). – If the service level string is equal or less than 7 bytes, all of the string will be output. – If the service level string is longer than 7 bytes, the Service column will only show the first 7 bytes of the service string, and the full service string will be shown in section of Full Service Level with max length of 64 bytes. • Status: Routine status can be call, exception, or running. The second part contains the following items: • DSA number A number assigned to the information for this active routine by dump processing. The number is used to associate information from the first part of the traceback with information in the second part of the traceback. • Stack frame (DSA) address • Entry point address • Program unit address • Program unit offset: The offset of the last instruction to run in the routine. If the offset is a negative number, zero, or a very large positive number, the routine associated with the offset probably did not allocate a save area, or the routine could have been called using SVC-assisted linkage. Adding the program unit address to the offset gives you the location of the current instruction in the routine. This offset is from the starting address of the routine. • Compile Date: Contains the year, month and day in which the routine was compiled. • Attributes: The available compilation attributes of the compile unit include: – A label identifying the LE-supported language such as COBOL, ENT PL/I, C/C++, and so on. – Compilation attributes such as EBCDIC, ASCII, IEEE, or hexadecimal floating point (HFP). The compilation attributes will only be displayed if there is enough information available. – POSIX, If the CEEDUMP was created under a POSIX environment. The third part of the traceback, which is also referred to as the "Full Service Level" section, contains the following: • DSA number • Entry • Service: The full service level string with max length of 64 bytes will be displayed here. The fourth part of the traceback, which is also referred to as the "AMODE 31 and AMODE 64 DSA Anchor" section, contains the following: • DSA number • Entry • Entry point address • Anchor DSA address
[18] Control Blocks Associated with the Thread	Lists the contents of the thread synchronization queue element (SQEL).
[19] Enclave Control Blocks	If the POSIX runtime option was set to ON, this section lists the contents of the mutex and condition variable control blocks, the enclave level latch table, and the thread synchronization trace block and trace table. If the HEAPCHK runtime option is set to ON, this section lists the contents of the HEAPCHK options control block (HCOP) and the HEAPCHK element tables (HCEL). A HEAPCHK element table contains the location and length of all allocated storage elements for a heap in the order that they were allocated.
[20] Language Environment Trace Table	If the TRACE runtime option was set to ON, this section shows the contents of the Language Environment trace table.
[21] Process Control Blocks	If the POSIX runtime option was set to ON, this section lists the contents of the process level latch table.
[22] Preinitialization Information	This section is included when the PTBL parameter is specified on the LEDATA invocation. This section formats information related to preinitialization. See PTBL LEDATA output for more information. If the preinitialization service CEEPIPI was not used to initialize this environment, the message: `No PIPICB associated with CAA` is displayed instead.

PTBL LEDATA output

The VERBEXIT LEDATA command generates formatted output of PreInit tables when the PTBL or ALL parameter are specified. If ALL is specified, PTBL defaults to CURRENT value. The following sample illustrates the output produced when the VERBEXIT LEDATA command is invoked with the PTBL parameter.

```
PTBL(CURRENT)
******************************************************************************
                             LANGUAGE ENVIRONMENT DATA
```

```
******************************************************************************

 Language Environment Product 04 V01 R09.00


PreInitialization Programming Interface Trace Data
CEEPIPI Environment Table Entry and Trace Entry :
 Active CEEPIPI Environment (  Address 20905CB0 )
 Eyecatcher  : CEEXIPTB
 TCB address : 008D6E88

 CEEPIPI Environment :
  Non-XPLINK Environment
  Environment Type : MAIN
  Sequence of Calls not active
  Exits not established
  Signal Interrupt Routines not registered
  Service Routines are not active

  CEEPIPI Environment Enclave Initialized
  Number of CEEPIPI Table Entries = 3

 CEEPIPI Table Entry Information :
 CEEPIPI Table Index 0  ( Entry 1   )
  Routine Name  = ISJPPCA3
  Routine Type  = C/C++
  Routine Entry Point  = A0910530
  Routine Function Pointer  = A0910620
  Routine Entry is Non-XPLINK
  Routine was loaded by Language Environment
  Routine Address was resolved
  Routine Function Descriptor was valid
  Routine Return Code    = 0
  Routine Reason Code    =
0


  Entry of routine in CEEPIPI Table for Index 0
( 20905DB8 )


   +000000 20905DB8  A0910620 20919B30 80000000 00000000  00000000 00000000 00000000 00000000
|.j...j..........................|
   +000020 20905DD8  00000000 00000000 00000000 A0910530  00000003 209197D8 00000003 20910530
|............j.......jpQ.....j..|
   +000040 20905DF8  A0910530 00009AD0 C9E2D1D7 D7C3C1F3  00000000 00000000 00000000 00000000
|.j......ISJPPCA3................|


 CEEPIPI Table Index 1  ( Entry 2   ) not in
use.


 CEEPIPI Table Index 2  ( Entry 3   ) not in
use.
```

```
 CEEPIPI Trace Table
Entries :
 Call Type =
INIT_MAIN
  PIPI Driver Address  =
A090068A
  Load Service Return Code   =
0
  Load Service Reason Code   =
0
  Most Recent Return Code    =
0
  Most Recent Reason Code    =
0
  An ABEND will be issued if storage can not be
obtained
  PreInit Environment will not allow EXEC CICS
commands
  Service RC = 0 :A new environment was
initialized.


 Call Type =
ADD_ENTRY
  Routine Table Index        =
1
  Routine Name  =
ISJPPCA1
  Routine Address =
A0FCC548
  Load Service Return Code   =
```

```
0
  Load Service Reason Code   =
3
  Service RC = 0 :The routine was added to the PreInit
table.


 Call Type =
IDENTIFY_ENTRY
  Routine Table Index        =
1
  Routine Programming Language  = C/C+
+
  Service RC = 0 :The programming language has been
returned.


 Call Type =
CALL_MAIN
  Routine Table Index     =
1
  Enclave Return Code     = 0
  Enclave Reason Code     = 0
  Routine Feedback Code   = 0000000000000000
  Service RC = 0 :The environment was activated and the routine called.

 Call Type =  DELETE_ENTRY
  Routine Table Index     = 1
  Routine Name  = ISJPPCA1
  Routine Address = A0FCC548
  Service RC = 0 :The routine was deleted from the PreInit table.

 Call Type =  CALL_MAIN
  Routine Table Index     = 0
  Enclave Return Code     = 0
  Enclave Reason Code     = 0
  Routine Feedback Code   = 0000000000000000
  Service RC = 0 :The environment was activated and the routine called.

Exiting Language Environment Data
```

When nested CEEPIPI main-DP environments are present, two new items will appear after the TCB address:

- Address of the CEEPIPI environment (PTBL) that called the currently displayed CEEPIPI environment.
- Saved register 13 value. This is the address of the DSA for the Language Environmentroutine called from the assembler CEEPIPI driver.

The following is an example:

```
⋮
Eyecatcher  : CEEXPITB
TCB address : xxxxxxxx
Caller PTBL : xxxxxxxx
Saved R13   : xxxxxxxx
⋮
```

Understanding the HEAP LEDATA output

The Language Environment IPCS VERBEXIT LEDATA generates a detailed heap segment report when the HEAP option is used with the DETAIL option, or when the SM,DETAIL option is specified. The detailed heap segment report is useful when trying to pinpoint damage because it provides very specific information. The report describes the nature of the damage, and specifies where the actual damage occurred. The report can also be used to diagnose storage leaks, and to identify heap fragmentation. The following example illustrates the output produced by specifying the HEAP option. "Heap report sections of the LEDATA output" on page 109 describes the information contained in the formatted output. For easy reference, the sections of the dump are numbered to correspond with the description of each section that follows in Table 22 on page 110. Ellipses are used to summarize some sections of the dump.

Note: Language Environment does not provide support for alternative Vendor Heap Manager (VHM) data. LEDATA verb exit will state that an alternative VHM is in use.

```
IP VERBEXIT LEDATA 'HEAP'
******************************************************************************
                              LANGUAGE ENVIRONMENT DATA
 ******************************************************************************
 Language Environment Productt 04 V01 R02.00

 Heap Storage Control Blocks
```

```
    ENSM:  00014D30
  +0000A8  ENSM_ADDL_HEAPS:259B1120

  User Heap Control Blocks

    HPCB:  00014D48
  +000000  EYE_CATCHER:HPCB  FIRST:25995000    LAST:25995000

    HANC:  25995000
  +000000  EYE_CATCHER:HANC  NEXT:00014D48     PREV:00014D48
  +00000C  HEAPID:00000000   SEG_ADDR:25995000       ROOT_ADDR:259950B0
  +000018  SEG_LEN:00008000        ROOT_LEN:00007F50

  This is the last heap segment in the current heap.

[1]Free Storage Tree for Heap Segment 25995000

         Node      Node     Parent     Left      Right     Left     Right
 Depth  Address    Length     Node      Node      Node     Length    Length
    0  259950B0  00007F50  00000000  00000000  00000000  00000000  00000000

[2]Map of Heap Segment 25995000

 To display entire segment: IP LIST 25995000 LEN(X'00008000') ASID(X'0021')

 25995020: Allocated storage element, length=00000038. To display: IP LIST 25995020 LEN(X'00000038') ASID(X'0021')
 25995028: C3C4D3D3 00000000 40000000 00000000  24700F98 24703F70 25993870 00000490 |CDLL.... ..........q.....r......|

 25995058: Allocated storage element, length=00000038. To display: IP LIST 25995058 LEN(X'00000038') ASID(X'0021')
 25995060: C3C4D3D3 25995028 80000000 00000000  247006F0 24700770 2471CEB0 00000150 |CDLL.r&............0...........&|

 25995090: Allocated storage element, length=00000010. To display: IP LIST 25995090 LEN(X'00000010') ASID(X'0021')
 25995098: 259ADBB8 00000000                                                        |........                        |

 259950A0: Allocated storage element, length=00000010. To display: IP LIST 259950A0 LEN(X'00000010') ASID(X'0021')
 259950A8: 259ADBE0 00000000                                                        |........                        |

 259950B0: Free storage element, length=00007F50. To display: IP LIST 259950B0 LEN(X'00007F50') ASID(X'0021')

 Summary of analysis for Heap Segment 25995000:

    Amounts of identified storage:  Free:00007F50  Allocated:00000090  Total:00007FE0
    Number of identified areas   :  Free:       1  Allocated:       4  Total:       5
    00000000 bytes of storage were not accounted for.
    No errors were found while processing this heap segment.
    This is the last heap segment in the current heap.


 Anywhere Heap Control Blocks

    HPCB:  00014D78
  +000000  EYE_CATCHER:HPCB  FIRST:24A91000    LAST:259C2000

    HANC:  24A91000
  +000000  EYE_CATCHER:HANC  NEXT:25993000     PREV:00014D78
  +00000C  HEAPID:00014D78   SEG_ADDR:24A91000       ROOT_ADDR:00000000
  +000018  SEG_LEN:00F00028        ROOT_LEN:00000000

  Free Storage Tree for Heap Segment 24A91000

      The free storage tree is empty.
```

```
  Map of Heap Segment 24A91000

 To display entire segment: IP LIST 24A91000 LEN(X'00F00028') ASID(X'0021')

 24A91020: Allocated storage element, length=00F00008. To display: IP LIST 24A91020 LEN(X'00F00008') ASID(X'0021')
 24A91028: B035F6D8 B2C00081 24ABED80 00000000  03000000 00000001 94818995 40404040 |..6Q...a................main    |

Summary of analysis for Heap Segment 24A91000:
    Amounts of identified storage:  Free:00000000  Allocated:00F00008  Total:00F00008
    Number of identified areas   :  Free:       0  Allocated:       1  Total:       1
    00000000 bytes of storage were not accounted for.
    No errors were found while processing this heap segment.
⋮

    HANC:  259AC000
  +000000  EYE_CATCHER:HANC  NEXT:259AF000     PREV:2599D000
  +00000C  HEAPID:00014D78   SEG_ADDR:259AC000       ROOT_ADDR:259AC020
  +000018  SEG_LEN:00002000        ROOT_LEN:00000C30

  Free Storage Tree for Heap Segment 259AC000

         Node      Node     Parent     Left      Right     Left     Right
 Depth  Address    Length     Node      Node      Node     Length    Length
    0  259AC020  00000C30  00000000  00000000  259ADC48  00000000  000003B8
    1  259ADC48  000003B8  259AC020  00000000  00000000  00000000  00000000

  Map of Heap Segment 259AC000

 To display entire segment: IP LIST 259AC000 LEN(X'00002000') ASID(X'0021')

 259AC020: Free storage element, length=00000C30. To display: IP LIST 259AC020 LEN(X'00000C30') ASID(X'0021')

 259ACC50: Allocated storage element, length=00000728. To display: IP LIST 259ACC50 LEN(X'00000728') ASID(X'0021')
 259ACC58: D3D3E340 071C0001 00000000 00000000  00000000 00000003 00000040 20010003 |LLT ....................... ....|

 259AD378: Allocated storage element, length=00000080. To display: IP LIST 259AD378 LEN(X'00000080') ASID(X'0021')
 259AD380: 00000000 00000000 247006F0 247006F0  000008A8 2471CEB0 00000000 00000001 |...........0...0...y............|

 259AD3F8: Allocated storage element, length=00000068. To display: IP LIST 259AD3F8 LEN(X'00000068') ASID(X'0021')
 259AD400: C5E3C3E2 00000007 00000000 25993870  A4797478 247971E0 25993870 A4797478 |ETCS.........r..u........r..u...|

 259AD460: Allocated storage element, length=00000728. To display: IP LIST 259AD460 LEN(X'00000728') ASID(X'0021')
 259AD468: C3D3D3E3 071C0001 00000000 00000000  00000000 00000001 00000040 60010005 |CLLT....................... -...|

 259ADB88: Allocated storage element, length=00000028. To display: IP LIST 259ADB88 LEN(X'00000028') ASID(X'0021')
 259ADB90: 180F58FF 001007FF 24700AB8 2471CEB0  2479A6E8 FFFFFFFE 247006F0 259AD380 |.................wY.......0..L.|

 259ADBB0: Allocated storage element, length=00000028. To display: IP LIST 259ADBB0 LEN(X'00000028') ASID(X'0021')
 259ADBB8: 00000000 25995098 70004000 00000000  00000000 00000000 00000000 00000000 |.....r.&q.......................|

 259ADBD8: Allocated storage element, length=00000028. To display: IP LIST 259ADBD8 LEN(X'00000028') ASID(X'0021')
 259ADBE0: 00000000 259950A8 70004000 00000000  00000000 00000000 00000000 00000000 |.....r.&y.......................|

 259ADC00: Allocated storage element, length=00000048. To display: IP LIST 259ADC00 LEN(X'00000048') ASID(X'0021')
 259ADC08: C1C4C8D7 F0F00000 259ADC14 C8D7C3C2  259AE000 259AE000 00001000 00001000 |ADHP00......HPCB................|

 259ADC48: Free storage element, length=000003B8. To display: IP LIST 259ADC48 LEN(X'000003B8') ASID(X'0021')

 Summary of analysis for Heap Segment 259AC000:
    Amounts of identified storage:  Free:00000FE8  Allocated:00000FF8  Total:00001FE0
    Number of identified areas   :  Free:       2  Allocated:       8  Total:      10
    00000000 bytes of storage were not accounted for.
    No errors were found while processing this heap segment.
```

```
⋮
```

```
   Below Heap Control Blocks

     HPCB:  00014DA8
   +000000  EYE_CATCHER:HPCB  FIRST:00044000    LAST:00044000

     HANC:  00044000
   +000000  EYE_CATCHER:HANC  NEXT:00014DA8     PREV:00014DA8
   +00000C  HEAPID:00014DA8   SEG_ADDR:80044000       ROOT_ADDR:00044388
   +000018  SEG_LEN:00002000        ROOT_LEN:00001C78

   This is the last heap segment in the current heap.

   Free Storage Tree for Heap Segment 00044000

          Node      Node     Parent     Left      Right     Left     Right
 Depth  Address    Length     Node      Node      Node     Length    Length

     0  00044388  00001C78  00000000  00000000  00000000  00000000  00000000

   Map of Heap Segment 00044000

 To display entire segment: IP LIST 00044000 LEN(X'00002000') ASID(X'0021')

 00044020: Allocated storage element, length=00000048. To display: IP LIST 00044020 LEN(X'00000048') ASID(X'0021')
 00044028: C8C4D3E2 00000000 00044220 00000040  00010000 00000001 000241E0 24701038 |HDLS........... ................|

 00044068: Allocated storage element, length=00000128. To display: IP LIST 00044068 LEN(X'00000128') ASID(X'0021')
 00044070: 07000700 05E0900F E0A641DE 002258C0  E11258F0 E1160B0F E2C6E7D4 01200001 |.........w.........0....SFXM....|

 00044190: Allocated storage element, length=00000088. To display: IP LIST 00044190 LEN(X'00000088') ASID(X'0021')
 00044198: C3E2E3D2 00000000 00000000 00800001  00000001 00000068 04000000 00000000 |CSTK............................|

 00044218: Allocated storage element, length=00000048. To display: IP LIST 00044218 LEN(X'00000048') ASID(X'0021')
 00044220: C8C4D3E2 00044028 00000000 00000040  00010000 00000002 000241E0 259ADB90 |HDLS.. ........ ................|

 00044260: Allocated storage element, length=00000128. To display: IP LIST 00044260 LEN(X'00000128') ASID(X'0021')
 00044268: 07000700 05E0900F E0A641DE 002258C0  E11258F0 E1160B0F E2C6E7D4 01200001 |.........w.........0....SFXM....|

 00044388: Free storage element, length=00001C78. To display: IP LIST 00044388 LEN(X'00001C78') ASID(X'0021')

 Summary of analysis for Heap Segment 00044000:
    Amounts of identified storage:  Free:00001C78  Allocated:00000368  Total:00001FE0
    Number of identified areas   :  Free:       1  Allocated:       5  Total:       6
    00000000 bytes of storage were not accounted for.
    No errors were found while processing this heap segment.
    This is the last heap segment in the current heap.

   Additional Heap Control Blocks

     ADHP:  259B1120
   +000000  EYE_CATCHER:ADHP  NEXT:259B24A8     HEAPID:259B112C

     HPCB:  259B112C
   +000000  EYE_CATCHER:hpcb  FIRST:259B112C    LAST:259B112C

     ADHP:  259B24A8
   +000000  EYE_CATCHER:ADHP  NEXT:259ADC08     HEAPID:259B24B4

     HPCB:  259B24B4
   +000000  EYE_CATCHER:hpcb  FIRST:259B24B4    LAST:259B24B4

     ADHP:  259ADC08
   +000000  EYE_CATCHER:ADHP  NEXT:F0F00000     HEAPID:259ADC14

     HPCB:  259ADC14
   +000000  EYE_CATCHER:HPCB  FIRST:259AE000    LAST:259AE000

     HANC:  259AE000
   +000000  EYE_CATCHER:HANC  NEXT:259ADC14     PREV:259ADC14
   +00000C  HEAPID:259ADC14   SEG_ADDR:259AE000       ROOT_ADDR:259AE1E8
   +000018  SEG_LEN:00001000        ROOT_LEN:00000E18
```

```
   This is the last heap segment in the current heap.

   Free Storage Tree for Heap Segment 259AE000

          Node      Node     Parent     Left      Right     Left     Right
 Depth  Address    Length     Node      Node      Node     Length    Length
     0  259AE1E8  00000E18  00000000  00000000  00000000  00000000  00000000

   Map of Heap Segment 259AE000

 To display entire segment: IP LIST 259AE000 LEN(X'00001000') ASID(X'0021')

 259AE020: Allocated storage element, length=000001C8. To display: IP LIST 259AE020 LEN(X'000001C8') ASID(X'0021')
 259AE028: D7C3C9C2 00000000 00000000 000101BC  00000000 00000000 00000000 00000000 |PCIB............................|

 259AE1E8: Free storage element, length=00000E18. To display: IP LIST 259AE1E8 LEN(X'00000E18') ASID(X'0021')

 Summary of analysis for Heap Segment 259AE000:
    Amounts of identified storage:  Free:00000E18  Allocated:000001C8  Total:00000FE0
    Number of identified areas   :  Free:       1  Allocated:       1  Total:       2
    00000000 bytes of storage were not accounted for.
    No errors were found while processing this heap segment.
    This is the last heap segment in the current heap.

Exiting Language Environment Data
```

Heap report sections of the LEDATA output

The Heap Report sections of the LEDATA output provide information for each heap segment in the dump. The detailed heap segment reports include information on the free storage tree in the heap segments, the allocated storage elements, and the cause of heap management data structure problems.

Table 22. Contents of the Heap report sections of LEDATA output

Section number and heading	Contents
[1] Free Storage Tree Report	Within each heap segment, Language Environment tracks deallocated storage areas by chaining them together into a tree. Each free area represents a node in the tree. Each node contains a header, which points to its left and right child nodes. The header also contains the length of each child. The LEDATA HEAP option formats the free storage tree within each heap, and validates all node addresses and lengths within each node. Each node address is validated to ensure that it: • Falls on a doubleword boundary. • Falls within the current heap segment. • Does not point to itself. • Does not point to a node that was previously traversed. Each node length is validated to ensure that it: • Is a multiple of 8. • Is not larger than the heap segment length. • Does not cause the end of the node to fall outside of the current heap segment. • Does not cause the node to overlap another node. If the formatter finds a problem, then it will place an error message that describes the problem directly after the formatted line of the node that failed validation.
[2] Heap Segment Map Report	The LEDATA HEAP option produces a report that lists all of the storage areas within each heap segment, and identifies the area as either allocated or freed. For each allocated area the contents of the first X'20 bytes of the area are displayed in order to help identify the reason for the storage allocation. Each allocated storage element has an 8-byte prefix that is used by Language Environment to manage the area. The first fullword contains a pointer to the start of the heap segment. The second fullword contains the length of the allocated storage element. The formatter validates this header to ensure that its heap segment pointer is valid. The length is also validated to ensure that it: • Is a multiple of 8. • Is not zero. • Is not larger than the heap segment length. • Does not cause the end of the element to fall outside of the current heap segment. • Does not cause the element to overlap a free storage node. If the `heap_free_value` of the STORAGE runtime option was specified, then the formatter also checks that the free storage within each free storage element is set to the requested `heap_free_value`. If a problem is found, then an error message that describes the problem is placed after the formatted line of the storage element that failed validation.

Diagnosing heap damage problems

Heap storage errors can occur when an application allocates a heap storage element that is too small for it to use, and therefore, accidently overlays heap storage. If this situation occurs then some of the typical error messages generated are:

- The node address does not represent a valid node within the heap segment
- The length of the segment is not valid, or
- The heap segment pointer is not valid.

If one of the above error messages is generated by one of the reports, then examine the storage element that immediately precedes the damaged node to determine if this storage element is owned by the application program. Check the size of the storage element and ensure that it is sufficient for the program's use. If the size of the storage element is not sufficient then adjust the allocation size.

If an error occurs indicating that the node's pointers form a circular loop within the free storage tree, then check the Free Storage Tree Report to see if such a loop exists. If a loop exists, then contact the IBM support center for assistance because this may be a problem in the Language Environment heap management routines.

Additional diagnostic information regarding heap damage can be obtained by using the HEAPCHK runtime option. This option provides a more accurate time perspective on when the heap damage actually occurred, which could help to determine the program that caused the damage. For more information about HEAPCHK, see HEAPCHK in *z/OS Language Environment Programming Reference*.

Diagnosing storage leak problems

A storage leak occurs when a program does not return storage back to the heap after it has finished using it. To determine if this problem exists, do one of the following:

- The *call-level* suboption of the HEAPCHK runtime option causes a report to be produced in the CEEDUMP. Any still-allocated (that is, not freed) storage identified by HEAPCHK is listed in the report, along with the corresponding traceback. This shows any storage that wasn't freed, as well as all the calls that were involved in allocating the storage. For more information about the HEAPCHK runtime option, see HEAPCHK in *z/OS Language Environment Programming Reference*.
- Examine the Heap Segment Map report to see if any data areas, within the allocated storage elements, appear more frequently than expected. If they do, then check to see if these data areas are still being used by the application program. If the data areas are not being used, then change the program to free the storage element after it is done with it.

Diagnosing heap fragmentation problems

Heap fragmentation occurs when allocated storage is interlaced with many free storage areas that are too small for the application to use. Heap fragmentation could indicate that the application is not making efficient use of its heap storage. Check the Heap Segment Map report for frequent free storage elements that are interspersed with the allocated storage elements.

Understanding the heap pools LEDATA output

The Language Environment IPCS VERBEXIT LEDATA generates a detailed heap pools report when HEAPPOOLS is ON. The detailed heap pools report is useful when trying to find potential damaged cells because it provides very specific information. The following sample shows an example of a report and “Heap pools report sections of the LEDATA output” on page 115 describes the information contained in the formatted output.

```
Heap Pool Report
    QPCB:  25C1EA00
  +000000  EYECATCHER:QPCB   LENGTH:00000F00   NUMPOOLS:0000000A
  +00000C  LARGEST_CELL_SIZE:00000800    BIG_REQUESTS:00000000
  +000014  STORAGE_HITS_ADDR:00000000    FLAGS:0400  NUMGETARRAYS:05
  +00001B  NUMCELLSIZES:06   GET_POOLINFO_ARRAYS_PTR:25C1EB00

  Data for pool 1:
POOLDATA:  25C1EE00
  +000000  POOL_INDEX:00000001     INPUT_CELL_SIZE:00000008
  +000008  CELL_SIZE:00000010      INPUT_PERCENT:00000001
  +000010  CELL_POOL_SIZE:00000140       CELL_POOL_NUM:00000014
  +000018  POOL_LATCH_ADDR:25C54BD4      POOL_EXTENTS:00000001
  +000020  LAST_CELL:25C45C30      NEXT_CELL:25C45B10
  +000028  Q_CONTROL_INFO:0000031F       Q_FIRST_CELL:25C45B00
  +000030  POOL_NUM_GET_TOTAL:00000190   POOL_NUM_FREE:00000001
  +000038  POOL_EXTENTS_ANCHOR:25C45AF8        POOL_INDEX_SAME_SIZE:01
  +00003D  POOL_INDEX_SIZE:01      POOL_NUM_SAME_SIZE:01
  +000040  POOL_TRACE_TABLE:25C56060
    [2]Heap Pool Extent Mapping
  EXTENT:  25C45AF8
  +000000  EYE_CATCHER:EX31  NEXT_EXTENT:00000000
    To display entire pool extent: IP LIST 25C45AF8 LEN(X'00000148') ASID(X'0020')
```

```
    25C45B00: Free storage cell. To display: IP LIST 25C45B00 LEN(X'00000010') ASID(X'0020')
    [1]Verifying free chain for pool: 1...
       No errors were found while processing free chain.
    Summary of analysis for Pool 1:
       Number of cells:  Unused:       19  Free:       1  Allocated:       0  Total Used:       20
       00000000 free cells were not accounted for.
       No errors were found while processing this Pool.

  Data for pool 2:
POOLDATA:  25C1EF00
  +000000  POOL_INDEX:00000002     INPUT_CELL_SIZE:00000020
  +000008  CELL_SIZE:00000028      INPUT_PERCENT:00000001
  +000010  CELL_POOL_SIZE:00000140       CELL_POOL_NUM:00000008
  +000018  POOL_LATCH_ADDR:25C54BE8      POOL_EXTENTS:00000001
  +000020  LAST_CELL:25C45D68      NEXT_CELL:25C45C78
  +000028  Q_CONTROL_INFO:0000031F       Q_FIRST_CELL:25C45C50
  +000030  POOL_NUM_GET_TOTAL:00000190   POOL_NUM_FREE:00000001
  +000038  POOL_EXTENTS_ANCHOR:25C45C48        POOL_INDEX_SAME_SIZE:01
  +00003D  POOL_INDEX_SIZE:02      POOL_NUM_SAME_SIZE:01
  +000040  POOL_TRACE_TABLE:25C86080
  [2]Heap Pool Extent Mapping
  EXTENT:  25C45C48
  +000000  EYE_CATCHER:EX31  NEXT_EXTENT:00000000
    To display entire pool extent: IP LIST 25C45C48 LEN(X'00000148') ASID(X'0020')
    25C45C50: Free storage cell. To display: IP LIST 25C45C50 LEN(X'00000028') ASID(X'0020')
  [1]Verifying free chain for pool: 2...
       No errors were found while processing free chain.
    Summary of analysis for Pool 2:
       Number of cells:  Unused:       7  Free:       1  Allocated:       0  Total Used:       8
       00000000 free cells were not accounted for.
       No errors were found while processing this Pool.

  Data for pool 3:
POOLDATA:  25C1F000
  +000000  POOL_INDEX:00000003     INPUT_CELL_SIZE:00000080
  +000008  CELL_SIZE:00000088      INPUT_PERCENT:00000001
  +000010  CELL_POOL_SIZE:00000220       CELL_POOL_NUM:00000004
  +000018  POOL_LATCH_ADDR:25C54BFC      POOL_EXTENTS:00000002
  +000020  LAST_CELL:25C45F38      NEXT_CELL:25C45F38
  +000028  Q_CONTROL_INFO:0000095D       Q_FIRST_CELL:25C45DA0
  +000030  POOL_NUM_GET_TOTAL:000004B4   POOL_NUM_FREE:00000003
  +000038  POOL_EXTENTS_ANCHOR:25C45D98        POOL_INDEX_SAME_SIZE:01
  +00003D  POOL_INDEX_SIZE:03      POOL_NUM_SAME_SIZE:01
  +000040  POOL_TRACE_TABLE:25CB60A0
```

```
[2]Heap Pool Extent Mapping
  EXTENT:  25C45D98
  +000000  EYE_CATCHER:EX31  NEXT_EXTENT:25C43898
    To display entire pool extent: IP LIST 25C45D98 LEN(X'00000228') ASID(X'0020')
    25C45DA0: Free storage cell. To display: IP LIST 25C45DA0 LEN(X'00000088') ASID(X'0020')
    25C45E28: Free storage cell. To display: IP LIST 25C45E28 LEN(X'00000088') ASID(X'0020')
    25C45EB0: Free storage cell. To display: IP LIST 25C45EB0 LEN(X'00000088') ASID(X'0020')
  EXTENT:  25C43898
  +000000  EYE_CATCHER:EX31  NEXT_EXTENT:00000000
    To display entire pool extent: IP LIST 25C43898 LEN(X'00000228') ASID(X'0020')
    25C438A0: Allocated storage cell. To display: IP LIST 25C438A0 LEN(X'00000088') ASID(X'0020')
    25C438A8: C3C4D3D3 00000000 40000000 00000000 25C00000 25C016F8 25E37038 00004EC0|CDLL.... ........
{...{.8.T....+{|
    25C43928: Allocated storage cell. To display: IP LIST 25C43928 LEN(X'00000088') ASID(X'0020')
    25C43930: 00000000 25C1F8E0 20004000 00000000 25C43954 00000000 00000000
00000000|.....A8\.. ......D.............|
    25C439B0: Allocated storage cell. To display: IP LIST 25C439B0 LEN(X'00000088') ASID(X'0020')
    25C439B8: 00000000 25C1F8EC 20004000 00000000 25C439DC 00000000 00000000
00000000|.....A8... ......D.............|
    25C43A38: Allocated storage cell. To display: IP LIST 25C43A38 LEN(X'00000088') ASID(X'0020')
    25C43A40: 00000000 25C1BBD8 20004000 00000000 25C43A64 00000000 00000000
00000000|.....A.Q.. ......D.............|
  [1]Verifying free chain for pool: 3...
       No errors were found while processing free chain.
    Summary of analysis for Pool 3:
       Number of cells:  Unused:       1  Free:       3  Allocated:       4  Total Used:       8
       00000000 free cells were not accounted for.
       No errors were found while processing this Pool.

  Data for pool 4:
POOLDATA:  25C1F100
  +000000  POOL_INDEX:00000004     INPUT_CELL_SIZE:00000100
  +000008  CELL_SIZE:00000108      INPUT_PERCENT:00000001
  +000010  CELL_POOL_SIZE:00000420       CELL_POOL_NUM:00000004
  +000018  POOL_LATCH_ADDR:25C54C10      POOL_EXTENTS:00000001
  +000020  LAST_CELL:25C462E8      NEXT_CELL:25C461E0
```

```
  +000028  Q_CONTROL_INFO:0000063E       Q_FIRST_CELL:25C45FD0
  +000030  POOL_NUM_GET_TOTAL:00000320   POOL_NUM_FREE:00000002
  +000038  POOL_EXTENTS_ANCHOR:25C45FC8        POOL_INDEX_SAME_SIZE:01
  +00003D  POOL_INDEX_SIZE:04      POOL_NUM_SAME_SIZE:01
  +000040  POOL_TRACE_TABLE:25CE60C0
  [2]Heap Pool Extent Mapping
  EXTENT:  25C45FC8
  +000000  EYE_CATCHER:EX31  NEXT_EXTENT:00000000
    To display entire pool extent: IP LIST 25C45FC8 LEN(X'00000428') ASID(X'0020')
    25C45FD0: Free storage cell. To display: IP LIST 25C45FD0 LEN(X'00000108') ASID(X'0020')
    25C460D8: Free storage cell. To display: IP LIST 25C460D8 LEN(X'00000108') ASID(X'0020')
  [1]Verifying free chain for pool: 4...
       No errors were found while processing free chain.
    Summary of analysis for Pool 4:
       Number of cells:  Unused:       2  Free:       2  Allocated:       0  Total Used:       4
       00000000 free cells were not accounted for.
       No errors were found while processing this Pool.

  Data for pool 5.1:
POOLDATA:  25C1F200
  +000000  POOL_INDEX:00000005     INPUT_CELL_SIZE:00000400
  +000008  CELL_SIZE:00000408      INPUT_PERCENT:00000001
  +000010  CELL_POOL_SIZE:00001020       CELL_POOL_NUM:00000004
  +000018  POOL_LATCH_ADDR:25C54C24      POOL_EXTENTS:00000002
  +000020  LAST_CELL:25E48C48      NEXT_CELL:25E48438
  +000028  Q_CONTROL_INFO:000001DD       Q_FIRST_CELL:25C42858
  +000030  POOL_NUM_GET_TOTAL:000000F2   POOL_NUM_FREE:00000003
  +000038  POOL_EXTENTS_ANCHOR:25E48028        POOL_INDEX_SAME_SIZE:01
  +00003D  POOL_INDEX_SIZE:05      POOL_NUM_SAME_SIZE:05
  +000040  POOL_TRACE_TABLE:25D160E0
```

```
  [2]Heap Pool Extent Mapping
  EXTENT:  25E48028
  +000000  EYE_CATCHER:EX31  NEXT_EXTENT:25C42040
    To display entire pool extent: IP LIST 25E48028 LEN(X'00001028') ASID(X'0020')
    25E48030: Free storage cell. To display: IP LIST 25E48030 LEN(X'00000408') ASID(X'0020')
  EXTENT:  25C42040
  +000000  EYE_CATCHER:EX31  NEXT_EXTENT:00000000
    To display entire pool extent: IP LIST 25C42040 LEN(X'00001028') ASID(X'0020')
    25C42048: Allocated storage cell. To display: IP LIST 25C42048 LEN(X'00000408') ASID(X'0020')
    25C42050: 25C43070 25C43258 25C43295 25C432D2 25C4330F 25C4334C 25C43389
25C433C6|.D...D...D.n.D.K.D...D.<.D.i.D.F|
    25C42450: Allocated storage cell. To display: IP LIST 25C42450 LEN(X'00000408') ASID(X'0020')
    25C42458: 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000|................................|
    25C42858: Free storage cell. To display: IP LIST 25C42858 LEN(X'00000408') ASID(X'0020')
    25C42C60: Free storage cell. To display: IP LIST 25C42C60 LEN(X'00000408') ASID(X'0020')
  [1]Verifying free chain for pool: 5.1...
       No errors were found while processing free chain.
    Summary of analysis for Pool 5.1:
       Number of cells:  Unused:       3  Free:       3  Allocated:       2  Total Used:       8
       00000000 free cells were not accounted for.
       No errors were found while processing this Pool.

  Data for pool 5.2:
POOLDATA:  25C1F300
  +000000  POOL_INDEX:00000006     INPUT_CELL_SIZE:00000400
  +000008  CELL_SIZE:00000408      INPUT_PERCENT:00000001
  +000010  CELL_POOL_SIZE:00001020       CELL_POOL_NUM:00000004
  +000018  POOL_LATCH_ADDR:25C54C24      POOL_EXTENTS:00000001
  +000020  LAST_CELL:25C47018      NEXT_CELL:25C47018
  +000028  Q_CONTROL_INFO:000001DD       Q_FIRST_CELL:25C46400
  +000030  POOL_NUM_GET_TOTAL:000000F0   POOL_NUM_FREE:00000003
  +000038  POOL_EXTENTS_ANCHOR:25C463F8        POOL_INDEX_SAME_SIZE:02
  +00003D  POOL_INDEX_SIZE:05      POOL_NUM_SAME_SIZE:05
  +000040  POOL_TRACE_TABLE:25D46100
  [2]Heap Pool Extent Mapping
  EXTENT:  25C463F8
  +000000  EYE_CATCHER:EX31  NEXT_EXTENT:00000000
    To display entire pool extent: IP LIST 25C463F8 LEN(X'00001028') ASID(X'0020')
    25C46400: Free storage cell. To display: IP LIST 25C46400 LEN(X'00000408') ASID(X'0020')
    25C46808: Free storage cell. To display: IP LIST 25C46808 LEN(X'00000408') ASID(X'0020')
    25C46C10: Free storage cell. To display: IP LIST 25C46C10 LEN(X'00000408') ASID(X'0020')
  [1]Verifying free chain for pool: 5.2...
       No errors were found while processing free chain.
    Summary of analysis for Pool 5.2:
       Number of cells:  Unused:       1  Free:       3  Allocated:       0  Total Used:       4
       00000000 free cells were not accounted for.
       No errors were found while processing this Pool.

  Data for pool 5.3:
```

```
POOLDATA:  25C1F400
  +000000  POOL_INDEX:00000007     INPUT_CELL_SIZE:00000400
  +000008  CELL_SIZE:00000408      INPUT_PERCENT:00000001
  +000010  CELL_POOL_SIZE:00001020       CELL_POOL_NUM:00000004
  +000018  POOL_LATCH_ADDR:25C54C24      POOL_EXTENTS:00000001
  +000020  LAST_CELL:25E49C78      NEXT_CELL:25E49C78
  +000028  Q_CONTROL_INFO:000001DD       Q_FIRST_CELL:25E49060
  +000030  POOL_NUM_GET_TOTAL:000000F0   POOL_NUM_FREE:00000003
  +000038  POOL_EXTENTS_ANCHOR:25E49058        POOL_INDEX_SAME_SIZE:03
  +00003D  POOL_INDEX_SIZE:05      POOL_NUM_SAME_SIZE:05
  +000040  POOL_TRACE_TABLE:25D76120
  [2]Heap Pool Extent Mapping
  EXTENT:  25E49058
  +000000  EYE_CATCHER:EX31  NEXT_EXTENT:00000000
    To display entire pool extent: IP LIST 25E49058 LEN(X'00001028') ASID(X'0020')
    25E49060: Free storage cell. To display: IP LIST 25E49060 LEN(X'00000408') ASID(X'0020')
    25E49468: Free storage cell. To display: IP LIST 25E49468 LEN(X'00000408') ASID(X'0020')
    25E49870: Free storage cell. To display: IP LIST 25E49870 LEN(X'00000408') ASID(X'0020')
  [1]Verifying free chain for pool: 5.3...
       No errors were found while processing free chain.
    Summary of analysis for Pool 5.3:
       Number of cells:  Unused:       1  Free:       3  Allocated:       0  Total Used:       4
       00000000 free cells were not accounted for.
       No errors were found while processing this Pool.
```

```
  Data for pool 5.4:
POOLDATA:  25C1F500
  +000000  POOL_INDEX:00000008     INPUT_CELL_SIZE:00000400
  +000008  CELL_SIZE:00000408      INPUT_PERCENT:00000001
  +000010  CELL_POOL_SIZE:00001020       CELL_POOL_NUM:00000004
  +000018  POOL_LATCH_ADDR:25C54C24      POOL_EXTENTS:00000001
  +000020  LAST_CELL:25C48048      NEXT_CELL:25C48048
  +000028  Q_CONTROL_INFO:000001DD       Q_FIRST_CELL:25C47430
  +000030  POOL_NUM_GET_TOTAL:000000F0   POOL_NUM_FREE:00000003
  +000038  POOL_EXTENTS_ANCHOR:25C47428        POOL_INDEX_SAME_SIZE:04
  +00003D  POOL_INDEX_SIZE:05      POOL_NUM_SAME_SIZE:05
  +000040  POOL_TRACE_TABLE:25DA6140
  [2]Heap Pool Extent Mapping
  EXTENT:  25C47428
  +000000  EYE_CATCHER:EX31  NEXT_EXTENT:00000000
    To display entire pool extent: IP LIST 25C47428 LEN(X'00001028') ASID(X'0020')
    25C47430: Free storage cell. To display: IP LIST 25C47430 LEN(X'00000408') ASID(X'0020')
    25C47838: Free storage cell. To display: IP LIST 25C47838 LEN(X'00000408') ASID(X'0020')
    25C47C40: Free storage cell. To display: IP LIST 25C47C40 LEN(X'00000408') ASID(X'0020')
  [1]Verifying free chain for pool: 5.4...
       No errors were found while processing free chain.
    Summary of analysis for Pool 5.4:
       Number of cells:  Unused:       1  Free:       3  Allocated:       0  Total Used:       4
       00000000 free cells were not accounted for.
       No errors were found while processing this Pool.

  Data for pool 5.5:
POOLDATA:  25C1F600
  +000000  POOL_INDEX:00000009     INPUT_CELL_SIZE:00000400
  +000008  CELL_SIZE:00000408      INPUT_PERCENT:00000001
  +000010  CELL_POOL_SIZE:00001020       CELL_POOL_NUM:00000004
  +000018  POOL_LATCH_ADDR:25C54C24      POOL_EXTENTS:00000001
  +000020  LAST_CELL:25C49078      NEXT_CELL:25C49078
  +000028  Q_CONTROL_INFO:000001DD       Q_FIRST_CELL:25C48460
  +000030  POOL_NUM_GET_TOTAL:000000F0   POOL_NUM_FREE:00000003
  +000038  POOL_EXTENTS_ANCHOR:25C48458        POOL_INDEX_SAME_SIZE:05
  +00003D  POOL_INDEX_SIZE:05      POOL_NUM_SAME_SIZE:05
  +000040  POOL_TRACE_TABLE:25DD6160
  [2]Heap Pool Extent Mapping
  EXTENT:  25C48458
  +000000  EYE_CATCHER:EX31  NEXT_EXTENT:00000000
    To display entire pool extent: IP LIST 25C48458 LEN(X'00001028') ASID(X'0020')
    25C48460: Free storage cell. To display: IP LIST 25C48460 LEN(X'00000408') ASID(X'0020')
    25C48868: Free storage cell. To display: IP LIST 25C48868 LEN(X'00000408') ASID(X'0020')
    25C48C70: Free storage cell. To display: IP LIST 25C48C70 LEN(X'00000408') ASID(X'0020')
  [1]Verifying free chain for pool: 5.5...
       No errors were found while processing free chain.
    Summary of analysis for Pool 5.5:
       Number of cells:  Unused:       1  Free:       3  Allocated:       0  Total Used:       4
       00000000 free cells were not accounted for.
       No errors were found while processing this Pool.

  Data for pool 6:
POOLDATA:  25C1F700
  +000000  POOL_INDEX:0000000A     INPUT_CELL_SIZE:00000800
```

```
  +000008  CELL_SIZE:00000808      INPUT_PERCENT:00000001
  +000010  CELL_POOL_SIZE:00002020       CELL_POOL_NUM:00000004
  +000018  POOL_LATCH_ADDR:25C54C38      POOL_EXTENTS:00000001
  +000020  LAST_CELL:25C452E8      NEXT_CELL:25C452E8
  +000028  Q_CONTROL_INFO:0000063E       Q_FIRST_CELL:25C442D8
  +000030  POOL_NUM_GET_TOTAL:00000321   POOL_NUM_FREE:00000002
  +000038  POOL_EXTENTS_ANCHOR:25C43AC8        POOL_INDEX_SAME_SIZE:01
  +00003D  POOL_INDEX_SIZE:06      POOL_NUM_SAME_SIZE:01
  +000040  POOL_TRACE_TABLE:25E06180
  [2]Heap Pool Extent Mapping
  EXTENT:  25C43AC8
  +000000  EYE_CATCHER:EX31  NEXT_EXTENT:00000000
    To display entire pool extent: IP LIST 25C43AC8 LEN(X'00002028') ASID(X'0020')
    25C43AD0: Allocated storage cell. To display: IP LIST 25C43AD0 LEN(X'00000808') ASID(X'0020')
    25C43AD8: 00000000 25C1F884 60004000 00000000 25C43AFC 00000000 00000000
00000000|.....A8d-. ......D.............|
    25C442D8: Free storage cell. To display: IP LIST 25C442D8 LEN(X'00000808') ASID(X'0020')
    25C44AE0: Free storage cell. To display: IP LIST 25C44AE0 LEN(X'00000808') ASID(X'0020')
  [1]Verifying free chain for pool: 6...
       No errors were found while processing free chain.
    Summary of analysis for Pool 6:
       Number of cells:  Unused:       1  Free:       2  Allocated:       1  Total Used:       4
       00000000 free cells were not accounted for.
       No errors were found while processing this Pool.
```

Heap pools report sections of the LEDATA output

The heap pools report provides information about the following items:

- Each cell pool.
- The free chain associated with every qpcb pool data area, and all the free and allocated cells in the extent chain.
- Errors found when the cells are validated.

Table 23. Contents of heap pools report sections of LEDATA output

Section Number and Heading	Contents
[1] Free Chain Validation	Within each cell pool, Language Environment keeps track of unallocated cells by chaining them together. The LEDATA HEAP option validates the free chain within each cell pool. It verifies that the cell pointer is within a valid extent and that the cell pool number is valid. If the formatter finds a problem, it will place an error message describing the problem directly after the formatted line of the cell that failed validation.
[2] Heap Pool Extent Mapping Report	The LEDATA HEAP option produces a report that lists all of the cells within each pool extent, and identifies the cells as either allocated or freed. For each allocated cell, the contents of the first X'20' bytes of the area are displayed to identify the reason for the storage allocation. The formatter validates if cell pool number in header is correct.

Understanding the heap pools trace LEDATA output

The Language Environment IPCS VERBEXIT LEDATA generates a detailed heap pools trace report when the HPT option is used. The argument *value* is the ID of the pool to be formatted in the report. Table 24 on page 117 describes the contents of the report.

```
    HPT(3)
    ******************************************************************************
                         LANGUAGE ENVIRONMENT DATA
    ******************************************************************************

    Language Environment Product 04 V01 R10.00

[1] HEAPPOOLS Trace Table

[2] POOLID: 3  ASID: 0024  AVAILABLE ENTRIES: 12 OF 12

[3] Timestamp: 2008/03/14          14:10:22.614088
    Type: FREE  Cell Address: 25E91AC0  Cpuid: 01  Tcb: 008AFCF0
[4] CALL NAME                         CALL ADDRESS       CALL OFFSET
    GetStorage::~GetStorage()         25E53360           00000088
    foo8()                            25E53598           000000B6
```

```
foo7()                              25E53678           0000005A
foo6()                              25E536F0           0000005A
foo5()                              25E53768           0000005A
foo4()                              25E537E0           0000005A
foo3()                              25E53858           0000005A
foo2()                              25E538D0           0000005A
foo1()                              25E53948           0000005A
thread                              25E53A50           00000000
```

```
Timestamp: 2008/03/14           14:10:22.614087
Type: FREE  Cell Address: 25E91B48  Cpuid: 01  Tcb: 008AFCF0
CALL NAME                           CALL ADDRESS       CALL OFFSET
GetStorage::~GetStorage()           25E53360           00000088
foo9()                              25E53430           000000B6
foo8()                              25E53598           0000009A
foo7()                              25E53678           0000005A
foo6()                              25E536F0           0000005A
foo5()                              25E53768           0000005A
foo4()                              25E537E0           0000005A
foo3()                              25E53858           0000005A
foo2()                              25E538D0           0000005A
foo1()                              25E53948           00000000

Timestamp: 2008/03/14           14:10:22.614034
Type: FREE  Cell Address: 25E91BD0  Cpuid: 01  Tcb: 008AFA60
CALL NAME                           CALL ADDRESS       CALL OFFSET
GetStorage::~GetStorage()           25E53360           00000088
foo8()                              25E53598           000000B6
foo7()                              25E53678           0000005A
foo6()                              25E536F0           0000005A
foo5()                              25E53768           0000005A
foo4()                              25E537E0           0000005A
foo3()                              25E53858           0000005A
foo2()                              25E538D0           0000005A
foo1()                              25E53948           0000005A
thread                              25E53A50           00000000

Timestamp: 2008/03/14           14:10:22.614032
Type: FREE  Cell Address: 25E91C58  Cpuid: 01  Tcb: 008AFA60
CALL NAME                           CALL ADDRESS       CALL OFFSET
GetStorage::~GetStorage()           25E53360           00000088
foo9()                              25E53430           000000B6
foo8()                              25E53598           0000009A
foo7()                              25E53678           0000005A
foo6()                              25E536F0           0000005A
foo5()                              25E53768           0000005A
foo4()                              25E537E0           0000005A
foo3()                              25E53858           0000005A
foo2()                              25E538D0           0000005A
foo1()                              25E53948           00000000

Timestamp: 2008/03/14           14:10:22.614030
Type: GET   Cell Address: 25E91C58  Cpuid: 01  Tcb: 008AFA60
CALL NAME                           CALL ADDRESS       CALL OFFSET
GetStorage::GetStorage(int)         25E53298           0000008C
foo9()                              25E53430           00000086
foo8()                              25E53598           0000009A
foo7()                              25E53678           0000005A
foo6()                              25E536F0           0000005A
foo5()                              25E53768           0000005A
foo4()                              25E537E0           0000005A
foo3()                              25E53858           0000005A
foo2()                              25E538D0           0000005A
foo1()                              25E53948           00000000
```

```
Timestamp: 2008/03/14           14:10:22.614029
Type: GET   Cell Address: 25E91BD0  Cpuid: 01  Tcb: 008AFA60
CALL NAME                           CALL ADDRESS       CALL OFFSET
GetStorage::GetStorage(int)         25E53298           0000008C
foo8()                              25E53598           00000086
foo7()                              25E53678           0000005A
foo6()                              25E536F0           0000005A
foo5()                              25E53768           0000005A
foo4()                              25E537E0           0000005A
foo3()                              25E53858           0000005A
foo2()                              25E538D0           0000005A
foo1()                              25E53948           0000005A
thread                              25E53A50           00000000
```

```
      Timestamp: 2008/03/14           14:10:22.612412
      Type: GET   Cell Address: 25E91B48  Cpuid: 01  Tcb: 008AFCF0
      CALL NAME                           CALL ADDRESS       CALL OFFSET
      GetStorage::GetStorage(int)         25E53298           0000008C
      foo9()                              25E53430           00000086
      foo8()                              25E53598           0000009A
      foo7()                              25E53678           0000005A
      foo6()                              25E536F0           0000005A
      foo5()                              25E53768           0000005A
      foo4()                              25E537E0           0000005A
      foo3()                              25E53858           0000005A
      foo2()                              25E538D0           0000005A
      foo1()                              25E53948           00000000

      Timestamp: 2008/03/14           14:10:22.612410
      Type: GET   Cell Address: 25E91AC0  Cpuid: 01  Tcb: 008AFCF0
      CALL NAME                           CALL ADDRESS       CALL OFFSET
      GetStorage::GetStorage(int)         25E53298           0000008C
      foo8()                              25E53598           00000086
      foo7()                              25E53678           0000005A
      foo6()                              25E536F0           0000005A
      foo5()                              25E53768           0000005A
      foo4()                              25E537E0           0000005A
      foo3()                              25E53858           0000005A
      foo2()                              25E538D0           0000005A
      foo1()                              25E53948           0000005A
      thread                              25E53A50           00000000

      Timestamp: 2008/03/14           14:10:22.593976
      Type: GET   Cell Address: 25E91A38  Cpuid: 01  Tcb: 008AFE88
      CALL NAME                           CALL ADDRESS       CALL OFFSET
      CEEOPMI                             0601F218           00000822
      CEEOPC                              0600C2C8           00000CEE
      pthread_create                      0658FE40           00000632
      main                                25E53B00           000000EE
      EDCZMINV                            064C2106
 00000000
```

```
      Timestamp: 2008/03/14           14:10:22.557633
      Type: GET   Cell Address: 25E919B0  Cpuid: 01  Tcb: 008AFE88
      CALL NAME                           CALL ADDRESS       CALL OFFSET
      CEEOPMI                             0601F218           00000822
      pthread_mutex_init                  06428B90           00000094
      pthread_create                      0658FE40           000002FC
      main                                25E53B00           000000EE
      EDCZMINV                            064C2106           00000000

      Timestamp: 2008/03/14           14:10:22.551547
      Type: GET   Cell Address: 25E91928  Cpuid: 01  Tcb: 008AFE88
      CALL NAME                           CALL ADDRESS       CALL OFFSET
      CEEOPMI                             0601F218           00000822
      pthread_mutex_init                  06428B90           00000094
      pthread_create                      0658FE40           0000026C
      main                                25E53B00           000000EE
      EDCZMINV                            064C2106           00000000

      Timestamp: 2008/03/14           14:10:22.544328
      Type: GET   Cell Address: 25E918A0  Cpuid: 01  Tcb: 008AFE88
      CALL NAME                           CALL ADDRESS       CALL OFFSET
      dllinit                             0622FBF8           0000009E
      CEEZIDT                             060C4B08           00000000
      Exiting Language Environment Data
```

Table 24. Contents of heap pools trace section of LEDATA output

Section number and heading	Contents
[1] Trace Header	HEAPPOOLS trace header information.
[2] Pool Information	Information includes the number of the pool (POOLID) that is currently being formatted, the ASID, and the number of entries formatted and the total number of entries taken. **Note:** The trace wraps for each poolid after a specific number of entries. The number of entries is controlled by the HEAPCHK runtime option.
[3] Timestamp	The time this trace entry was taken. The trace entries are formatted in reverse order (most recent trace entry first).

Table 24. Contents of heap pools trace section of LEDATA output (continued)

Section number and heading	Contents
[4] Trace Table Entry contents	The individual trace entry: • The TYPE - GET or FREE. • The Cell within the pool being acted upon. • The CPU and TCB which requested or freed the cell. • A traceback at the time of the request. The number of entries in this traceback is limited by the HEAPCHK runtime option.

Understanding the C/C++-specific LEDATA output

The Language Environment IPCS VERBEXIT LEDATA generates formatted output of C/C++-specific control blocks from a system dump when the COMP(C), COMP(ALL), or ALL parameter is specified and C/C++ is active in the dump. The following example illustrates the C/C++-specific output produced. Figure 8 on page 41 and Table 25 on page 136 describe the information contained in the formatted output. Ellipses are used to summarize some sections of the dump. For easy reference, the sections of the dump are numbered to correspond with the description of each section that follows.

```
********************************************************************************
                              CRTL ENVIRONMENT DATA
********************************************************************************
[1]CGEN:  20C13A10
   +00007C  OS_SPCTYPE:00000000     CGENE:20C10B90    CRENT:20C14FF8
   +0001F8  CFLTINIT:4E000000 00000000    CPRMS:20C127A8    TRACE:00000000
   +000208  CTHD:20C0E8A0      CURR_FECB:20C101D8       CEDCXV:A0DF66D8
   +000214  CGEN_CPCB:20C0DEA8       CGEN_CEDB:20C0F938      CFLG3:00
   +000220  CIO:20C0E098       FDSETFD:00000000         FCB_MUTEXOK:0000
   +00022C  T_C16:00000000     T_C17:00000000    CEDCOV:2117A9A8
   +000238  CTOFSV:00000000    TRTSPACE:20C0EE50

[2]CGENE:  20C10B90
   +000000  CGENEYE:GENE       CGENESIZE:000006E0       CGENEPTR:20C10B90
   +0000D0  CERRNO:00000000    TEMPLONG:00000000        AMRC:20C0E770
   +000104  STDINFILE:20C0F718       STDOUTFILE:20C0F2D8
   +00010C  STDERRFILE:20C0F4F8      CTYPE:21035412    LC_CTYPE:21035412
   +000124  LC_CHARMAP:21035F00
   +000500  MIN_FLT:00100000 00000000 00000000 00000000
   +000510  MAX_FLT:7FFFFFFF FFFFFFFF 71FFFFFF FFFFFFFF
   +000520  FLT_EPS:3C100000         DBL_EPS:34100000 00000000
   +000530  LDBL_EPS:26100000 00000000 18000000 00000000
   +000544  IMSPCBLIST:20C145A4      ADDRTBL:20C0EC28
   +0006D4  ABND_CODE:00000000       RSN_CODE:00000000
[3]CEDB:  20C0F938
   +000000  EYE:CEDB    SIZE:000007C0     PTR:20C0F938      CLLST:20C00568
   +000010  CEELANG:0003       CASWITCH:0000      CLWA:20C11270
   +000018  CALTLWA:20C115C0        CCADDR:20C00A10    CFLGS:00000080
   +000024  CEESTART:20C00000       CANCHOR:00000000        RPLLEN:00000000
   +000030  ACBLEN:00000000    LC:20C10100        VALID_HIGH:210306C0
   +00003C  _LOW:2102FBE8      HEAD_FECB:00000000       ATEXIT_COUNT:00000000
   +000048  _EMPTY_COUNT:20C0FA10   MAINPRMS:2132D768
   +000050  STDINFILE:20C0F718       STDOUTFILE:20C0F2D8
   +000058  STDERRFILE:20C0F4F8      CTYPE:21035412    TZDFLT:00003840
   +000064  CINFO:20C10190     CMS_WRITE_DISK:4040      _DISK_SET:00000000
   +000070  MIN_FLT:00100000 00000000 00000000 00000000
   +000080  MAX_FLT:7FFFFFFF FFFFFFFF 71FFFFFF FFFFFFFF
   +000090  FLT_EPS:3C100000         DBL_EPS:34100000 00000000
   +0000A0  LDBL_EPS:26100000 00000000 18000000 00000000    FLAGS1:02080000
   +0000B4  MTF_MAINTASK_BLK:00000000     EMSG_SETTING:00   DEPTH:00000000
   +0000C0  SCREEN_WIDTH:00000000   USERID:CHARUM .
   +0000CC  HEAP24_ANCHOR:00000000        TCIC:00000000     TKCLI:00000000
   +0000D8  ATEXIT_FUNCS01:20C0FA24 00000000 00000000 00000000 00000000
   +0000EC  ATEXIT_FUNCS02:20C0FA38 00000000 00000000 00000000 00000000
   +000100  ATEXIT_FUNCS03:20C0FA4C 00000000 00000000 00000000 00000000
   +000114  ATEXIT_FUNCS04:20C0FA60 00000000 00000000 00000000 00000000
   +000128  ATEXIT_FUNCS05:20C0FA74 00000000 00000000 00000000 00000000
   +00013C  ATEXIT_FUNCS06:20C0FA88 00000000 00000000 00000000 00000000
   +000150  ATEXIT_FUNCS07:20C0FA9C 00000000 00000000 00000000 00000000
   +000164  ATEXIT_FUNCS08:20C0FAB0 00000000 00000000 00000000 00000000
   +000178  ATEXIT_FUNCS09:20C0FAC4 00000000 00000000 00000000 00000000
   +00018C  ATEXIT_FUNCS10:20C0FAD8 00000000 00000000 00000000 00000000
```

```
   +0001A0  ATEXIT_FUNCS11:20C0FAEC 00000000 00000000 00000000 00000000
   +0001B4  ATEXIT_FUNCS12:20C0FB00 00000000 00000000 00000000 00000000
   +0001C8  ATEXIT_FUNCS13:20C0FB14 00000000 00000000 00000000 00000000
   +0001DC  ATEXIT_FUNCS14:20C0FB28 00000000 00000000 00000000 00000000
   +0001F0  ATEXIT_FUNCS15:20C0FB3C 00000000 00000000 00000000 00000000
   +000204  ATEXIT_FUNCS16:20C0FB50 00000000 00000000 00000000 00000000
   +000218  ATEXIT_FUNCS17:20C0FB64 00000000 00000000 00000000 00000000
   +00022C  ATEXIT_FUNCS18:20C0FB78 00000000 00000000 00000000 00000000
   +000240  ATEXIT_FUNCS19:20C0FB8C 00000000 00000000 00000000 00000000
   +000254  ATEXIT_FUNCS20:20C0FBA0 00000000 00000000 00000000 00000000
   +000268  ATEXIT_FUNCS21:20C0FBB4 00000000 00000000 00000000 00000000
   +00027C  ATEXIT_FUNCS22:20C0FBC8 00000000 00000000 00000000 00000000
   +000290  ATEXIT_FUNCS23:20C0FBDC 00000000 00000000 00000000 00000000
   +0002A4  ATEXIT_FUNCS24:20C0FBF0 00000000 00000000 00000000 00000000
   +0002B8  ATEXIT_FUNCS25:20C0FC04 00000000 00000000 00000000 00000000
   +0002CC  ATEXIT_FUNCS26:20C0FC18 00000000 00000000 00000000 00000000
```

```
   +0002E0  ATEXIT_FUNCS27:20C0FC2C 00000000 00000000 00000000 00000000
   +0002F4  ATEXIT_FUNCS28:20C0FC40 00000000 00000000 00000000 00000000
   +000308  ATEXIT_FUNCS29:20C0FC54 00000000 00000000 00000000 00000000
   +00031C  ATEXIT_FUNCS30:20C0FC68 00000000 00000000 00000000 00000000
   +000330  ATEXIT_FUNCS31:20C0FC7C 00000000 00000000 00000000 00000000
   +000344  ATEXIT_FUNCS32:00000000 00000000 00000000 00000000 00000000
   +000358  HEAD_FOREIGN_FECB:00000000    SNAP_DUMP_COUNT:00000000
   +000360  ENVIRON:00000000        GETENV_BUF:00000000
   +000368  _BUF_LEN:00000000       CDLL:21351CE0
   +000370  INSPECT_GLOBALS:00000000      _JMP_BUFF:00000000
   +000378  _BACK_END:00000000      _FLAGS:00000000   _TAB:00000000
   +000384  INTOFFLIST:00000000     CGEN_CRENT:20C14FF8     _CPRMS:20C127A8
   +000390  _CEDCXV:A0DF66D8        _CEDCOV:2117A9A8
   +000398  _EPCBLIST:00000000      CAA_ADDR:20C13A10
   +0003A0  CDLL_PENDING:00000000   USERIDLENGTH:00000006
   +0003A8  TZSHR_1:20C102B8        TZSHR_2:20C102BC
   +0003B0  MAXUNGETCOUNT:0004      DLL_DIAG_FLAG:04  RWSTATIC:20C14FF8
   +0003B8  RWLEN:00000008    CSGDLLI:00000000        DLLISIZE:00000000
   +0003C4  IOGET_ANY:213244E8      _BELOW:213240B8   IOFREE_ANY:21323D80
   +0003D0  _BELOW:21323A48   CSGSTINIT:00000000      STINITSIZE:00000000
   +0003DC  MTFMAINTASKBLK:00000000       SIGTABLE:20C103B8
   +0003E4  INIT_STDIN:20C0F718     _STDOUT:20C0F2D8
   +0003EC  _STDERR:20C0F4F8        TABNUM:00000008   FLAGS2:00000000
   +000400  OPENMVS_FLAGS:00  MRPSTDR:2100AA80        MWPSTDR:2100A8A8
   +00040C  MRPSTDC:21009EE0        MWPSTDC:21009D08        OWRP1:00000000
   +000418  OWRP3:00000000    STATIC_EDCOV:00000000   GETENV_BUF2:00000000
   +000424  _BUF2_LEN:00000000      DLCB_MUTEX:00000000     _CONDV:00000000
   +000430  EDCOV:00000000    LCX:20C102B8      MUTEX_ATTR:00000000
   +00043C  STOR_INIT_B:00001000    _INCR_B:00001000
   +000444  STOR_INIT:00003000      _INCR:00002000    DEMANGLE:00000000
   +000454  TEMPR15:00000000        TERMINATE:210FC578
   +00045C  CXX_INV:00000000        D4_JOIN_MUTEX_ATTR:00000000
   +000468  _MUTEX:00000000   _CONDV_ATTR:00000000    _CONDV:00000000
   +000474  DLLANCHOR:00000000      DLLLAST:00000000        MEM24P:20C145A8
   +000480  RTLMUTEX_ARRAYPTR:00000000    MSGCATLIST:00000000
   +000488  SRCHP:00000000    ETOAP:00000000    ATOEP:00000000
   +000494  NDMGMTP:00000000        POPENP:00000000   RND48P:00000000
   +0004A0  BRK_HEAPID:00000000     _START:00000000   _CURRENT:00000000
   +0004AC  _END:00000000     RESTARTTABLE:00000000   SYSLOGP:00000000
   +0004BC  LOGIN_NAME:.........    PREV_UMASK_VAL:00000000
   +0004D0  HFP_LDBL_LMS:00100000 00000000 00000000 00000000 7FFFFFFF FFFFFFFF 71FFFFFF FFFFFFFF 26
   +000500  BFP_LDBL_LMS:00010000 00000000 00000000 00000000 7FFEFFFF FFFFFFFF FFFFFFFF FFFFFFFF 3F
   +000590  HFP_DBL_LMS:00100000 00000000 7FFFFFFF FFFFFFFF 34100000 00000000
   +0005A8  BFP_DBL_LMS:00100000 00000000 7FEFFFFF FFFFFFFF 3CB00000 00000000 7FF00000 00000000 FF
   +0005F0  HFP_MHDC:412B7E15 1628AED3 41171547 652B82FE 406F2DEC 549B9439 40B17217 F7D1CF7A 41
   +000660  BFP_MHDC:4005BF0A 8B145769 3FF71547 652B82FE 3FDBCB7B 1526E50E 3FE62E42 FEFA39EF 40
   +0006D0  HFP_FLT_LMS:00100000 7FFFFFFF 3C100000
   +0006DC  BFP_FLT_LMS:00800000 7F7FFFFF 34000000 7F800000 FF800000 7FA00000 FFA00000 7FC00000 FF
   +000700  HFP_FHDC:00000010 0006000E 001C0006 000F0020 FFC0FFC0 FFC0FFB2 FFB2FFB2 003F003F 00
   +000728  BFP_FHDC:00010002 00180035 00710006 000F0021 FF83FC03 C003FFDB FECDECBD 00800400 40
   +000750  ASCII_CCSID:0333  EBCDIC_CCSID:0417       LOGIN_NAME_A:.........
   +000760  CINFO_A:00000000        LC_C:20C108B0     _A:00000000
   +00076C  LCX_A:00000000    CORRESTABLE:00000000
   +000774  TZSHR_A:00000000 00000000     CGENVEC31:20EA8500
   +000780  CEDBVEC31:00000000      FORKQ_HEAD:00000000
   +000788  FORKQ_TAIL:00000000     PTHREAD_YIELD1:0001D100
   +000790  PTHREAD_YIELD2:00002E80       ICONV_MODE:U      _TECH:LMREC....
   +00079E  _USERSET:D
 [4]CTHD:  20C0E8A0
   +000000  CTHDEYE:CTHD      SIZE:00000380     CTHDPTR:20C0E8A0
   +00000C  STORPTR:00000000        TOKPTR:2102F210
   +000014  ASCTIME_RESULT:..........................
   +00002E  SNAP_DUMP_FLAG:00       GMTIME_BKDN:20C0EE28
   +000034  TIMECALLED:00000000     DATECALLED:00000000
```

```
    +00003C  DTCALLED:00000000       LOC_CALLED:00000000
    +000044  DOFMTO_DISCARDS:00000000      CERRNO:00000031   AMRC:20C0E770
    +000050  AMRC2:20C0E878    GDATE:00000000    OPTARGV:00000000
```

```
    +00005C  OPTERRV:00000001        OPTINDV:00000001
    +000064  OPTOPTV:00000000        OPTSIND:00000000        DLGHTV:00000000
    +000070  TZONEV:00000000   GTDTERRV:00000000       OPTARGP:20C0E8F8
    +00007C  OPTERRP:20C0E8FC        OPTINDP:20C0E900
    +000084  OPTOPTP:20C0E904        DLGHTP:20C0E90C   TZONEP:20C0E910
    +000090  GTDTERRP:20C0E914       RNDSTGP:00000000
    +000098  LOCNAME:00000000        ENCRYPTP:00000000       CRYPTP:00000000
    +0000A4  RND48P:00000000   L64AP:00000000    WCSTOKP:00000000
    +0000B0  CUSERP:00000000   GPASSP:00000000   UTMPXP:00000000
    +0000BC  NDMGMTP:00000000        RECOMP:00000000   STACKPTR:00000000
    +0000C8  STACKSIZE:00000000      STACKFLAGS:40     THREAD_CHARMODE:E
    +0000D0  MCVTP:00000000    H_ERRNO:00000000        SD:FFFFFFFF
    +0000DC  HOSTENT_DATA_P:00000000       HOSTENT_P:00000000
    +0000E4  NETENT_DATA_P:00000000        NETENT_P:00000000
    +0000EC  PROTOENT_DATA_P:00000000      PROTOENT_P:00000000
    +0000F4  SERVENT_DATA_P:00000000       SERVENT_P:00000000
    +0000FC  NTOA_BUF:..................   __LOC1V:00000000
    +000114  LOCS_V:00000000   HERRNOP:20C0E9B0        __LOC1P:00000000
    +000120  REXECP:00000000   CXXEXCEPTION:20C0E560   TEMPDCBE:00000000
    +00012C  T_ERRNOV:20C0E9CC       T_ERRNOP:20C0E9E0       LOC1_P:20C0E9E4
    +000138  LOC2_P:20C0E9B4   LOCS_P:00000000   LOC1_V:00000000
    +000144  LOC2_V:00000000   THD_STORAGE:00000000    CONTEXT_LINK:00000000
    +000150  FLAGS1:20C0EF50   LABEL_VAR:00000000      ABND_CODE:00000000
    +00015C  RSN_CODE:00000000       STRFTIME_ERADTCALLED:00000000
    +000164  STRFTIME_ERADATECALLED:00000000
    +000168  STRFTIME_ERATIMECALLED:00000000
    +00016C  STRFTIME_ERAYEARCALLED:00000000     MBRLEN_STATE:0000
    +000172  MBRTOWC_STATE:0000      WCRTOMB_STATE:0000
    +000176  MBSRTOWCS_STATE:0000    WCSRTOMBS_STATE:0000    MBLEN_STATE:F0F0
    +00017C  MBTOWC_STATE:0000       SBCS:.      CPTYPE:.
    +000180  CURR_HEAP_ID:00000000   CURR_CAA:00000000
    +000188  CURR_MOD_HANDLE:00000000      CURR_BMR:00000000
    +000190  CU_LIST:00024040        CURR_STATUS:00    CURR_CASE:00
    +000198  RAND_NEXT:20C0E2D8      STRERRORBUF:00000000
    +0001A0  TMPAREA:20C0E638        IOWORKAREA:00012088
    +0001A8  TEMPDCB:000120E8        TEMPJFCB:20C0E598
    +0001B0  TEMPDSCB:00000000       NAMEBUF:C00B0641
    +0001B8  ERRNO_JR:00000000       RET_STRUCT:00000000
    +0001C0  BKDN_IS_LOCALTIME:00008000    SWPRINTF_SIZE:00000000
    +0001C8  SWPRINTF_BUF:20C0E540   S99P:20C0F1A8     MUTEXCTARRAY:00000000
    +0001D4  STRFTIME_ERANAMECALLED:00000000     HPJRTL_1:00000000
    +0001DC  HPJRTL_2:00000000       HPJRTL_3:00000000
    +0001E4  HPJRTL_4:00000000       HPJRTL_5:00000000
    +0001EC  HPJRTL_6:00000000       HPJRTL_7:00000000
    +0001F4  HPJRTL_8:00000000       DLL_LOADLEVEL:00000000
    +0002FC  DLL_CONSTLIST:00000000        FCB_MUTEX:20C0E280
    +000204  HSPABHWA:20C0F204       MUTEX_SAVE:00012198
    +00020C  IO24WORKAREA:4D000000   INITIAL_CPU_TIME:0000F603 00000001
    +000218  FCB_MUTEX_OK:00000000   FCB_MUTEX_SAVE:00000000
    +000220  ENTRY_ADDRTABLESIZE:00000000        ADDRESS:00000000
    +000228  NUMBEROFNAMES:00000000        NAMES1:.........................
    +000245  NAMES2:.........................
    +00025E  NAMES3:.........................
    +000277  NAMES4:.........................
    +000290  NAMES5:.........................
    +0002A9  NAMES6:.........................
    +0002C4  ENTRY_SITETABLESIZE:00000000        KIND:00
    +0002CC  NUM_ADDRS:00000000      ADDRESSES_1:00000000
    +0002D4  ADDRESSES_2:00000000    ADDRESSES_3:00000000
    +0002DC  ADDRESSES_4:00000000    ADDRESSES_5:00000000
    +0002E4  ADDRESSES_6:00000000    NAME:.....................{U.
    +000300  T_STRERRORBUF:00000000        THD_OURFDSET:00000000
    +000308  IEEECWAP:00000000       FPC_SAVEAREA_TRAP:00
    +00030D  FPC_SAVEAREA_XCP:00     FPC_SAVEAREA_DXC:00
    +00030F  FPC_SAVEAREA_RMODE:00   LAST_YIELD_1:00000000
    +000314  LAST_YIELD_2:00000000   YIELD_COUNT:00000000
    +00031C  RETVAL_P:00000000       CTHD_SETENV_FB:............
    +000334  LIBASCIIWAP:00000000    SETLOCALE_ACALLED:00
    +00033A  ASCIINAMEBUFL:0000      ASCIINAMEBUF:00000000
    +000348  LOCNAME_A:00000000      EBCDICENTRY:00000000
```

```
    +000350  ASCIIENTRY:00000000     CTHD_NASCIIWAP:00000000
    +000358  CTHD_PROCRESP:00000000        CTHD_OPTN_P:00000000
    +000360  CTHD_GAI_STRERROR_P:00000000
    +000364  CTHD_CKPATHDD_PARMS:00000000
    +000370  LAST_YIELD_EX:00000000 00000000 00000000 00000000
```

```
[5]CPCB:  20C0DEA8
   +000000  CPCB_EYE:CPCB     CPCB_SIZE:00000080      CPCB_PTR:00000000
   +00000C  FLAGS1:40000000   TTKNHDR:00000000        TTKN:00000000
   +000018  FOOTPRINT:20C0F938      CODE370:00000000        CIO:20C0E098
   +000024  _Reuse:00000000   _RSAbove:20C0DEA8       _RSAbovelen:00003FF0
   +000030  _RSBelow:20C145A0       _RSBelowlen:00000010
[6]CIO:  20C0E098
   +000000  EYE:CIO     SIZE:00000090     PTR:00000000      FLG1:09
   +00000D  FLG2:E0     FLG3:00     FLG4:00     DUMMYF:20C0E128
   +000014  EDCZ24:00000000   FCBSTART:2135A040       DUMMYFCB:20C0E148
   +000020  MFCBSTART:2135A470      IOANYLIST:2135A000
   +000028  IOBELOWLIST:00014000    FCBDDLIST:00000000
   +000030  PERRORBUF:20C0DF60      TMPCOUNTER:00000000
   +000038  TEMPMEM:00000000        PROMPTBUF:00000000      IO24:000122D0
   +000044  IOEXITS:000127C8        TERMINALCHAIN:00000000
   +00004C  VANCHOR:00000000        XTI:00000000      ENOWP24:20F484A0
   +000058  MAXNUMDESCRPS:00000000        DESCARRAY:00000000
   +000064  TEMPFILENUM:00000000    CSS:00000000      DUMMY_NAME:........
   +000074  HOSTNAME_CACHE:00000000       HOSTADDR_CACHE:00000000
   +00007C  IO31:20E62508
   +000080 LAST_FD_CLOSE:00000000 00000000 00000000 00000000
   +000090  IOGET64:213244E8        IOFREE64:21323D80

Exiting CRTL Environment Data

********************************************************************************
                            CRTL I/O CONTROL BLOCKS
********************************************************************************
      CIO:  20C0E098
   +000000  EYE:CIO     SIZE:00000090     PTR:00000000      FLG1:09
   +00000D  FLG2:E0     FLG3:00     FLG4:00     DUMMYF:20C0E128
   +000014  EDCZ24:00000000   FCBSTART:2135A040       DUMMYFCB:20C0E148
   +000020  MFCBSTART:2135A470      IOANYLIST:2135A000
   +000028  IOBELOWLIST:00014000    FCBDDLIST:00000000
   +000030  PERRORBUF:20C0DF60      TMPCOUNTER:00000000
   +000038  TEMPMEM:00000000        PROMPTBUF:00000000      IO24:000122D0
   +000044  IOEXITS:000127C8        TERMINALCHAIN:00000000
   +00004C  VANCHOR:00000000        XTI:00000000      ENOWP24:20F484A0
   +000058  MAXNUMDESCRPS:00000000        DESCARRAY:00000000
   +000064  TEMPFILENUM:00000000    CSS:00000000      DUMMY_NAME:........
   +000074  HOSTNAME_CACHE:00000000       HOSTADDR_CACHE:00000000
   +00007C  IO31:20E62508
   +000080  LAST_FD_CLOSE:00000000 00000000 00000000 00000000
   +000090  IOGET64:213244E8        IOFREE64:21323D80

     FFIL:  2135A020
   +000000  MARKER1:AFCB      FILE:00000000     __FP:2135A040
   +00000C  MARKER2:AFCBAFCB        FF_FLAGS:01000000
   +000014  FCBMUTEX:00000000       THREADID:00000000 00000000

    File name: /u/charum/b235/in.txt

[7]FCB:  2135A040
   +000000  BUFPTR:00000000   COUNTIN:00000000        COUNTOUT:00000000
   +00000C  READFUNC:2135A110       WRITEFUNC:2135A130      FLAGS1:0000
   +000016  DEPTH:0000  NAME:2135A1FC      _LENGTH:00000015
   +000020  _BUFSIZE:00000044       MEMBER:........   NEXT:2135A268
   +000030  PREV:00000000     PARENT:2135A040   CHILD:00000000
   +00003C  DDNAME:........   FD:00000000       DEVTYPE:09  FCBTYPE:007C
   +00004C  FSCE:2135A174     UNGETBUF:2135A174       REPOS:212FD080
   +000058  GETPOS:212FCF50   CLOSE:21318C78    FLUSH:212FCEE8
   +000064  UTILITY:21318870        USERBUF:00000000        LRECL:00000000
   +000070  BLKSIZE:00000000        REALBUFPTR:00000000
   +000078  UNGETCOUNT:00000000     BUFSIZE:00001000        BUF:00000000
   +000084  CURSOR:00000000   ENDOFDATA:00000000      SAVEDBUF:00000000
   +000090  REALCOUNTIN:00000000    REALCOUNTOUT:00000000
   +000098  POSMAJOR:FFFFFFFF       SAVEMAJOR:00000000
   +0000A0  POSMINOR:00000000       SAVEMINOR:00000000      STATE:0000
   +0000AA  SAVESTATE:0000    EXITFTELL:00000000      EXITUNGETC:00000000
   +0000B4  DBCSTART:00000000       UTILITYAREA:00000000
   +0000BC  INTERCEPT:00000000      FLAGS2:00190040 00001300
   +0000C8  DBCSSTATE:0000    FCB_CPCB:20C0DEA8
   +0000D0  READGLUE:58FF0008 07FF0000    READ:212FD418
   +0000DC  RADDR_WSA:00000000      _GETFN:00000000   RDLL_INDEX:00000000
```

```
   +0000E8  RCEESG003:00000000      RWSA:00000000
   +0000F0  WRITEGLUE:58FF0008 07FF0000   WRITE:212FD220
   +0000FC  WADDR_WSA:00000000      _GETFN:00000000   WDLL_INDEX:00000000
   +000108  WCEESG003:00000000      WWSA:00000000

     HFSF:  2135A174
```

```
    +000000  HFSF_EYE:HFSF     READ:2131A1F8     WRITE:213197A0
    +00000C  REPOS:21319198    GETPOS:21318EA8   FLUSH:21318A08
    +000018  READBUFLEN:00000000     OPENFLAG:00000403       FLAG1:00000000
    +000024  HFSF_ST_MODE:030001C0   HFSF_LAST_FSTAT:4DC12A2E C5C4ADF8

      FFIL:  2135A248
    +000000  MARKER1:AFCB      FILE:00000000     __FP:2135A268
    +00000C  MARKER2:AFCBAFCB        FF_FLAGS:01000000
    +000014  FCBMUTEX:00000000       THREADID:00000000 00000000

     File name: CHARUM.A.B

       FCB:  2135A268
    +000000  BUFPTR:00000000   COUNTIN:00000000        COUNTOUT:00000000
    +00000C  READFUNC:2135A338       WRITEFUNC:2135A358      FLAGS1:0000
    +000016  DEPTH:0000  NAME:2135A424     _LENGTH:0000000A
    +000020  _BUFSIZE:00000044       MEMBER:........   NEXT:2135A660
    +000030  PREV:2135A040     PARENT:2135A268   CHILD:00000000
    +00003C  DDNAME:........   FD:FFFFFFFF       DEVTYPE:08  FCBTYPE:0055
    +00004C  FSCE:2135A39C     UNGETBUF:2135A39C       REPOS:20F52B90
    +000058  GETPOS:20FDD460   CLOSE:20FDD058    FLUSH:20F52AF8
    +000064  UTILITY:20F3C030        USERBUF:00000000        LRECL:00000400
    +000070  BLKSIZE:00000400        REALBUFPTR:00000000
    +000078  UNGETCOUNT:00000000     BUFSIZE:00000400        BUF:00000000
    +000084  CURSOR:00000000   ENDOFDATA:00000000      SAVEDBUF:00000000
    +000090  REALCOUNTIN:00000000    REALCOUNTOUT:00000000
    +000098  POSMAJOR:00000000       SAVEMAJOR:00000000
    +0000A0  POSMINOR:00000000       SAVEMINOR:00000000      STATE:0000
    +0000AA  SAVESTATE:0000    EXITFTELL:00000000      EXITUNGETC:20F481E8
    +0000B4  DBCSTART:00000000       UTILITYAREA:00000000
    +0000BC  INTERCEPT:00000000      FLAGS2:02020008 40000100
    +0000C8  DBCSSTATE:0000    FCB_CPCB:20C0DEA8
    +0000D0  READGLUE:58FF0008 07FF0000    READ:20F48580
    +0000DC  RADDR_WSA:00000000      _GETFN:00000000   RDLL_INDEX:00000000
    +0000E8  RCEESG003:00000000      RWSA:00000000
    +0000F0  WRITEGLUE:58FF0008 07FF0000   WRITE:20F531A0
    +0000FC  WADDR_WSA:00000000      _GETFN:00000000   WDLL_INDEX:00000000
    +000108  WCEESG003:00000000      WWSA:00000000
      MEMO:  2135A39C
    +000000  MEMO_EYE:MEMO     MFCB:2135A470     NEBULA:2135A4E4
    +00000C  NEBINDEX:0001     CURRDS:00000000   READ:20F48580
    +000018  WRITE:20FDF820    REPOS:20FDD670    FLUSH:20FDCDE0

      FFIL:  2135A640
    +000000  MARKER1:AFCB      FILE:00000000     __FP:2135A660
    +00000C  MARKER2:AFCBAFCB        FF_FLAGS:01000000
    +000014  FCBMUTEX:00000000       THREADID:00000000 00000000

     File name: CHARUM.B.C
```

```
       FCB:  2135A660
    +000000  BUFPTR:00000000   COUNTIN:00000000        COUNTOUT:00000000
    +00000C  READFUNC:2135A730       WRITEFUNC:2135A750      FLAGS1:0000
    +000016  DEPTH:0000  NAME:2135A81C     _LENGTH:0000000A
    +000020  _BUFSIZE:00000044       MEMBER:........   NEXT:2135AA60
    +000030  PREV:2135A268     PARENT:2135A660   CHILD:00000000
    +00003C  DDNAME:........   FD:FFFFFFFF       DEVTYPE:0A  FCBTYPE:0056
    +00004C  FSCE:2135A794     UNGETBUF:2135A794       REPOS:21313E38
    +000058  GETPOS:21313AF0   CLOSE:213150A8    FLUSH:21313A70
    +000064  UTILITY:20F3C030        USERBUF:00000000        LRECL:00001000
    +000070  BLKSIZE:00001000        REALBUFPTR:00000000
    +000078  UNGETCOUNT:00000000     BUFSIZE:00001000        BUF:00000000
    +000084  CURSOR:00000000   ENDOFDATA:00000000      SAVEDBUF:00000000
    +000090  REALCOUNTIN:00000000    REALCOUNTOUT:00000000
    +000098  POSMAJOR:00000000       SAVEMAJOR:00000000
    +0000A0  POSMINOR:00000000       SAVEMINOR:00000000      STATE:0000
    +0000AA  SAVESTATE:0000    EXITFTELL:00000000      EXITUNGETC:20F481E8
    +0000B4  DBCSTART:00000000       UTILITYAREA:00000000
    +0000BC  INTERCEPT:00000000      FLAGS2:02020028 40004100
    +0000C8  DBCSSTATE:0000    FCB_CPCB:20C0DEA8
    +0000D0  READGLUE:58FF0008 07FF0000    READ:20F48580
    +0000DC  RADDR_WSA:00000000      _GETFN:00000000   RDLL_INDEX:00000000
    +0000E8  RCEESG003:00000000      RWSA:00000000
    +0000F0  WRITEGLUE:58FF0008 07FF0000   WRITE:21314110
    +0000FC  WADDR_WSA:00000000      _GETFN:00000000   WDLL_INDEX:00000000
    +000108  WCEESG003:00000000      WWSA:00000000

      HSPF:  2135A794
    +000000  HSPF_EYE:HSPF     MFCB:2135A970     READ:20F48580
    +00000C  WRITE:21316858    REPOS:21315650    GETPOS:21315470
    +000018  FLUSH:21314A30    CURBUFSIZEUSED:00000000
```

```
 +000020  LASTBLKOFFSET:00000000        HSPPARM:2135A868

   FFIL:  2135AA40
 +000000  MARKER1:AFCB      FILE:00000000     __FP:2135AA60
 +00000C  MARKER2:AFCBAFCB        FF_FLAGS:01000000
 +000014  FCBMUTEX:00000000       THREADID:00000000 00000000

  File name: CHARUM.C.D

    FCB:  2135AA60
 +000000  BUFPTR:00000000   COUNTIN:00000000        COUNTOUT:00000000
 +00000C  READFUNC:2135AB30       WRITEFUNC:2135AB50      FLAGS1:0000
 +000016  DEPTH:0000  NAME:2135AC1C      _LENGTH:0000000A
 +000020  _BUFSIZE:00000044       MEMBER:........   NEXT:2135AD30
 +000030  PREV:2135A660     PARENT:2135AA60   CHILD:00000000
 +00003C  DDNAME:SYS00011   FD:FFFFFFFF       DEVTYPE:00  FCBTYPE:0027
 +00004C  FSCE:2135AB94     UNGETBUF:2135AB94       REPOS:20F5F2A0
 +000058  GETPOS:20F48330   CLOSE:20F7E1A0    FLUSH:20F5F3A8
 +000064  UTILITY:20F5F160        USERBUF:00000000        LRECL:00000050
 +000070  BLKSIZE:00000050        REALBUFPTR:00000000
 +000078  UNGETCOUNT:00000000     BUFSIZE:00000051        BUF:00000000
 +000084  CURSOR:00000000   ENDOFDATA:00000000      SAVEDBUF:00000000
 +000090  REALCOUNTIN:00000000    REALCOUNTOUT:00000000
 +000098  POSMAJOR:00000000       SAVEMAJOR:00000000
 +0000A0  POSMINOR:00000000       SAVEMINOR:00000000      STATE:0000
 +0000AA  SAVESTATE:0000    EXITFTELL:20F482A8      EXITUNGETC:20F481E8
 +0000B4  DBCSTART:00000000       UTILITYAREA:00000000
 +0000BC  INTERCEPT:00000000      FLAGS2:02120020 40489100
 +0000C8  DBCSSTATE:0000    FCB_CPCB:20C0DEA8
 +0000D0  READGLUE:58FF0008 07FF0000    READ:20F48580
 +0000DC  RADDR_WSA:00000000      _GETFN:00000000   RDLL_INDEX:00000000
 +0000E8  RCEESG003:00000000      RWSA:00000000
 +0000F0  WRITEGLUE:58FF0008 07FF0000   WRITE:20F7ED60
 +0000FC  WADDR_WSA:00000000      _GETFN:00000000   WDLL_INDEX:00000000
 +000108  WCEESG003:00000000      WWSA:00000000
```

```
   OSNS:  2135AB94
 +000000  OSNS_EYE:OSNS     READ:20F48580     WRITE:20F7E640
 +00000C  REPOS:20F5F588    GETPOS:20F48330   CLOSE:20F7E1A0
 +000018  FLUSH:20F7E4C0    UTILITY:213126A0        EXITFTELL:20F482A8
 +000024  EXITUNGETC:20F481E8     OSIOBLK:2135AC68
 +00002C  NEWLINEPTR:00000000     RECLENGTH:00000050      FLAGS:81000000

   OSIO:  2135AC68
 +000000  OSIO_EYE:OSIO     DCBW:00012020     DCBRU:00000000
 +00000C  JFCB:000127E8     CURRMBUF:00000000       MBUFCOUNT:00000000
 +000018  READMAX:00000000        CURBLKNUM:FFFFFFFF
 +000020  LASTBLKNUM:FFFFFFFF     BLKSPERTRK:0000   OSIO_ACCESS_METHOD:02
 +000027  OSIO_NOSEEK_TO_SEEK:00  FIRSTPOS:00000000
 +00002C  LASTPOS:00000000        NEWPOS:00000000   READFUNCNUM:00000002
 +000038  WRITEFUNCNUM:00000005   FCB:2135AA60      PARENT:2135AC68
 +000044  FLAGS1:81000000   DCBERU:00000000   DCBEW:2135ACD0
 +000050  OSIO_VOLSEQ:0000  OSIO_NEWVOLSEQ:0000     OSIO_EXT:00000000
 +000058  OSIO_HIGHVOL:0000       APPENDEDLASTVOLSEQ:0000
 +00005C  OSIO_JFCBX:00000000

    DCB:  00012020
 +000000  DCBRELAD:2135ACD0       DCBFDAD:00000000 D2000300
 +000014  DCBBUFNO:05       DCBSRG1:40  DCBEODAD:000000   DCBRECFM:80
 +000025  DCBEXLSA:0127D0   DCBDDNAM:...&..'d       DCBMACR1:A0
 +000033  DCBMACR2:58       DCBSYNAD:000000   DCBBLKSI:0050     DCBNCP:21
 +000052  DCBLRECL:0050

   DCBE:  2135ACD0
 +000000  DCBEID:DCBE       DCBELEN:0038      RESERVED0:0000
 +000008  DCBEDCB:00012020        DCBERELA:00000000       DCBEFLG1:C0
 +000011  DCBEFLG2:88       DCBENSTR:0000     DCBEFLG3:80
 +000024  DCBESIZE:00000000       DCBEEODA:20E6269A
 +00002C  DCBESYNA:20E6263C       MULTSDN:00

   JFCB:  000127E8
 +000000  JFCBDSNM:CHARUM.C.D
 +00002C  JFCBELNM:               JFCBTSDM:80       JFCBDSCB:01291C
 +000046  JFCBVLSQ:0000     JFCBIND1:00       JFCBIND2:40
 +000058  JFCBUFNO:00       JFCDSRG1:00       JFCDSRG2:00
 +000064  JFCRECFM:00       JFCBLKSI:0000     JFCLRECL:0000     JFCNCP:00
 +000075  JFCBNVOL:01       JFCBNVOLS:SL4A00
 +000094  JFCBEXTL:00       JFCBEXAD:0009AF   JFCFLGS1:00
 +0000AE  JFCBVLCT:01

   FFIL:  2135AD10
```

```
+000000  MARKER1:AFCB      FILE:00000000      __FP:2135AD30
+00000C  MARKER2:AFCBAFCB        FF_FLAGS:01000000
+000014  FCBMUTEX:00000000       THREADID:00000000 00000000

 File name: CHARUM.D.E

   FCB:  2135AD30
+000000  BUFPTR:2135AFE0   COUNTIN:00000007        COUNTOUT:00000000
+00000C  READFUNC:2135AE00       WRITEFUNC:2135AE20      FLAGS1:9000
+000016  DEPTH:0000  NAME:2135AEEC      _LENGTH:0000000A
+000020  _BUFSIZE:00000044       MEMBER:........   NEXT:2135B0A0
+000030  PREV:2135AA60     PARENT:2135AD30   CHILD:00000000
+00003C  DDNAME:SYS00012   FD:FFFFFFFF       DEVTYPE:00  FCBTYPE:002A
+00004C  FSCE:2135AE64     UNGETBUF:2135AE64       REPOS:20F87590
+000058  GETPOS:20F89070   CLOSE:20F862E0    FLUSH:20F86D50
+000064  UTILITY:20F85D60        USERBUF:00000000        LRECL:00000050
+000070  BLKSIZE:00000050        REALBUFPTR:2135AFE0
+000078  UNGETCOUNT:00000000     BUFSIZE:00000051        BUF:2135AFE0
+000084  CURSOR:2135AFE0   ENDOFDATA:2135AFE0      SAVEDBUF:00000000
+000090  REALCOUNTIN:00000000    REALCOUNTOUT:00000050
+000098  POSMAJOR:00000000       SAVEMAJOR:00000000
+0000A0  POSMINOR:00000000       SAVEMINOR:00000000      STATE:0000
+0000AA  SAVESTATE:0000    EXITFTELL:00000000      EXITUNGETC:00000000
+0000B4  DBCSTART:00000000       UTILITYAREA:00000000
+0000BC  INTERCEPT:00000000      FLAGS2:021A0000 40440100
```

```
+0000C8  DBCSSTATE:0000    FCB_CPCB:20C0DEA8
+0000D0  READGLUE:58FF0008 07FF0000    READ:20F8C258
+0000DC  RADDR_WSA:00000000      _GETFN:00000000   RDLL_INDEX:00000000
+0000E8  RCEESG003:00000000      RWSA:00000000
+0000F0  WRITEGLUE:58FF0008 07FF0000   WRITE:20F89A10
+0000FC  WADDR_WSA:00000000      _GETFN:00000000   WDLL_INDEX:00000000
+000108  WCEESG003:00000000      WWSA:00000000

  OSFS:  2135AE64
+000000  OSFS_EYE:OSFS     READ:20F8C258     WRITE:20F89A10
+00000C  REPOS:20F87590    GETPOS:20F89070   CLOSE:20F862E0
+000018  FLUSH:20F86D50    UTILITY:20F85D60        EXITFTELL:00000000
+000024  EXITUNGETC:00000000     OSIOBLK:2135AF38        SAVECURSOR:21
+00002D  NEWLINEPTR:35AFE021     ENDOFBLOCK:35AFE600
+000035  CURRBLKSIZE:00000000    LASTBLKSIZE:00005000
+00003D  HIGHMAJOR:00000000      RELRECNUM:00000000
+000045  MAXFTELLBLK:00000001    RECBITS:FFFFFF00
+00004D  RECSPERBLOCK:00000700   SAVECHAR:00000140       FLAGS1:72000000

  OSIO:  2135AF38
+000000  OSIO_EYE:OSIO     DCBW:000128A0     DCBRU:000129F8
+00000C  JFCB:00012908     CURRMBUF:000129C0       MBUFCOUNT:00000001
+000018  READMAX:00000001        CURBLKNUM:00000000
+000020  LASTBLKNUM:00000257     BLKSPERTRK:0000   OSIO_ACCESS_METHOD:01
+000027  OSIO_NOSEEK_TO_SEEK:00  FIRSTPOS:00000100
+00002C  LASTPOS:00073600        NEWPOS:00000000   READFUNCNUM:00000003
+000038  WRITEFUNCNUM:00000005   FCB:2135AD30      PARENT:2135AF38
+000044  FLAGS1:B5020000   DCBERU:2135B040   DCBEW:2135AFA0
+000050  OSIO_VOLSEQ:0000  OSIO_NEWVOLSEQ:0000     OSIO_EXT:00000000
+000058  OSIO_HIGHVOL:0000       APPENDEDLASTVOLSEQ:0000
+00005C  OSIO_JFCBX:00000000

   DCB:  000128A0
+000000  DCBRELAD:2135AFA0       DCBFDAD:02000000 3B000236
+000014  DCBBUFNO:00       DCBSRG1:40  DCBEODAD:000000   DCBRECFM:80
+000025  DCBEXLSA:0127D0   DCBDDNAM:.u.....d       DCBMACR1:65
+000033  DCBMACR2:B8       DCBSYNAD:000000   DCBBLKSI:0050     DCBNCP:01
+000052  DCBLRECL:0050

   DCB:  000129F8
+000000  DCBRELAD:2135B040       DCBFDAD:00000000 1F000501
+000014  DCBBUFNO:00       DCBSRG1:40  DCBEODAD:000000   DCBRECFM:80
+000025  DCBEXLSA:0127D0   DCBDDNAM:.u....=u       DCBMACR1:0A
+000033  DCBMACR2:F0       DCBSYNAD:000000   DCBBLKSI:0050     DCBNCP:01
+000052  DCBLRECL:0050

  DCBE:  2135AFA0
+000000  DCBEID:DCBE       DCBELEN:0038      RESERVED0:0000
+000008  DCBEDCB:000128A0        DCBERELA:00000000       DCBEFLG1:C0
+000011  DCBEFLG2:88       DCBENSTR:0000     DCBEFLG3:00
+000024  DCBESIZE:00000000       DCBEEODA:20E6269A
+00002C  DCBESYNA:20E6263C       MULTSDN:00

  DCBE:  2135B040
+000000  DCBEID:DCBE       DCBELEN:0038      RESERVED0:0000
```

```
+000008  DCBEDCB:000129F8        DCBERELA:00000000       DCBEFLG1:C0
+000011  DCBEFLG2:88       DCBENSTR:0000     DCBEFLG3:00
+000024  DCBESIZE:00000000       DCBEEODA:20E6269A
+00002C  DCBESYNA:20E6263C       MULTSDN:00

  JFCB:  00012908
+000000  JFCBDSNM:CHARUM.D.E
+00002C  JFCBELNM:               JFCBTSDM:80       JFCBDSCB:003E15
+000046  JFCBVLSQ:0000     JFCBIND1:00       JFCBIND2:40
+000058  JFCBUFNO:00       JFCDSRG1:00       JFCDSRG2:00
+000064  JFCRECFM:00       JFCBLKSI:0000     JFCLRECL:0000     JFCNCP:00
+000075  JFCBNVOL:01       JFCBNVOLS:SL621D
+000094  JFCBEXTL:00       JFCBEXAD:0009FF   JFCFLGS1:00
+0000AE  JFCBVLCT:01
```

```
  MBUF:  000129C0
+000000  NEXTMBUF:000129C0       BUFFER:2135AFE0   CHECKRESULT:00000000
+00000C  BLKSIZE:00000050
+000010  DECB:7F000000 80800000 000129F8 2135AFE0 00006AF8 00000000 00000000 00000000

  FFIL:  2135B080
+000000  MARKER1:AFCB      FILE:00000000     __FP:2135B0A0
+00000C  MARKER2:AFCBAFCB        FF_FLAGS:01000000
+000014  FCBMUTEX:00000000       THREADID:00000000 00000000

 File name: CHARUM.E.F

   FCB:  2135B0A0
+000000  BUFPTR:00000000   COUNTIN:00000000        COUNTOUT:00000000
+00000C  READFUNC:2135B170       WRITEFUNC:2135B190      FLAGS1:0000
+000016  DEPTH:0000  NAME:2135B25C      _LENGTH:0000000A
+000020  _BUFSIZE:00000044       MEMBER:........   NEXT:2135B370
+000030  PREV:2135AD30     PARENT:2135B0A0   CHILD:00000000
+00003C  DDNAME:SYS00013   FD:FFFFFFFF       DEVTYPE:00  FCBTYPE:0020
+00004C  FSCE:2135B1D4     UNGETBUF:2135B1D4       REPOS:20F7CAF0
+000058  GETPOS:20F7CEC0   CLOSE:20F77BE8    FLUSH:20F7CA78
+000064  UTILITY:213126A0        USERBUF:00000000        LRECL:00000404
+000070  BLKSIZE:00000408        REALBUFPTR:00000000
+000078  UNGETCOUNT:00000000     BUFSIZE:00000408        BUF:00000000
+000084  CURSOR:00000000   ENDOFDATA:00000000      SAVEDBUF:00000000
+000090  REALCOUNTIN:00000000    REALCOUNTOUT:00000000
+000098  POSMAJOR:00000000       SAVEMAJOR:00000000
+0000A0  POSMINOR:00000000       SAVEMINOR:00000000      STATE:0000
+0000AA  SAVESTATE:0000    EXITFTELL:00000000      EXITUNGETC:20F481E8
+0000B4  DBCSTART:00000000       UTILITYAREA:00000000
+0000BC  INTERCEPT:00000000      FLAGS2:02120020 20441100
+0000C8  DBCSSTATE:0000    FCB_CPCB:20C0DEA8
+0000D0  READGLUE:58FF0008 07FF0000    READ:20F48580
+0000DC  RADDR_WSA:00000000      _GETFN:00000000   RDLL_INDEX:00000000
+0000E8  RCEESG003:00000000      RWSA:00000000
+0000F0  WRITEGLUE:58FF0008 07FF0000   WRITE:20F7D260
+0000FC  WADDR_WSA:00000000      _GETFN:00000000   WDLL_INDEX:00000000
+000108  WCEESG003:00000000      WWSA:00000000

  OSVF:  2135B1D4
+000000  OSVF_EYE:OSVF     READ:20F48580     WRITE:20F7ADD8
+00000C  REPOS:20F786B0    GETPOS:20F7A5C8   CLOSE:00000000
+000018  FLUSH:20F77F38    UTILITY:213126A0        EXITFTELL:00000000
+000024  EXITUNGETC:20F481E8     OSIOBLK:2135B2A8
+00002C  SAVECURSOR:00000000     NEWLINEPTR:00000000
+000034  CURBLKSIZE:00000000     LASTBLKSIZE:00000000
+00003C  HIGHMAJOR:00000000      MAXFTELLBLK:001FFFFF
+000044  RECBITS:0000000B        FLAGS:72000000    RECLEN:00000000
+000050  CURRBLKNUM:00000000     LASTBLKNUM:00000000
+000058  OSWRITETOK:00000000     RECCOUNTOUT1:00000000
+000060  BLKCOUNTOUT1:00000000   SAVECOUNTOUT:00000000   SDWCODE:0000
+00006A  SAVECHAR:.  LASTTTRBLT:00000000     LASTWRTSIZE:00000000
+000073  LRECLUSED:00000000      OLDLRECLUSED:00000000
+00007B  READERCOUNT:00000000    UNWRITTENDATA:00000000
+000083  MINRECLEN:00000000

  OSIO:  2135B2A8
+000000  OSIO_EYE:OSIO     DCBW:00012A60     DCBRU:00000000
+00000C  JFCB:00012AC8     CURRMBUF:00000000       MBUFCOUNT:00000001
+000018  READMAX:00000000        CURBLKNUM:FFFFFFFF
+000020  LASTBLKNUM:FFFFFFFF     BLKSPERTRK:0000   OSIO_ACCESS_METHOD:01
+000027  OSIO_NOSEEK_TO_SEEK:00  FIRSTPOS:00000100
+00002C  LASTPOS:00000100        NEWPOS:00000000   READFUNCNUM:00000002
+000038  WRITEFUNCNUM:00000005   FCB:2135B0A0      PARENT:2135B2A8
+000044  FLAGS1:81020000   DCBERU:00000000   DCBEW:2135B310
+000050  OSIO_VOLSEQ:0000  OSIO_NEWVOLSEQ:0000     OSIO_EXT:00000000
```

```
  +000058  OSIO_HIGHVOL:0000       APPENDEDLASTVOLSEQ:0000
  +00005C  OSIO_JFCBX:00000000
```

```
     DCB:  00012A60
  +000000  DCBRELAD:2135B310       DCBFDAD:00000000 01000D00
  +000014  DCBBUFNO:00       DCBSRG1:40  DCBEODAD:000000   DCBRECFM:40
  +000025  DCBEXLSA:0127D0   DCBDDNAM:........       DCBMACR1:65
  +000033  DCBMACR2:B8       DCBSYNAD:000000   DCBBLKSI:0408     DCBNCP:01
  +000052  DCBLRECL:0404

    DCBE:  2135B310
  +000000  DCBEID:DCBE       DCBELEN:0038      RESERVED0:0000
  +000008  DCBEDCB:00012A60        DCBERELA:00000000       DCBEFLG1:C0
  +000011  DCBEFLG2:88       DCBENSTR:0000     DCBEFLG3:00
  +000024  DCBESIZE:00000000       DCBEEODA:20E6269A
  +00002C  DCBESYNA:20E6263C       MULTSDN:00

    JFCB:  00012AC8
  +000000  JFCBDSNM:CHARUM.E.F
  +00002C  JFCBELNM:               JFCBTSDM:80       JFCBDSCB:004B17
  +000046  JFCBVLSQ:0000     JFCBIND1:00       JFCBIND2:40
  +000058  JFCBUFNO:00       JFCDSRG1:00       JFCDSRG2:00
  +000064  JFCRECFM:00       JFCBLKSI:0000     JFCLRECL:0000     JFCNCP:00
  +000075  JFCBNVOL:01       JFCBNVOLS:SL880B
  +000094  JFCBEXTL:00       JFCBEXAD:000A4F   JFCFLGS1:00
  +0000AE  JFCBVLCT:01

    FFIL:  2135B350
  +000000  MARKER1:AFCB      FILE:00000000     __FP:2135B370
  +00000C  MARKER2:AFCBAFCB        FF_FLAGS:01000000
  +000014  FCBMUTEX:00000000       THREADID:00000000 00000000

   File name: CHARUM.F.G

     FCB:  2135B370
  +000000  BUFPTR:00000000   COUNTIN:00000000        COUNTOUT:00000000
  +00000C  READFUNC:2135B440       WRITEFUNC:2135B460      FLAGS1:0000
  +000016  DEPTH:0000  NAME:2135B52C      _LENGTH:0000000A
  +000020  _BUFSIZE:00000044       MEMBER:........   NEXT:2135B640
  +000030  PREV:2135B0A0     PARENT:2135B370   CHILD:00000000
  +00003C  DDNAME:SYS00014   FD:FFFFFFFF       DEVTYPE:00  FCBTYPE:0028
  +00004C  FSCE:2135B4A4     UNGETBUF:2135B4A4       REPOS:20F590C0
  +000058  GETPOS:20F59368   CLOSE:20F804A0    FLUSH:20F59048
  +000064  UTILITY:20F58D70        USERBUF:00000000        LRECL:00000000
  +000070  BLKSIZE:00001800        REALBUFPTR:00000000
  +000078  UNGETCOUNT:00000000     BUFSIZE:00001800        BUF:00000000
  +000084  CURSOR:00000000   ENDOFDATA:00000000      SAVEDBUF:00000000
  +000090  REALCOUNTIN:00000000    REALCOUNTOUT:00000000
  +000098  POSMAJOR:00000000       SAVEMAJOR:00000000
  +0000A0  POSMINOR:00000000       SAVEMINOR:00000000      STATE:0000
  +0000AA  SAVESTATE:0000    EXITFTELL:00000000      EXITUNGETC:20F481E8
  +0000B4  DBCSTART:00000000       UTILITYAREA:00000000
  +0000BC  INTERCEPT:00000000      FLAGS2:02120000 60441100
  +0000C8  DBCSSTATE:0000    FCB_CPCB:20C0DEA8
  +0000D0  READGLUE:58FF0008 07FF0000    READ:20F48580
  +0000DC  RADDR_WSA:00000000      _GETFN:00000000   RDLL_INDEX:00000000
  +0000E8  RCEESG003:00000000      RWSA:00000000
  +0000F0  WRITEGLUE:58FF0008 07FF0000   WRITE:20F595D8
  +0000FC  WADDR_WSA:00000000      _GETFN:00000000   WDLL_INDEX:00000000
  +000108  WCEESG003:00000000      WWSA:00000000
```

```
    OSFS:  2135B4A4
  +000000  OSFS_EYE:OSFS     READ:20F48580     WRITE:20F83078
  +00000C  REPOS:20F80CC0    GETPOS:20F826B8   CLOSE:00000000
  +000018  FLUSH:20F808B0    UTILITY:213126A0        EXITFTELL:00000000
  +000024  EXITUNGETC:20F481E8     OSIOBLK:2135B578        SAVECURSOR:00
  +00002D  NEWLINEPTR:00000000     ENDOFBLOCK:00000000
  +000035  CURRBLKSIZE:00000000    LASTBLKSIZE:00000000
  +00003D  HIGHMAJOR:00000000      RELRECNUM:00000000
  +000045  MAXFTELLBLK:00000000    RECBITS:07FFFF00
  +00004D  RECSPERBLOCK:00000D00   SAVECHAR:00000000       FLAGS1:72000000

    OSIO:  2135B578
  +000000  OSIO_EYE:OSIO     DCBW:00012B80     DCBRU:00000000
  +00000C  JFCB:00012BE8     CURRMBUF:00000000       MBUFCOUNT:00000001
  +000018  READMAX:00000000        CURBLKNUM:FFFFFFFF
  +000020  LASTBLKNUM:FFFFFFFF     BLKSPERTRK:0000   OSIO_ACCESS_METHOD:01
  +000027  OSIO_NOSEEK_TO_SEEK:00  FIRSTPOS:00000100
  +00002C  LASTPOS:00000100        NEWPOS:00000000   READFUNCNUM:00000002
  +000038  WRITEFUNCNUM:00000005   FCB:2135B370      PARENT:2135B578
```

```
    +000044  FLAGS1:81020000   DCBERU:00000000   DCBEW:2135B5E0
    +000050  OSIO_VOLSEQ:0000  OSIO_NEWVOLSEQ:0000     OSIO_EXT:00000000
    +000058  OSIO_HIGHVOL:0000       APPENDEDLASTVOLSEQ:0000
    +00005C  OSIO_JFCBX:00000000

       DCB:  00012B80
    +000000  DCBRELAD:2135B5E0       DCBFDAD:00000000 EA000800
    +000014  DCBBUFNO:00       DCBSRG1:40  DCBEODAD:000000   DCBRECFM:C0
    +000025  DCBEXLSA:0127D0   DCBDDNAM:......fd       DCBMACR1:65
    +000033  DCBMACR2:B8       DCBSYNAD:000000   DCBBLKSI:1800     DCBNCP:01
    +000052  DCBLRECL:0000

      DCBE:  2135B5E0
    +000000  DCBEID:DCBE       DCBELEN:0038      RESERVED0:0000
    +000008  DCBEDCB:00012B80        DCBERELA:00000000       DCBEFLG1:C0
    +000011  DCBEFLG2:88       DCBENSTR:0000     DCBEFLG3:00
    +000024  DCBESIZE:00000000       DCBEEODA:20E6269A
    +00002C  DCBESYNA:20E6263C       MULTSDN:00

      JFCB:  00012BE8
    +000000  JFCBDSNM:CHARUM.F.G
    +00002C  JFCBELNM:               JFCBTSDM:80       JFCBDSCB:01402A
    +000046  JFCBVLSQ:0000     JFCBIND1:00       JFCBIND2:40
    +000058  JFCBUFNO:00       JFCDSRG1:00       JFCDSRG2:00
    +000064  JFCRECFM:00       JFCBLKSI:0000     JFCLRECL:0000     JFCNCP:00
    +000075  JFCBNVOL:01       JFCBNVOLS:SL4C06
    +000094  JFCBEXTL:00       JFCBEXAD:000A9F   JFCFLGS1:00
    +0000AE  JFCBVLCT:01

      FFIL:  2135B620
    +000000  MARKER1:AFCB      FILE:00000000     __FP:2135B640
    +00000C  MARKER2:AFCBAFCB        FF_FLAGS:01000000
    +000014  FCBMUTEX:00000000       THREADID:00000000 00000000

     File name: CHARUM.G.H

       FCB:  2135B640
    +000000  BUFPTR:00000000   COUNTIN:00000000        COUNTOUT:00000000
    +00000C  READFUNC:2135B710       WRITEFUNC:2135B730      FLAGS1:8000
    +000016  DEPTH:0000  NAME:2135B7FC      _LENGTH:0000000A
    +000020  _BUFSIZE:00000044       MEMBER:........   NEXT:2135B910
    +000030  PREV:2135B370     PARENT:2135B640   CHILD:00000000
    +00003C  DDNAME:SYS00015   FD:FFFFFFFF       DEVTYPE:00  FCBTYPE:0041
    +00004C  FSCE:2135B774     UNGETBUF:2135B774       REPOS:20F5F2A0
    +000058  GETPOS:20F48330   CLOSE:20FB8930    FLUSH:20F5F3A8
    +000064  UTILITY:20F5F160        USERBUF:00000000        LRECL:00000050
    +000070  BLKSIZE:00000050        REALBUFPTR:00000000
    +000078  UNGETCOUNT:00000000     BUFSIZE:00000051        BUF:00000000
    +000084  CURSOR:00000000   ENDOFDATA:00000000      SAVEDBUF:00000000
    +000090  REALCOUNTIN:00000000    REALCOUNTOUT:00000000
    +000098  POSMAJOR:00000000       SAVEMAJOR:00000000
    +0000A0  POSMINOR:00000000       SAVEMINOR:00000000      STATE:0000
```

```
    +0000AA  SAVESTATE:0000    EXITFTELL:20F482A8      EXITUNGETC:20F481E8
    +0000B4  DBCSTART:00000000       UTILITYAREA:00000000
    +0000BC  INTERCEPT:00000000      FLAGS2:02120020 40488100
    +0000C8  DBCSSTATE:0000    FCB_CPCB:20C0DEA8
    +0000D0  READGLUE:58FF0008 07FF0000    READ:20F48580
    +0000DC  RADDR_WSA:00000000      _GETFN:00000000   RDLL_INDEX:00000000
    +0000E8  RCEESG003:00000000      RWSA:00000000
    +0000F0  WRITEGLUE:58FF0008 07FF0000   WRITE:20FBA568
    +0000FC  WADDR_WSA:00000000      _GETFN:00000000   WDLL_INDEX:00000000
    +000108  WCEESG003:00000000      WWSA:00000000

      OSNS:  2135B774
    +000000  OSNS_EYE:OSNS     READ:20F48580     WRITE:20FB8D88
    +00000C  REPOS:20F5F588    GETPOS:20F48330   CLOSE:20FB8930
    +000018  FLUSH:20FB8CC0    UTILITY:20FB8600        EXITFTELL:20F482A8
    +000024  EXITUNGETC:20F481E8     OSIOBLK:2135B848
    +00002C  NEWLINEPTR:00000000     RECLENGTH:00000050      FLAGS:81000000

      OSIO:  2135B848
    +000000  OSIO_EYE:OSIO     DCBW:00012CA0     DCBRU:00000000
    +00000C  JFCB:00012D08     CURRMBUF:00000000       MBUFCOUNT:00000001
    +000018  READMAX:00000000        CURBLKNUM:FFFFFFFF
    +000020  LASTBLKNUM:FFFFFFFF     BLKSPERTRK:0000   OSIO_ACCESS_METHOD:02
    +000027  OSIO_NOSEEK_TO_SEEK:00  FIRSTPOS:00000000
    +00002C  LASTPOS:00000000        NEWPOS:00000000   READFUNCNUM:00000002
    +000038  WRITEFUNCNUM:00000005   FCB:2135B640      PARENT:2135B848
    +000044  FLAGS1:81000000   DCBERU:00000000   DCBEW:2135B8B0
    +000050  OSIO_VOLSEQ:0000  OSIO_NEWVOLSEQ:0000     OSIO_EXT:00000000
```

```
   +000058  OSIO_HIGHVOL:0000       APPENDEDLASTVOLSEQ:0000
   +00005C  OSIO_JFCBX:00000000

      DCB:  00012CA0
   +000000  DCBRELAD:2135B8B0       DCBFDAD:00000000 F1000200
   +000014  DCBBUFNO:05      DCBSRG1:40  DCBEODAD:000000   DCBRECFM:80
   +000025  DCBEXLSA:0127D0   DCBDDNAM:.\.&..a.       DCBMACR1:A0
   +000033  DCBMACR2:58       DCBSYNAD:000000   DCBBLKSI:0050     DCBNCP:21
   +000052  DCBLRECL:0050

     DCBE:  2135B8B0
   +000000  DCBEID:DCBE       DCBELEN:0038      RESERVED0:0000
   +000008  DCBEDCB:00012CA0        DCBERELA:00000000       DCBEFLG1:C0
   +000011  DCBEFLG2:88       DCBENSTR:0000     DCBEFLG3:80
   +000024  DCBESIZE:00000000       DCBEEODA:20E6269A
   +00002C  DCBESYNA:20E6263C       MULTSDN:00

     JFCB:  00012D08
   +000000  JFCBDSNM:CHARUM.G.H
   +00002C  JFCBELNM:               JFCBTSDM:80       JFCBDSCB:01391F
   +000046  JFCBVLSQ:0000     JFCBIND1:00       JFCBIND2:40
   +000058  JFCBUFNO:00       JFCDSRG1:00       JFCDSRG2:00
   +000064  JFCRECFM:00       JFCBLKSI:0000     JFCLRECL:0000     JFCNCP:00
   +000075  JFCBNVOL:01       JFCBNVOLS:SL4A04
   +000094  JFCBEXTL:00       JFCBEXAD:000AEF   JFCFLGS1:00
   +0000AE  JFCBVLCT:01
```

```
     FFIL:  2135B8F0
   +000000  MARKER1:AFCB      FILE:00000000     __FP:2135B910
   +00000C  MARKER2:AFCBAFCB        FF_FLAGS:01000000
   +000014  FCBMUTEX:00000000       THREADID:00000000 00000000

    File name: CHARUM.H.I

      FCB:  2135B910
   +000000  BUFPTR:00000000   COUNTIN:00000000        COUNTOUT:00000000
   +00000C  READFUNC:2135B9E0       WRITEFUNC:2135BA00      FLAGS1:8000
   +000016  DEPTH:0000  NAME:2135BACC      _LENGTH:0000000A
   +000020  _BUFSIZE:00000044       MEMBER:........   NEXT:2135BBE0
   +000030  PREV:2135B640     PARENT:2135B910   CHILD:00000000
   +00003C  DDNAME:SYS00016   FD:FFFFFFFF       DEVTYPE:00  FCBTYPE:002A
   +00004C  FSCE:2135BA44     UNGETBUF:2135BA44       REPOS:20F5A418
   +000058  GETPOS:20F5AAC8   CLOSE:20F862E0    FLUSH:20F5A3A0
   +000064  UTILITY:20F85D60        USERBUF:00000000        LRECL:00000050
   +000070  BLKSIZE:00000050        REALBUFPTR:00000000
   +000078  UNGETCOUNT:00000000     BUFSIZE:00000051        BUF:00000000
   +000084  CURSOR:00000000   ENDOFDATA:00000000      SAVEDBUF:00000000
   +000090  REALCOUNTIN:00000000    REALCOUNTOUT:00000000
   +000098  POSMAJOR:00000000       SAVEMAJOR:00000000
   +0000A0  POSMINOR:00000000       SAVEMINOR:00000000      STATE:0000
   +0000AA  SAVESTATE:0000    EXITFTELL:00000000      EXITUNGETC:20F481E8
   +0000B4  DBCSTART:00000000       UTILITYAREA:00000000
   +0000BC  INTERCEPT:00000000      FLAGS2:02120020 40440100
   +0000C8  DBCSSTATE:0000    FCB_CPCB:20C0DEA8
   +0000D0  READGLUE:58FF0008 07FF0000    READ:20F48580
   +0000DC  RADDR_WSA:00000000      _GETFN:00000000   RDLL_INDEX:00000000
   +0000E8  RCEESG003:00000000      RWSA:00000000
   +0000F0  WRITEGLUE:58FF0008 07FF0000   WRITE:20F5B168
   +0000FC  WADDR_WSA:00000000      _GETFN:00000000   WDLL_INDEX:00000000
   +000108  WCEESG003:00000000      WWSA:00000000

     OSFS:  2135BA44
   +000000  OSFS_EYE:OSFS     READ:20F48580     WRITE:20F89A10
   +00000C  REPOS:20F87590    GETPOS:20F89070   CLOSE:20F862E0
   +000018  FLUSH:20F86D50    UTILITY:20F85D60        EXITFTELL:00000000
   +000024  EXITUNGETC:20F481E8     OSIOBLK:2135BB18        SAVECURSOR:00
   +00002D  NEWLINEPTR:00000000     ENDOFBLOCK:00000000
   +000035  CURRBLKSIZE:00000000    LASTBLKSIZE:00000000
   +00003D  HIGHMAJOR:00000000      RELRECNUM:00000000
   +000045  MAXFTELLBLK:00000001    RECBITS:FFFFFF00
   +00004D  RECSPERBLOCK:00000700   SAVECHAR:00000100       FLAGS1:72000000

     OSIO:  2135BB18
   +000000  OSIO_EYE:OSIO     DCBW:00012DC0     DCBRU:00000000
   +00000C  JFCB:00012E28     CURRMBUF:00000000       MBUFCOUNT:00000001
   +000018  READMAX:00000000        CURBLKNUM:FFFFFFFF
   +000020  LASTBLKNUM:FFFFFFFF     BLKSPERTRK:0000   OSIO_ACCESS_METHOD:01
   +000027  OSIO_NOSEEK_TO_SEEK:00  FIRSTPOS:00000100
   +00002C  LASTPOS:00000100        NEWPOS:00000000   READFUNCNUM:00000002
   +000038  WRITEFUNCNUM:00000005   FCB:2135B910      PARENT:2135BB18
   +000044  FLAGS1:85020000   DCBERU:00000000   DCBEW:2135BB80
```

```
   +000050  OSIO_VOLSEQ:0000  OSIO_NEWVOLSEQ:0000     OSIO_EXT:00000000
   +000058  OSIO_HIGHVOL:0000       APPENDEDLASTVOLSEQ:0000
   +00005C  OSIO_JFCBX:00000000

     DCB:  00012DC0
   +000000  DCBRELAD:2135BB80       DCBFDAD:00000000 09000D00
   +000014  DCBBUFNO:00       DCBSRG1:40  DCBEODAD:000000   DCBRECFM:80
   +000025  DCBEXLSA:0127D0   DCBDDNAM:.4....a.       DCBMACR1:65
   +000033  DCBMACR2:B8       DCBSYNAD:000000   DCBBLKSI:0050     DCBNCP:01
   +000052  DCBLRECL:0050
```

```
      DCBE:  2135BB80
   +000000  DCBEID:DCBE       DCBELEN:0038      RESERVED0:0000
   +000008  DCBEDCB:00012DC0        DCBERELA:00000000       DCBEFLG1:C0
   +000011  DCBEFLG2:88       DCBENSTR:0000     DCBEFLG3:00
   +000024  DCBESIZE:00000000       DCBEEODA:20E6269A
   +00002C  DCBESYNA:20E6263C       MULTSDN:00

     JFCB:  00012E28
   +000000  JFCBDSNM:CHARUM.H.I
   +00002C  JFCBELNM:               JFCBTSDM:80       JFCBDSCB:002214
   +000046  JFCBVLSQ:0000     JFCBIND1:00       JFCBIND2:40
   +000058  JFCBUFNO:00       JFCDSRG1:00       JFCDSRG2:00
   +000064  JFCRECFM:00       JFCBLKSI:0000     JFCLRECL:0000     JFCNCP:00
   +000075  JFCBNVOL:01       JFCBNVOLS:SL8B14
   +000094  JFCBEXTL:00       JFCBEXAD:000B3F   JFCFLGS1:00
   +0000AE  JFCBVLCT:01

     FFIL:  2135BBC0
   +000000  MARKER1:AFCB      FILE:00000000     __FP:2135BBE0
   +00000C  MARKER2:AFCBAFCB        FF_FLAGS:01000000
   +000014  FCBMUTEX:00000000       THREADID:00000000 00000000

    File name: CHARUM.I.J

      FCB:  2135BBE0
   +000000  BUFPTR:00000000   COUNTIN:00000000        COUNTOUT:00000000
   +00000C  READFUNC:2135BCB0       WRITEFUNC:2135BCD0      FLAGS1:8000
   +000016  DEPTH:0000  NAME:2135BD9C      _LENGTH:0000000A
   +000020  _BUFSIZE:00000044       MEMBER:........   NEXT:2135BEB0
   +000030  PREV:2135B910     PARENT:2135BBE0   CHILD:00000000
   +00003C  DDNAME:SYS00017   FD:FFFFFFFF       DEVTYPE:00  FCBTYPE:0036
   +00004C  FSCE:2135BD14     UNGETBUF:2135BD14       REPOS:20F5BFD0
   +000058  GETPOS:20F5C2E0   CLOSE:20FA16C0    FLUSH:20F5BF58
   +000064  UTILITY:20FA0550        USERBUF:00000000        LRECL:00000404
   +000070  BLKSIZE:00000408        REALBUFPTR:00000000
   +000078  UNGETCOUNT:00000000     BUFSIZE:00000409        BUF:00000000
   +000084  CURSOR:00000000   ENDOFDATA:00000000      SAVEDBUF:00000000
   +000090  REALCOUNTIN:00000000    REALCOUNTOUT:00000000
   +000098  POSMAJOR:00000000       SAVEMAJOR:00000000
   +0000A0  POSMINOR:00000000       SAVEMINOR:00000000      STATE:0000
   +0000AA  SAVESTATE:0000    EXITFTELL:00000000      EXITUNGETC:20F481E8
   +0000B4  DBCSTART:00000000       UTILITYAREA:00000000
   +0000BC  INTERCEPT:00000000      FLAGS2:02120020 20440100
   +0000C8  DBCSSTATE:0000    FCB_CPCB:20C0DEA8
   +0000D0  READGLUE:58FF0008 07FF0000    READ:20F48580
   +0000DC  RADDR_WSA:00000000      _GETFN:00000000   RDLL_INDEX:00000000
   +0000E8  RCEESG003:00000000      RWSA:00000000
   +0000F0  WRITEGLUE:58FF0008 07FF0000   WRITE:20F5C620
   +0000FC  WADDR_WSA:00000000      _GETFN:00000000   WDLL_INDEX:00000000
   +000108  WCEESG003:00000000      WWSA:00000000

     OSVF:  2135BD14
   +000000  OSVF_EYE:OSVF     READ:20F48580     WRITE:20FA8D58
   +00000C  REPOS:20FA4BD8    GETPOS:20FA84E0   CLOSE:20FA16C0
   +000018  FLUSH:20FA3FD0    UTILITY:20FA0550        EXITFTELL:00000000
   +000024  EXITUNGETC:20F481E8     OSIOBLK:2135BDE8
   +00002C  SAVECURSOR:00000000     NEWLINEPTR:7FFFFFFF
   +000034  CURBLKSIZE:00000000     LASTBLKSIZE:00000000
   +00003C  HIGHMAJOR:00000000      MAXFTELLBLK:001FFFFF
   +000044  RECBITS:0000000B        FLAGS:73100000    RECLEN:00000000
   +000050  CURRBLKNUM:00000000     LASTBLKNUM:00000000
   +000058  OSWRITETOK:00000000     RECCOUNTOUT1:00000000
   +000060  BLKCOUNTOUT1:00000000   SAVECOUNTOUT:00000000   SDWCODE:0000
   +00006A  SAVECHAR:.  LASTTTRBLT:00000000     LASTWRTSIZE:00000000
   +000073  LRECLUSED:00000000      OLDLRECLUSED:00000000
   +00007B  READERCOUNT:00000000    UNWRITTENDATA:00000000
   +000083  MINRECLEN:00000000
```

```
   OSIO:  2135BDE8
  +000000  OSIO_EYE:OSIO      DCBW:00012EE0      DCBRU:00000000
  +00000C  JFCB:00012F48      CURRMBUF:00000000        MBUFCOUNT:00000001
  +000018  READMAX:00000000         CURBLKNUM:FFFFFFFF
  +000020  LASTBLKNUM:FFFFFFFF      BLKSPERTRK:0000   OSIO_ACCESS_METHOD:01
  +000027  OSIO_NOSEEK_TO_SEEK:00  FIRSTPOS:00000100
  +00002C  LASTPOS:00000100         NEWPOS:00000000   READFUNCNUM:00000002
  +000038  WRITEFUNCNUM:00000005   FCB:2135BBE0       PARENT:2135BDE8
  +000044  FLAGS1:81020000   DCBERU:00000000   DCBEW:2135BE50
  +000050  OSIO_VOLSEQ:0000  OSIO_NEWVOLSEQ:0000      OSIO_EXT:00000000
  +000058  OSIO_HIGHVOL:0000        APPENDEDLASTVOLSEQ:0000
  +00005C  OSIO_JFCBX:00000000

    DCB:  00012EE0
  +000000  DCBRELAD:2135BE50        DCBFDAD:00000000 23000300
  +000014  DCBBUFNO:00       DCBSRG1:40  DCBEODAD:000000   DCBRECFM:40
  +000025  DCBEXLSA:0127D0   DCBDDNAM:......bm        DCBMACR1:65
  +000033  DCBMACR2:B8       DCBSYNAD:000000   DCBBLKSI:0408     DCBNCP:01
  +000052  DCBLRECL:0404

   DCBE:  2135BE50
  +000000  DCBEID:DCBE       DCBELEN:0038      RESERVED0:0000
  +000008  DCBEDCB:00012EE0         DCBERELA:00000000        DCBEFLG1:C0
  +000011  DCBEFLG2:88       DCBENSTR:0000     DCBEFLG3:00
  +000024  DCBESIZE:00000000        DCBEEODA:20E6269A
  +00002C  DCBESYNA:20E6263C        MULTSDN:00

   JFCB:  00012F48
  +000000  JFCBDSNM:CHARUM.I.J
  +00002C  JFCBELNM:                JFCBTSDM:80       JFCBDSCB:002C16
  +000046  JFCBVLSQ:0000     JFCBIND1:00       JFCBIND2:40
  +000058  JFCBUFNO:00       JFCDSRG1:00       JFCDSRG2:00
  +000064  JFCRECFM:00       JFCBLKSI:0000     JFCLRECL:0000     JFCNCP:00
  +000075  JFCBNVOL:01       JFCBNVOLS:SL8D1E
  +000094  JFCBEXTL:00       JFCBEXAD:000B8F   JFCFLGS1:00
  +0000AE  JFCBVLCT:01

   FFIL:  2135BE90
  +000000  MARKER1:AFCB      FILE:00000000      __FP:2135BEB0
  +00000C  MARKER2:AFCBAFCB         FF_FLAGS:01000000
  +000014  FCBMUTEX:00000000        THREADID:00000000 00000000

   File name: CHARUM.J.K

    FCB:  2135BEB0
  +000000  BUFPTR:00000000   COUNTIN:00000000         COUNTOUT:00000000
  +00000C  READFUNC:2135BF80        WRITEFUNC:2135BFA0       FLAGS1:8000
  +000016  DEPTH:0000  NAME:2135C06C      _LENGTH:0000000A
  +000020  _BUFSIZE:00000044        MEMBER:........   NEXT:2135C180
  +000030  PREV:2135BBE0     PARENT:2135BEB0   CHILD:00000000
  +00003C  DDNAME:SYS00018   FD:FFFFFFFF       DEVTYPE:00  FCBTYPE:0042
  +00004C  FSCE:2135BFE4     UNGETBUF:2135BFE4        REPOS:20F5D0A0
  +000058  GETPOS:20F5D2D0   CLOSE:20FBBBE0    FLUSH:20F5D028
  +000064  UTILITY:20FBB708         USERBUF:00000000         LRECL:00000000
  +000070  BLKSIZE:00001800         REALBUFPTR:00000000
  +000078  UNGETCOUNT:00000000      BUFSIZE:00001801         BUF:00000000
```

```
  +000084  CURSOR:00000000   ENDOFDATA:00000000       SAVEDBUF:00000000
  +000090  REALCOUNTIN:00000000     REALCOUNTOUT:00000000
  +000098  POSMAJOR:00000000        SAVEMAJOR:00000000
  +0000A0  POSMINOR:00000000        SAVEMINOR:00000000       STATE:0000
  +0000AA  SAVESTATE:0000    EXITFTELL:00000000       EXITUNGETC:20F481E8
  +0000B4  DBCSTART:00000000        UTILITYAREA:00000000
  +0000BC  INTERCEPT:00000000       FLAGS2:02220020 60440100
  +0000C8  DBCSSTATE:0000    FCB_CPCB:20C0DEA8
  +0000D0  READGLUE:58FF0008 07FF0000    READ:20F48580
  +0000DC  RADDR_WSA:00000000       _GETFN:00000000   RDLL_INDEX:00000000
  +0000E8  RCEESG003:00000000       RWSA:00000000
  +0000F0  WRITEGLUE:58FF0008 07FF0000   WRITE:20F5D4E8
  +0000FC  WADDR_WSA:00000000       _GETFN:00000000   WDLL_INDEX:00000000
  +000108  WCEESG003:00000000       WWSA:00000000

   OSUT:  2135BFE4
  +000000  OSUT_EYE:OSUT     READ:20F48580     WRITE:20FBE8B0
  +00000C  REPOS:20FBCAD0    GETPOS:20FBDEC8   CLOSE:00000000
  +000018  FLUSH:20FBC5C0    UTILITY:20FBB708         EXITFTELL:00000000
  +000024  EXITUNGETC:20F481E8      OSIOBLK:2135C0B8
  +00002C  NEWLINEPTR:00000000      MAXFTELLBLK:0007FFFF
  +000034  RECBITS:0000000D         FLAGS:E0000000
```

```
    OSIO:  2135C0B8
  +000000  OSIO_EYE:OSIO     DCBW:00014020     DCBRU:00000000
  +00000C  JFCB:00014088     CURRMBUF:00000000       MBUFCOUNT:00000001
  +000018  READMAX:00000000        CURBLKNUM:FFFFFFFF
  +000020  LASTBLKNUM:FFFFFFFF     BLKSPERTRK:0000   OSIO_ACCESS_METHOD:01
  +000027  OSIO_NOSEEK_TO_SEEK:00  FIRSTPOS:00000100
  +00002C  LASTPOS:00000100        NEWPOS:00000000   READFUNCNUM:00000002
  +000038  WRITEFUNCNUM:00000005   FCB:2135BEB0      PARENT:2135C0B8
  +000044  FLAGS1:81020000   DCBERU:00000000   DCBEW:2135C120
  +000050  OSIO_VOLSEQ:0000  OSIO_NEWVOLSEQ:0000     OSIO_EXT:00000000
  +000058  OSIO_HIGHVOL:0000       APPENDEDLASTVOLSEQ:0000
  +00005C  OSIO_JFCBX:00000000

     DCB:  00014020
  +000000  DCBRELAD:2135C120       DCBFDAD:00000000 10000C00
  +000014  DCBBUFNO:00       DCBSRG1:40  DCBEODAD:000000   DCBRECFM:C0
  +000025  DCBEXLSA:0127D0   DCBDDNAM:......c.       DCBMACR1:65
  +000033  DCBMACR2:B8       DCBSYNAD:000000   DCBBLKSI:1800     DCBNCP:01
  +000052  DCBLRECL:0000

    DCBE:  2135C120
  +000000  DCBEID:DCBE       DCBELEN:0038      RESERVED0:0000
  +000008  DCBEDCB:00014020        DCBERELA:00000000       DCBEFLG1:C0
  +000011  DCBEFLG2:88       DCBENSTR:0000     DCBEFLG3:00
  +000024  DCBESIZE:00000000       DCBEEODA:20E6269A
  +00002C  DCBESYNA:20E6263C       MULTSDN:00

    JFCB:  00014088
  +000000  JFCBDSNM:CHARUM.J.K
  +00002C  JFCBELNM:               JFCBTSDM:80       JFCBDSCB:002B0D
  +000046  JFCBVLSQ:0000     JFCBIND1:00       JFCBIND2:40
  +000058  JFCBUFNO:00       JFCDSRG1:00       JFCDSRG2:00
  +000064  JFCRECFM:00       JFCBLKSI:0000     JFCLRECL:0000     JFCNCP:00
  +000075  JFCBNVOL:01       JFCBNVOLS:SL8D1C
  +000094  JFCBEXTL:00       JFCBEXAD:000BDF   JFCFLGS1:00
  +0000AE  JFCBVLCT:01
```

```
    FFIL:  2135C160
  +000000  MARKER1:AFCB      FILE:00000000     __FP:2135C180
  +00000C  MARKER2:AFCBAFCB        FF_FLAGS:01000000
  +000014  FCBMUTEX:00000000       THREADID:00000000 00000000

   File name: CHARUM.K.L

     FCB:  2135C180
  +000000  BUFPTR:00000000   COUNTIN:00000000        COUNTOUT:00000000
  +00000C  READFUNC:2135C250       WRITEFUNC:2135C270      FLAGS1:0000
  +000016  DEPTH:0000  NAME:2135C33C      _LENGTH:0000000A
  +000020  _BUFSIZE:00000044       MEMBER:........   NEXT:2135C450
  +000030  PREV:2135BEB0     PARENT:2135C180   CHILD:00000000
  +00003C  DDNAME:SYS00019   FD:FFFFFFFF       DEVTYPE:00  FCBTYPE:0053
  +00004C  FSCE:2135C2B4     UNGETBUF:2135C2B4       REPOS:20F5F2A0
  +000058  GETPOS:20F48330   CLOSE:20FD8658    FLUSH:20F5F3A8
  +000064  UTILITY:20F5F160        USERBUF:00000000        LRECL:00000050
  +000070  BLKSIZE:00000050        REALBUFPTR:00000000
  +000078  UNGETCOUNT:00000000     BUFSIZE:00000051        BUF:00000000
  +000084  CURSOR:00000000   ENDOFDATA:00000000      SAVEDBUF:00000000
  +000090  REALCOUNTIN:00000000    REALCOUNTOUT:00000000
  +000098  POSMAJOR:00000000       SAVEMAJOR:00000000
  +0000A0  POSMINOR:00000000       SAVEMINOR:00000000      STATE:0000
  +0000AA  SAVESTATE:0000    EXITFTELL:20F482A8      EXITUNGETC:20F481E8
  +0000B4  DBCSTART:00000000       UTILITYAREA:00000000
  +0000BC  INTERCEPT:00000000      FLAGS2:02120020 404A9100
  +0000C8  DBCSSTATE:0000    FCB_CPCB:20C0DEA8
  +0000D0  READGLUE:58FF0008 07FF0000    READ:20F48580
  +0000DC  RADDR_WSA:00000000      _GETFN:00000000   RDLL_INDEX:00000000
  +0000E8  RCEESG003:00000000      RWSA:00000000
  +0000F0  WRITEGLUE:58FF0008 07FF0000   WRITE:20FD8E88
  +0000FC  WADDR_WSA:00000000      _GETFN:00000000   WDLL_INDEX:00000000
  +000108  WCEESG003:00000000      WWSA:00000000

    OSNS:  2135C2B4
  +000000  OSNS_EYE:OSNS     READ:20F48580     WRITE:20FD88B8
  +00000C  REPOS:20F5F588    GETPOS:20F48330   CLOSE:20FD8658
  +000018  FLUSH:20FD87F0    UTILITY:213126A0        EXITFTELL:20F482A8
  +000024  EXITUNGETC:20F481E8     OSIOBLK:2135C388
  +00002C  NEWLINEPTR:00000000     RECLENGTH:00000050      FLAGS:81000000

    OSIO:  2135C388
  +000000  OSIO_EYE:OSIO     DCBW:00014140     DCBRU:00000000
  +00000C  JFCB:000141A8     CURRMBUF:00000000       MBUFCOUNT:00000000
```

```
    +000018  READMAX:00000000        CURBLKNUM:FFFFFFFF
    +000020  LASTBLKNUM:FFFFFFFF     BLKSPERTRK:0000   OSIO_ACCESS_METHOD:02
    +000027  OSIO_NOSEEK_TO_SEEK:00  FIRSTPOS:00000000
    +00002C  LASTPOS:00000000        NEWPOS:00000000   READFUNCNUM:00000002
    +000038  WRITEFUNCNUM:00000005   FCB:2135C180      PARENT:2135C388
    +000044  FLAGS1:81000000   DCBERU:00000000   DCBEW:2135C3F0
    +000050  OSIO_VOLSEQ:0000  OSIO_NEWVOLSEQ:0000     OSIO_EXT:00000000
    +000058  OSIO_HIGHVOL:0000       APPENDEDLASTVOLSEQ:0000
    +00005C  OSIO_JFCBX:00000000

      DCB:  00014140
    +000000  DCBRELAD:2135C3F0       DCBFDAD:00000000 0A000A00
    +000014  DCBBUFNO:05       DCBSRG1:40  DCBEODAD:000000   DCBRECFM:80
    +000025  DCBEXLSA:0127D0   DCBDDNAM:...&..gM       DCBMACR1:A0
    +000033  DCBMACR2:58       DCBSYNAD:000000   DCBBLKSI:0050     DCBNCP:21
    +000052  DCBLRECL:0050
```

```
      DCBE:  2135C3F0
    +000000  DCBEID:DCBE       DCBELEN:0038      RESERVED0:0000
    +000008  DCBEDCB:00014140        DCBERELA:00000000       DCBEFLG1:C0
    +000011  DCBEFLG2:88       DCBENSTR:0000     DCBEFLG3:80
    +000024  DCBESIZE:00000000       DCBEEODA:20E6269A
    +00002C  DCBESYNA:20E6263C       MULTSDN:00

      JFCB:  000141A8
    +000000  JFCBDSNM:CHARUM.K.L
    +00002C  JFCBELNM:               JFCBTSDM:80       JFCBDSCB:004610
    +000046  JFCBVLSQ:0000     JFCBIND1:00       JFCBIND2:40
    +000058  JFCBUFNO:00       JFCDSRG1:00       JFCDSRG2:00
    +000064  JFCRECFM:00       JFCBLKSI:0000     JFCLRECL:0000     JFCNCP:00
    +000075  JFCBNVOL:01       JFCBNVOLS:SL8818
    +000094  JFCBEXTL:00       JFCBEXAD:000C2F   JFCFLGS1:00
    +0000AE  JFCBVLCT:01

      FFIL:  2135C430
    +000000  MARKER1:AFCB      FILE:00000000     __FP:2135C450
    +00000C  MARKER2:AFCBAFCB        FF_FLAGS:01000000
    +000014  FCBMUTEX:00000000       THREADID:00000000 00000000

     File name: CHARUM.L.M

       FCB:  2135C450
    +000000  BUFPTR:00000000   COUNTIN:00000000        COUNTOUT:00000000
    +00000C  READFUNC:2135C520       WRITEFUNC:2135C540      FLAGS1:0000
    +000016  DEPTH:0000  NAME:2135C60C      _LENGTH:0000000A
    +000020  _BUFSIZE:00000044       MEMBER:........   NEXT:2135C720
    +000030  PREV:2135C180     PARENT:2135C450   CHILD:00000000
    +00003C  DDNAME:SYS00020   FD:FFFFFFFF       DEVTYPE:00  FCBTYPE:0046
    +00004C  FSCE:2135C584     UNGETBUF:2135C584       REPOS:20FD0D10
    +000058  GETPOS:20FD1240   CLOSE:20FCD070    FLUSH:20FD0CB0
    +000064  UTILITY:20FD07B0        USERBUF:00000000        LRECL:00000050
    +000070  BLKSIZE:00000050        REALBUFPTR:00000000
    +000078  UNGETCOUNT:00000000     BUFSIZE:00000050        BUF:00000000
    +000084  CURSOR:00000000   ENDOFDATA:00000000      SAVEDBUF:00000000
    +000090  REALCOUNTIN:00000000    REALCOUNTOUT:00000000
    +000098  POSMAJOR:00000000       SAVEMAJOR:00000000
    +0000A0  POSMINOR:00000000       SAVEMINOR:00000000      STATE:0000
    +0000AA  SAVESTATE:0000    EXITFTELL:00000000      EXITUNGETC:20F481E8
    +0000B4  DBCSTART:00000000       UTILITYAREA:00000000
    +0000BC  INTERCEPT:00000000      FLAGS2:00120020 40461100
    +0000C8  DBCSSTATE:0000    FCB_CPCB:20C0DEA8
    +0000D0  READGLUE:58FF0008 07FF0000    READ:20F48580
    +0000DC  RADDR_WSA:00000000      _GETFN:00000000   RDLL_INDEX:00000000
    +0000E8  RCEESG003:00000000      RWSA:00000000
    +0000F0  WRITEGLUE:58FF0008 07FF0000   WRITE:20FD16E0
    +0000FC  WADDR_WSA:00000000      _GETFN:00000000   WDLL_INDEX:00000000
    +000108  WCEESG003:00000000      WWSA:00000000

      OSFS:  2135C584
    +000000  OSFS_EYE:OSFS     READ:20F48580     WRITE:20FCFA28
    +00000C  REPOS:20FCD838    GETPOS:20FCF4C8   CLOSE:00000000
    +000018  FLUSH:20FCD3E8    UTILITY:213126A0        EXITFTELL:00000000
    +000024  EXITUNGETC:20F481E8     OSIOBLK:2135C658        SAVECURSOR:00
    +00002D  NEWLINEPTR:00000000     ENDOFBLOCK:00000000
    +000035  CURRBLKSIZE:00000000    LASTBLKSIZE:00000000
    +00003D  HIGHMAJOR:00000000      RELRECNUM:00000000
    +000045  MAXFTELLBLK:00000000    RECBITS:00000000
    +00004D  RECSPERBLOCK:00000000   SAVECHAR:00000100       FLAGS1:72000000

      OSIO:  2135C658
    +000000  OSIO_EYE:OSIO     DCBW:00014260     DCBRU:00000000
```

```
  +00000C  JFCB:000142C8     CURRMBUF:00000000       MBUFCOUNT:00000001
  +000018  READMAX:00000000        CURBLKNUM:FFFFFFFF
  +000020  LASTBLKNUM:FFFFFFFF     BLKSPERTRK:0000   OSIO_ACCESS_METHOD:01
  +000027  OSIO_NOSEEK_TO_SEEK:00  FIRSTPOS:00000100
```

```
  +00002C  LASTPOS:00000100        NEWPOS:00000000   READFUNCNUM:00000002
  +000038  WRITEFUNCNUM:00000005   FCB:2135C450      PARENT:2135C658
  +000044  FLAGS1:85020000   DCBERU:00000000   DCBEW:2135C6C0
  +000050  OSIO_VOLSEQ:0000  OSIO_NEWVOLSEQ:0000     OSIO_EXT:00000000
  +000058  OSIO_HIGHVOL:0000       APPENDEDLASTVOLSEQ:0000
  +00005C  OSIO_JFCBX:00000000

     DCB:  00014260
  +000000  DCBRELAD:2135C6C0       DCBFDAD:00000000 22000100
  +000014  DCBBUFNO:00       DCBSRG1:40  DCBEODAD:000000   DCBRECFM:80
  +000025  DCBEXLSA:0127D0   DCBDDNAM:......g<       DCBMACR1:65
  +000033  DCBMACR2:B8       DCBSYNAD:000000   DCBBLKSI:0050     DCBNCP:01
  +000052  DCBLRECL:0050

    DCBE:  2135C6C0
  +000000  DCBEID:DCBE       DCBELEN:0038      RESERVED0:0000
  +000008  DCBEDCB:00014260        DCBERELA:00000000       DCBEFLG1:C0
  +000011  DCBEFLG2:88       DCBENSTR:0000     DCBEFLG3:00
  +000024  DCBESIZE:00000000       DCBEEODA:20E6269A
  +00002C  DCBESYNA:20E6263C       MULTSDN:00

    JFCB:  000142C8
  +000000  JFCBDSNM:CHARUM.L.M
  +00002C  JFCBELNM:               JFCBTSDM:80       JFCBDSCB:004309
  +000046  JFCBVLSQ:0000     JFCBIND1:00       JFCBIND2:40
  +000058  JFCBUFNO:00       JFCDSRG1:00       JFCDSRG2:00
  +000064  JFCRECFM:00       JFCBLKSI:0000     JFCLRECL:0000     JFCNCP:00
  +000075  JFCBNVOL:01       JFCBNVOLS:SL620C
  +000094  JFCBEXTL:00       JFCBEXAD:000C7F   JFCFLGS1:00
  +0000AE  JFCBVLCT:01

    FFIL:  2135C700
  +000000  MARKER1:AFCB      FILE:00000000     __FP:2135C720
  +00000C  MARKER2:AFCBAFCB        FF_FLAGS:01000000
  +000014  FCBMUTEX:00000000       THREADID:00000000 00000000

   File name: CHARUM.M.N

     FCB:  2135C720
  +000000  BUFPTR:00000000   COUNTIN:00000000        COUNTOUT:00000000
  +00000C  READFUNC:2135C7F0       WRITEFUNC:2135C810      FLAGS1:0000
  +000016  DEPTH:0000  NAME:2135C8DC      _LENGTH:0000000A
  +000020  _BUFSIZE:00000044       MEMBER:........   NEXT:2135C9F0
  +000030  PREV:2135C450     PARENT:2135C720   CHILD:00000000
  +00003C  DDNAME:SYS00021   FD:FFFFFFFF       DEVTYPE:00  FCBTYPE:004C
  +00004C  FSCE:2135C854     UNGETBUF:2135C854       REPOS:20F5E880
  +000058  GETPOS:20F5EA80   CLOSE:20FD3118    FLUSH:20F5E818
  +000064  UTILITY:213126A0        USERBUF:00000000        LRECL:00000404
  +000070  BLKSIZE:00000408        REALBUFPTR:00000000
  +000078  UNGETCOUNT:00000000     BUFSIZE:00000408        BUF:00000000
  +000084  CURSOR:00000000   ENDOFDATA:00000000      SAVEDBUF:00000000
  +000090  REALCOUNTIN:00000000    REALCOUNTOUT:00000000
  +000098  POSMAJOR:00000000       SAVEMAJOR:00000000
  +0000A0  POSMINOR:00000000       SAVEMINOR:00000000      STATE:0000
  +0000AA  SAVESTATE:0000    EXITFTELL:00000000      EXITUNGETC:20F481E8
  +0000B4  DBCSTART:00000000       UTILITYAREA:00000000
  +0000BC  INTERCEPT:00000000      FLAGS2:02120000 20461100
  +0000C8  DBCSSTATE:0000    FCB_CPCB:20C0DEA8
  +0000D0  READGLUE:58FF0008 07FF0000    READ:20F48580
  +0000DC  RADDR_WSA:00000000      _GETFN:00000000   RDLL_INDEX:00000000
  +0000E8  RCEESG003:00000000      RWSA:00000000
  +0000F0  WRITEGLUE:58FF0008 07FF0000   WRITE:20F5EC68
  +0000FC  WADDR_WSA:00000000      _GETFN:00000000   WDLL_INDEX:00000000
  +000108  WCEESG003:00000000      WWSA:00000000
```

```
    OSFS:  2135C854
  +000000  OSFS_EYE:OSFS     READ:20F48580     WRITE:20FD5EC0
  +00000C  REPOS:20FD3788    GETPOS:20FD5890   CLOSE:00000000
  +000018  FLUSH:20FD3428    UTILITY:213126A0        EXITFTELL:00000000
  +000024  EXITUNGETC:20F481E8     OSIOBLK:2135C928        SAVECURSOR:00
  +00002D  NEWLINEPTR:00000000     ENDOFBLOCK:00000000
  +000035  CURRBLKSIZE:00000000    LASTBLKSIZE:00000000
  +00003D  HIGHMAJOR:00000000      RELRECNUM:00000000
  +000045  MAXFTELLBLK:00000000    RECBITS:00000000
  +00004D  RECSPERBLOCK:00000000   SAVECHAR:00000000       FLAGS1:72000000
```

```
  OSIO:  2135C928
+000000  OSIO_EYE:OSIO     DCBW:00014380     DCBRU:00000000
+00000C  JFCB:000143E8     CURRMBUF:00000000       MBUFCOUNT:00000001
+000018  READMAX:00000000        CURBLKNUM:FFFFFFFF
+000020  LASTBLKNUM:FFFFFFFF     BLKSPERTRK:0000   OSIO_ACCESS_METHOD:01
+000027  OSIO_NOSEEK_TO_SEEK:00  FIRSTPOS:00000100
+00002C  LASTPOS:00000100        NEWPOS:00000000   READFUNCNUM:00000002
+000038  WRITEFUNCNUM:00000005   FCB:2135C720      PARENT:2135C928
+000044  FLAGS1:81020000   DCBERU:00000000   DCBEW:2135C990
+000050  OSIO_VOLSEQ:0000  OSIO_NEWVOLSEQ:0000     OSIO_EXT:00000000
+000058  OSIO_HIGHVOL:0000       APPENDEDLASTVOLSEQ:0000
+00005C  OSIO_JFCBX:00000000

   DCB:  00014380
+000000  DCBRELAD:2135C990       DCBFDAD:00000000 D9000200
+000014  DCBBUFNO:00       DCBSRG1:40  DCBEODAD:000000   DCBRECFM:40
+000025  DCBEXLSA:0127D0   DCBDDNAM:......h.       DCBMACR1:65
+000033  DCBMACR2:B8       DCBSYNAD:000000   DCBBLKSI:0408     DCBNCP:01
+000052  DCBLRECL:0404

  DCBE:  2135C990
+000000  DCBEID:DCBE       DCBELEN:0038      RESERVED0:0000
+000008  DCBEDCB:00014380        DCBERELA:00000000       DCBEFLG1:C0
+000011  DCBEFLG2:88       DCBENSTR:0000     DCBEFLG3:00
+000024  DCBESIZE:00000000       DCBEEODA:20E6269A
+00002C  DCBESYNA:20E6263C       MULTSDN:00

  JFCB:  000143E8
+000000  JFCBDSNM:CHARUM.M.N
+00002C  JFCBELNM:               JFCBTSDM:80       JFCBDSCB:013609
+000046  JFCBVLSQ:0000     JFCBIND1:00       JFCBIND2:40
+000058  JFCBUFNO:00       JFCDSRG1:00       JFCDSRG2:00
+000064  JFCRECFM:00       JFCBLKSI:0000     JFCLRECL:0000     JFCNCP:00
+000075  JFCBNVOL:01       JFCBNVOLS:SL4A05
+000094  JFCBEXTL:00       JFCBEXAD:000CCF   JFCFLGS1:00
+0000AE  JFCBVLCT:01

  FFIL:  2135C9D0
+000000  MARKER1:AFCB      FILE:00000000     __FP:2135C9F0
+00000C  MARKER2:AFCBAFCB        FF_FLAGS:01000000
+000014  FCBMUTEX:00000000       THREADID:00000000 00000000
 File name: CHARUM.N.O

   FCB:  2135C9F0
+000000  BUFPTR:00000000   COUNTIN:00000000        COUNTOUT:00000000
+00000C  READFUNC:2135CAC0       WRITEFUNC:2135CAE0      FLAGS1:0000
+000016  DEPTH:0000  NAME:2135CBAC      _LENGTH:0000000A
+000020  _BUFSIZE:00000044       MEMBER:........   NEXT:20C0E148
+000030  PREV:2135C720     PARENT:2135C9F0   CHILD:00000000
+00003C  DDNAME:SYS00022   FD:FFFFFFFF       DEVTYPE:00  FCBTYPE:0054
+00004C  FSCE:2135CB24     UNGETBUF:2135CB24       REPOS:20FDB888
+000058  GETPOS:20FDBAA0   CLOSE:20FD9EC0    FLUSH:20FDB828
+000064  UTILITY:20FDB5D8        USERBUF:00000000        LRECL:00000000
+000070  BLKSIZE:00001800        REALBUFPTR:00000000
+000078  UNGETCOUNT:00000000     BUFSIZE:00001800        BUF:00000000
+000084  CURSOR:00000000   ENDOFDATA:00000000      SAVEDBUF:00000000
+000090  REALCOUNTIN:00000000    REALCOUNTOUT:00000000
+000098  POSMAJOR:00000000       SAVEMAJOR:00000000
```

```
+0000A0  POSMINOR:00000000       SAVEMINOR:00000000      STATE:0000
+0000AA  SAVESTATE:0000    EXITFTELL:00000000      EXITUNGETC:20F481E8
+0000B4  DBCSTART:00000000       UTILITYAREA:00000000
+0000BC  INTERCEPT:00000000      FLAGS2:02120020 60461100
+0000C8  DBCSSTATE:0000    FCB_CPCB:20C0DEA8
+0000D0  READGLUE:58FF0008 07FF0000    READ:20F48580
+0000DC  RADDR_WSA:00000000      _GETFN:00000000   RDLL_INDEX:00000000
+0000E8  RCEESG003:00000000      RWSA:00000000
+0000F0  WRITEGLUE:58FF0008 07FF0000   WRITE:20FDBC88
+0000FC  WADDR_WSA:00000000      _GETFN:00000000   WDLL_INDEX:00000000
+000108  WCEESG003:00000000      WWSA:00000000

  OSFS:  2135CB24
+000000  OSFS_EYE:OSFS     READ:20F48580     WRITE:20FDAF60
+00000C  REPOS:20FDA1A0    GETPOS:20FDAC30   CLOSE:00000000
+000018  FLUSH:20FDA078    UTILITY:213126A0        EXITFTELL:00000000
+000024  EXITUNGETC:20F481E8     OSIOBLK:2135CBF8        SAVECURSOR:00
+00002D  NEWLINEPTR:00000000     ENDOFBLOCK:00000000
+000035  CURRBLKSIZE:00000000    LASTBLKSIZE:00000000
+00003D  HIGHMAJOR:00000000      RELRECNUM:00000000
+000045  MAXFTELLBLK:00000000    RECBITS:00000000
```

```
   +00004D  RECSPERBLOCK:00000000   SAVECHAR:00000000       FLAGS1:72000000

     OSIO:  2135CBF8
   +000000  OSIO_EYE:OSIO     DCBW:000144A0     DCBRU:00000000
   +00000C  JFCB:00014508     CURRMBUF:00000000       MBUFCOUNT:00000001
   +000018  READMAX:00000000        CURBLKNUM:FFFFFFFF
   +000020  LASTBLKNUM:FFFFFFFF     BLKSPERTRK:0000   OSIO_ACCESS_METHOD:01
   +000027  OSIO_NOSEEK_TO_SEEK:00  FIRSTPOS:00000100
   +00002C  LASTPOS:00000100        NEWPOS:00000000   READFUNCNUM:00000002
   +000038  WRITEFUNCNUM:00000005   FCB:2135C9F0      PARENT:2135CBF8
   +000044  FLAGS1:81020000   DCBERU:00000000   DCBEW:2135CC60
   +000050  OSIO_VOLSEQ:0000  OSIO_NEWVOLSEQ:0000     OSIO_EXT:00000000
   +000058  OSIO_HIGHVOL:0000       APPENDEDLASTVOLSEQ:0000
   +00005C  OSIO_JFCBX:00000000

      DCB:  000144A0
   +000000  DCBRELAD:2135CC60       DCBFDAD:00000000 22000600
   +000014  DCBBUFNO:00       DCBSRG1:40  DCBEODAD:000000   DCBRECFM:C0
   +000025  DCBEXLSA:0127D0   DCBDDNAM:.%....im       DCBMACR1:65
   +000033  DCBMACR2:B8       DCBSYNAD:000000   DCBBLKSI:1800     DCBNCP:01
   +000052  DCBLRECL:0000

     DCBE:  2135CC60
   +000000  DCBEID:DCBE       DCBELEN:0038      RESERVED0:0000
   +000008  DCBEDCB:000144A0        DCBERELA:00000000       DCBEFLG1:C0
   +000011  DCBEFLG2:88       DCBENSTR:0000     DCBEFLG3:00
   +000024  DCBESIZE:00000000       DCBEEODA:20E6269A
   +00002C  DCBESYNA:20E6263C       MULTSDN:00

     JFCB:  00014508
   +000000  JFCBDSNM:CHARUM.N.O
   +00002C  JFCBELNM:               JFCBTSDM:80       JFCBDSCB:00471E
   +000046  JFCBVLSQ:0000     JFCBIND1:00       JFCBIND2:40
   +000058  JFCBUFNO:00       JFCDSRG1:00       JFCDSRG2:00
   +000064  JFCRECFM:00       JFCBLKSI:0000     JFCLRECL:0000     JFCNCP:00
   +000075  JFCBNVOL:01       JFCBNVOLS:SL6206
   +000094  JFCBEXTL:00       JFCBEXAD:000D1F   JFCFLGS1:00
   +0000AE  JFCBVLCT:01
```

```
Dummy FCB encountered at location 20C0E148

     AMRC:  20C0E770
   +000000  CODE:00021708     RBA:00000000      LASTOP:00000032
   +00000C  FILL_LEN:00000000       MSG_LEN:00000000
   +000014  STR1:............................................................
   +000050  STR1_CONT:............................................................
   +00008C  PARM0R0:00000000        PARMR1:00000000
   +00009C  STR2:...............................................................
   +0000DC  RPLFDBWD:00000000       XRBA:00000000 00000000
   +0000E8  AMRC_NOSEEK_TO_SEEK:00

    AMRC2:  20C0E878
   +000000  __ERROR2:00000000       __FILEPTR:00000000

    File name: CHARUM.A.B

[8]MFCB:  2135A470
   +000000  FIRSTNEBULA:2135A4E4    REFCNT:00000001   NEXTMFCB:2135A970
   +000010  WRITEFCB:2135A268       FLAG1:0001  DEPTH:0000  NAME:2135A5F0
   +00001C  NAMELENGTH:0000000A     NAMEBUFSIZE:00000044    MEMBER:........
   +00002C  NEXTFCB:00000000        PREVFCB:00000000
   +000034  PARENTFCB:2135A268      CHILDFCB:00000000
   +00003C  PREVMFCB:00000000       PARENTMFCB:2135A470
   +000044  CHILDMFCB:00000000      HIPERKEY:00000000 00000000
   +000050  CURHSPBYTES:00000000    LASTBYTE:0000     CREATELEVEL:0000
   +000058  FLAG2:00000000    LASTNEBULA:2135A4E4     LASTNEBINDEX:0001
   +000064  LASTDS:00000000   MAXHSPBYTES:00000000
   +00006C  LASTBLKOFFSET:00000000        MFCB_CPCB:20C0DEA8

    File name: CHARUM.B.C

     MFCB:  2135A970
   +000000  FIRSTNEBULA:00000000    REFCNT:00000001   NEXTMFCB:00000000
   +000010  WRITEFCB:2135A660       FLAG1:0001  DEPTH:0000  NAME:2135A9F0
   +00001C  NAMELENGTH:0000000A     NAMEBUFSIZE:00000044    MEMBER:........
   +00002C  NEXTFCB:00000000        PREVFCB:00000000
   +000034  PARENTFCB:2135A660      CHILDFCB:00000000
   +00003C  PREVMFCB:2135A470       PARENTMFCB:2135A970
   +000044  CHILDMFCB:00000000      HIPERKEY:80007400 00011F4C
   +000050  CURHSPBYTES:00020000    LASTBYTE:0000     CREATELEVEL:0000
   +000058  FLAG2:40000000    LASTNEBULA:00000000     LASTNEBINDEX:0000
```

```
   +000064  LASTDS:00000000   MAXHSPBYTES:80000000
   +00006C  LASTBLKOFFSET:00000000        MFCB_CPCB:20C0DEA8

Exiting CRTL I/O Control Blocks
Exiting Language Environment Data
```

Table 25. Contents of C/C++-specific sections of LEDATA output

Section Number and Heading	Contents
[1] CGEN	Formats the C/C++-specific portion of the Language Environment common anchor area (CAA).
[2] CGENE	Formats the extension to the C/C++-specific portion of the Language Environment common anchor area (CAA).
[3] CEDB	Formats the C/C++-specific portion of the Language Environment enclave data block (EDB).
[4] CTHD	Formats the C/C++ thread-level control block (CTHD).
[5] CPCB	Formats the C/C++-specific portion of the Language Environment process control block (PCB).
[6] CIO	Formats the C/C++ IO control block (CIO).

Table 25. Contents of C/C++-specific sections of LEDATA output (continued)

Section Number and Heading	Contents
[7] File Control Blocks	Formats the C/C++ file control block (FCB). The FCB and its related control blocks represent the information that is needed by each open stream. The following related control blocks are included. **FFIL** Formats the header of the C/C++ file control block (FCB). **FSCE** The file-specific category extension control block (FSCE), which represents the specific type of IO being performed. The following is a list of FSCEs that may be formatted; other FSCEs will be displayed using a generic overlay. **HFSF** UNIX file system file **HSPF** Hiperspace file **INTC** Intercept file **MEMF** Memory file **OSNS** OS no seek **OSFS** OS fixed text **OSVF** OS variable text **OSUT** OS undefined format text **TDQF** CICS Transient Data Queue file **TERM** Terminal file **VSAM** VSAM file **OSIO** The OS IO interface control block. **OSIOE** The OS IO extended interface control block. **DCB** The data control block. **DCBE** The data control block extension. **JFCB** The job file control block (JFCB). For more information about the JFCB, see *z/OS MVS Data Areas* in z/OS Internet library (www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosInternetLibrary). **JFCBX** The job file control block extension (JFCBX). **MBUF** The message buffer control block (MBUF).
[8] Memory File Control Blocks	This section formats the C/C++ memory file control block (MFCB).

Understanding the COBOL-specific LEDATA output

The Language Environment IPCS VERBEXIT LEDATA generates formatted output of COBOL-specific control blocks from a system dump when the COMP(COBOL), COMP(ALL) or ALL parameter is specified and COBOL is active in the dump. The following example illustrates the COBOL-specific output produced. The system dump being formatted was obtained by specifying the TERMTHDACT(UADUMP) runtime option. Table 26 on page 139 describes the information contained in the formatted output. For easy reference, the sections of the dump are numbered to correspond with the description of each section that follows.

```
********************************************************************************
                             COBOL ENVIRONMENT DATA
********************************************************************************


[1]RUNCOM:  00049038
   +000000  IDENT:C3RUNCOM    LENGTH:000002D8   FLAGS:00860000
   +000010  RU_ID:000178B0    INVK_RSA:00005F80
   +000024  MAIN_PGM_ADDR:00007DE8        MAIN_PGM_CLLE:00049328
   +00002C  ITBNAB:00000000   PARM_ADDR:000179D0      NEXT_RUNCOM:00000000
   +000040  THDCOM:0001AA80   COBVEC:0001A1BC   SUBCOM:00000000
   +00004C  COBVEC2:0001A7FC        CAA:00018920      UPSI_SWITCHES:00000000
   +00007C  DUM_CLLE:0BF15BA8       1ST_FREE_CLLE:00000000
   +000088  HAT:0BF157A8      1ST_CLLE:00049488
   +000090  SORT_CONTROL_DCB:00000000     COBOL_ACTIVE:00000000
   +0000A4  IO_FLAGS:00000000       UNSTR_WRK:00000000
   +00011C  INSP_WRK:00000000       INSP_WRK1:00000000
   +00012C  DDNAME_SORT_CONTROL:........  LEN_UNSTR_WRK:00000000
   +000138  UNSTR_DELIMS:0000
   +000154  CEEINT_PLIST:000491B0 00000008 00000006 000491B4 00000000 00000000
   +00016C  ----------->:00000005 00000000 00000000 00000000 00000000
   +0001C8  MAIN_ID:CALLSUBX
   +000204  ------>:
   +000240  ------>:

[2]THDCOM:  0001AA80
   +000000  IDENT:C3THDCOM    LENGTH:000001E8   FLAGS:81000000 00000100
   +000018  COBCOM:0001A108   COBVEC:0001A1BC   1ST_RUNCOM:00049038
   +000028  1ST_PROGRAM:CALLSUBX    SUBCOM:00000000
   +000034  CEEINT_PLIST:00000000 00000000 00000000 00000000 00000000 00000000
   +00004C  ----------->:00000000 00000000 00000000 00000000 00000000
   +000084  COBVEC2:0001A7FC        ITBLK:00000000    STT_BST:00000000
   +000098  CICS_EIB:00000000       SIBLING:00000000
   +0000AC  SORT_RETURN:00000000    INFO_MSG_LIMIT:0000
   +0000C8  R12_SAVE:00000000       STP_DUM_TGT:00000000
   +000180  LRR_COBCOM:00000000     CAA:00018920      DUM_THDCOM:00000000
   +00019C  ITBLK_TRAP_RSA:00000000       ITBLK_PLFPARMS:00000000
   +0001A4  ITBLK_BS2PARMS:00000000       ITBLK_NAB:00000000
   +0001AC  DUM_MAIN_DSA:00000000   BDY_RSA:00000000
   +0001D0  RRE_TAIL_RSA:00000000   ESTUB_TGT:00000000

[3]COBCOM:  0001A108
   +000000  IDENT:C3COBCOM    LENGTH:00000978   VERSION:010900
   +000058  FLAGS:906000      ESM_ID:O    COBVEC:0001A1BC
   +000060  COBVEC2:0001A7FC
   +000064  LOADFG:00000100 00000000 80000000 00008000 00000000
   +000078  THDCOM:0001AA80   INSH:00000000     LRR_THDCOM:00000000
   +00009C  LRR_ITBLK:00000000      LRR_SUBCOM:00000000
   +0000A4  LRR_EPLF:00000000

[4]  CLLE:  00049488
   +000000  PGMNAME:PARM5     OPEN_NON_EXT_FILES:0000       TGT_FLAGS:00
   +00000C  LANG_LST:00050F98       INFO_FLAGS:8891   LOAD_ADDR:8004FF88
   +000018  TGT_ADDR:00050248       LE_TOKEN:0BF150BC       FLAGS2:00
```

```
[5]   TGT:  00050248
   +000048  IDENT:3TGT  LVL:05      FLAGS:40020220    RUNCOM:00049038
   +00005C  COBVEC:0001A7FC   #FCBS:00000000    WS_LEN:00000000
   +000070  SMG_WRK:00000000        CAA:00018920      LEN:00000154
   +00008C  EXT_FCBS:00000000       OUTDD:SYSOUT
   +0000AC  CALC_RSA:00000000 00000000 00000000 00000000 00000000 00000000
   +0000C4  ------->:00000000 00000000 00000000 00000000 00000000 00000000
   +0000DC  ------->:00000000       ABINF:000500A5    TESTINF:00000000
   +000100  PGMADDR:0004FF88        1STFCB:00000000   WS_ADDR:00000000
   +000118  1STEXTFCB:00000000
```

```
     CLLE:  00049440
   +000000  PGMNAME:PARM1     OPEN_NON_EXT_FILES:0000       TGT_FLAGS:00
   +00000C  LANG_LST:0004EF98       INFO_FLAGS:8891   LOAD_ADDR:8004DFE0
   +000018  TGT_ADDR:0004E258       LE_TOKEN:0BF150A0       FLAGS2:00

      TGT:  0004E258
   +000048  IDENT:3TGT  LVL:05      FLAGS:40020220    RUNCOM:00049038
   +00005C  COBVEC:0001A7FC   #FCBS:00000000    WS_LEN:00000000
   +000070  SMG_WRK:00000000        CAA:00018920      LEN:00000144
   +00008C  EXT_FCBS:00000000       OUTDD:SYSOUT
   +0000AC  CALC_RSA:00000000 00000000 00000000 00000000 00000000 00000000
   +0000C4  ------->:00000000 00000000 00000000 00000000 00000000 00000000
   +0000DC  ------->:00000000       ABINF:0004E0FD    TESTINF:00000000
   +000100  PGMADDR:0004DFE0        1STFCB:00000000   WS_ADDR:00000000
   +000118  1STEXTFCB:00000000

     CLLE:  00049370
   +000000  PGMNAME:PARM0     OPEN_NON_EXT_FILES:0000       TGT_FLAGS:00
   +00000C  LANG_LST:0004CF98       INFO_FLAGS:8891   LOAD_ADDR:8004BFF8
   +000018  TGT_ADDR:0004C260       LE_TOKEN:0BF15084       FLAGS2:00

      TGT:  0004C260
   +000048  IDENT:3TGT  LVL:05      FLAGS:40020220    RUNCOM:00049038
   +00005C  COBVEC:0001A7FC   #FCBS:00000000    WS_LEN:00000000
   +000070  SMG_WRK:00000000        CAA:00018920      LEN:00000140
   +00008C  EXT_FCBS:00000000       OUTDD:SYSOUT
   +0000AC  CALC_RSA:00000000 00000000 00000000 00000000 00000000 00000000
   +0000C4  ------->:00000000 00000000 00000000 00000000 00000000 00000000
   +0000DC  ------->:00000000       ABINF:0004C115    TESTINF:00000000
   +000100  PGMADDR:0004BFF8        1STFCB:00000000   WS_ADDR:00000000
   +000118  1STEXTFCB:00000000

     CLLE:  00049328
   +000000  PGMNAME:CALLSUBX  OPEN_NON_EXT_FILES:0000       TGT_FLAGS:00
   +00000C  LANG_LST:00000000       INFO_FLAGS:9881   LOAD_ADDR:80007DE8
   +000018  TGT_ADDR:00008220       LE_TOKEN:00000000       FLAGS2:00

      TGT:  00008220
   +000048  IDENT:3TGT  LVL:05      FLAGS:60020220    RUNCOM:00049038
   +00005C  COBVEC:0001A7FC   #FCBS:00000000    WS_LEN:0000002C
   +000070  SMG_WRK:00000000        CAA:00018920      LEN:00000150
   +00008C  EXT_FCBS:00000000       OUTDD:SYSOUT
   +0000AC  CALC_RSA:00000000 00000000 00000000 00000000 00000000 00000000
   +0000C4  ------->:00000000 00000000 00000000 00000000 00000000 00000000
   +0000DC  ------->:00000000       ABINF:00007F34    TESTINF:00000000
   +000100  PGMADDR:00007DE8        1STFCB:00000000   WS_ADDR:000083C0
   +000118  1STEXTFCB:00000000

Exiting COBOL Environment Data
```

Table 26. Contents of COBOL-specific sections of LEDATA Output

Section Number and Heading	Contents
[1] RUNCOM	Formats the COBOL enclave-level control block (RUNCOM).
[2] THDCOM	Formats the COBOL process-level control block (THDCOM).
[3] COBCOM	Formats the COBOL region-level control block (COBCOM).
[4] CLLE	Formats the COBOL loaded program control blocks (CLLE).
[5] TGT	Formats the COBOL TGT control blocks.

```
********************************************************************************
                             COBOLV5+ ENVIRONMENT DATA
********************************************************************************

[1]COBEDB:  0CFE7048
   +000000  IDENT:COBEDB      LENGTH:0000011C   INPL_MAIN:0CE00000
   +000014  FLAGS:80000000    MAIN_CLLE:0CFE7C08      DUMMY_CLLE:0CFE9A08
   +000020  FREE_CLLE:00000000      CLLE_HASH:0CFE9608
   +000028  FIRST_CLLE:0D74E360     EXT_DATA_LIST:00000000
   +000030  EXT_FILE_BLOCK:00000000       EXT_FILESYNC@:00000000
   +000038  V4_EVENT_NF:0CE23EC8    V4_OTH_EVENT_NF:0CE55958
   +000040  CLLESRCH:0CED0A00       FUNCDESC:0CED0D60
   +000060  QSAM_EOD_DSP_FUNC:00000000    QSAM_GET_DSP_FUNC:00000000
   +000068  QSAM_PUT_DSP_FUNC:00000000    QSAM_PUTX_DSP_FUNC:00000000
```

```
   +000070  QSAM_UGET_DSP_FUNC:00000000   QSAM_UPUT_DSP_FUNC:00000000
   +000078  QSAM_VPUT_DSP_FUNC:00000000   QSAM_LBI_UGET_DSP_FUNC:00000000
   +000080  QSAM_LBI_UPUT_DSP_FUNC:00000000     QSAM_QULE_DSP_FUNC:00000000
   +000088  QSAM_VULE_DSP_FUNC:00000000   QSAM_EOD_DSP_EXIT:00000000
   +000090  QSAM_SYN_DSP_EXIT:00000000    VSAM_VIO_DSP_FUNC:00000000
   +000098  LSEQ_READ_DSP_FUNC:00000000   LSEQ_WRITE_DSP_FUNC:00000000
   +0000A0  LE_UPSI:F0F0F0F0 F0F0F0F0     JVM_ANCHOR:00000000
   +0000AC  THREAD_STATUS:00000000  MTX_PGM:00000000  MTX_SYSIN:00000000
   +0000B8  MTX_SYSOUT:00000000     MTX_SYSPUN:00000000
   +0000C0  MTX_CONSOLE:00000000    MTX_RANDOM:00000000     MTX_CLL:00000000
   +0000CC  MTX_MISC_EVENTS:00000000      A_THREAD_STATUS:0CFE70F4
   +0000D4  A_MTX_PGM:00000000      A_MTX_SYSIN:0CFE79E8
   +0000DC  A_MTX_SYSOUT:0CFE79EC   A_MTX_SYSPUN:0CFE79F0
   +0000E4  A_MTX_CONSOLE:0CFE79F4  A_MTX_RANDOM:00000000
   +0000EC  A_RANDOM_SEED:0CFE7A2C  RANDOM_SEED:00000001
   +0000F4  LE_TRACE_FLAGS:00000000       FIRST_CAA_ENCLAVE:0CE1CBE0
   +0000FC  V4_SYNC_FLAG:05   HAS_C:00000000    HAS_IGZXLPKC:00000000
   +000108  DBG_API:00000000  COB_THREAD_IPT:0CFE7198       CAA_SORT:0CE1CBE0
   +000114  IDENT_2:E_COBEDB

  COBTHRED:  0CFE7198
   +000000  IDENT:COBTHRED    FLAGS:80000000    IOSAVEAREA:0CFE7360
   +000010  IONATIONALWORKAREA:0CFE7400   WSA24SZ:00000000  THCSIGPS:0CFE7418
   +00001C  XDCALP:0CFE72F8   SPRINTF_NAB:0D133AA8    FCAL_CACHE:0CFE84A0
   +000028  EINI_CACHE:00000000     RCMSGLST:00000000
   +000030  DEFERREDMSG:00000000    SORT_STATE:0D136C80     THCXWRK@:00000000
   +00003C  THCPGMIIP:0000    THCFILEIP:0000    THCOFCBL:00000000
   +000048  CLLE_LOCAL_CACHE:00000000 00000000 00000000 00000000 00000000
   +00005C  ---------------->:00000000 00000000 00000000 00000000 00000000
   +000070  ---------------->:00000000 00000000 00000000 00000000 00000000
   +000084  ---------------->:00000000 00000000 0D134E40 0CFE9A78 00000000
   +000098  ---------------->:00000000 00000000 00000000 00000000 00000000
   +0000AC  ---------------->:00000000 00000000 00000000 00000000 00000000
   +0000C0  ---------------->:00000000 0D74E360
   +0000C8  XUCP_CACHE:00000000 00000000 00000000 00000000 00000000 00000000
   +0000E0  ---------->:00000000 00000000 00000000 00000000 00000000 00000000
   +0000F8  ---------->:00000000 00000000 00000000 00000000 00000000 00000000
   +000110  ---------->:00000000 00000000 00000000 00000000 00000000 00000000
   +000128  ---------->:00000000 00000000 00000000 00000000 00000000 00000000
   +000140  ---------->:00000000 00000000 00000000 00000000 00000000 00000000
   +000158  ---------->:00000000 00000000
   +000160  CLLE:0D74E360     XDCALNAME:00000000      WSA@:00000000
   +00016C  SAVED_R4:00000000       SAVED_R5:00000000       SAVED_R6:00000000
   +000178  SAVED_R7:00000000       SAVED_R8:00000000       SAVED_R14:00000000
   +000184  SIGINFO:0CE086EE  XAPI_STACK:0CFE7618     V4RUNCOM:0CFE7908
   +000190  MUTEX_LOCKED:00000000   FCB_LOCKED:00000000
   +000198  PENDING_LOCK:00000000   PC_TREN_TREC:00000000
   +0001A0  SORT_STATE_BUFF:0D136C80      PRINTKCOUNT:00000000
   +0001A8  THCXWRKC@:00000000      XTRM_STACK:00000000
   +0001B0  OLD_COBRENT:00000000    DCS2_CLLE:00000000

   IPT

[2]COBPCB:  00012070
   +000000  IDENT:COBPCB      FLAGS:00000000    MAINDSA:00000000
   +000010  BDYSAVE:00000000  PTCPCHDCB:00015B58      PTCPCHBUF:00015B5C
   +00001C  PTCPCHLEN:00015B60      PTCDSPFLG:00015A90      PTCRDRDCB:00015B64
   +000028  PTCACPFLG:00015A91      TCPCHDCB:00000000       TCPCHBUF:00000000
   +000034  TCPCHLEN:0000     TCDSPFLG:00       TCUSSFLG:00       TCACPFLG:00
   +000039  TCADUFL2:02       AVAIL:0000  TCRDRDCB:00000000
   +000040  TCIMCNT:00000000  DEBUGCOUNTER:00000000   PROG_CAA:00000000
   +000050  PROG_DSA:00000000       PROG_CLLE:00000000      PROG_WSA:00000000
   +00005C  PROG_WSTOR:00000000     DUMP_REPEAT_TRACKER:00000000
   +000064  ARRAY_INFO:00000000     ID_NEST:00000000  IGZ_CDATOKEN:00000000
   +000070  GOFF_INIT@:00000000     PCLINES@:00000000       LINENO@:00000000
   +00007C  SET_CODESET@:00000000   ARANGE@:00000000  CUDIEOFF@:00000000
   +000088  OFFDIE@:00000000  CHILD@:00000000   SIBLINGOF@:00000000
   +000094  TAG@:00000000     ATTR@:00000000    DIENAME@:00000000
   +0000A0  DIETYPE@:00000000       WHATFORM@:00000000
   +0000A8  FORMUDATA@:00000000     FORMSTRING@:00000000
   +0000B0  LOCLIST_N@:00000000     DIESECTION@:00000000    DEALLOC@:00000000
   +0000BC  ALTLINE@:00000000       GLOBAL_FORMREF@:00000000
   +0000C4  DEBUG_SECTION@:00000000       OFFDIE_IN_SECTION@:00000000
   +0000CC  SRCATTR_GET_ALTLINES@:00000000      FINISH@:00000000
   +0000D4  LINEBEGINSTATEMENT@:00000000  PCSUBR@:00000000  CDA_EP:00000000
   +0000E0  CDA_CODE_ADDR:00000000  CDA_COBEDB:00000000     V4TCB:00000000
   +0000EC  PROG_EP:00000000  IDENT_2:E_COBPCB

[3]COBRCB:  00012020
   +000000  IDENT:COBRCB      LENGTH:00000148   COBPCBPTR:00012070
   +000010  LIBVEC:00013038   XD24:00000000     DT_NOTIFY:00000000
   +00001C  FLAGS:00000000    RCDYNLST:00000000       QSAM24NEXTLST:00041020
```

```
    +000028  QSAM24NMEFEXTLST:00000000     QSAM24SYSINPUNEXTLST:00045020
    +000030  VSAMEXITBODY:00000000   DBGTAB:00000000   GETSTGCNT:00000000
    +000044  IDENT_2:E_COBRCB

    NOWSA AM31 NOWSA DynLoad FastPath

    ------------------ Control blocks for program COB5PGRM ------------------
 [4]  CLLE:  0CFE7C08
    +000000  CLEENTNM:COB5PGRM       CLESW1:01   CLEV4FLG:00
    +00000C  CLELGLST:00000000       CLEFLG1:35  CLEFLG2:81  CLELDADR:0CE00000
    +000018  CLETGTAD_CLEPDB:0CFE7C80      CLETOKEN:00000000
    +000020  CLEWSAADDR:0CFEB048     CLLEHB:0CFE96D4   CLLEHF:0CFE9A08
    +00002C  CLLENEXT:00000000       CLESTAT:00000002  CLECNT:00000000
    +000038  CLENUMOPEN:FFFFFFF9     CLEFDESC:00000000

    CBLV5+ Main Rent AM31 PgmInit StgInit

    COBPDB:  0CFE7C80
    +000000  IDENT:COBPDB      GPCB:0CFF1234     WSA24SZ:00000000
    +000010  WSA24@:00000000   IDENT_2:E_COBPDB

      GPCB:  0CFF1234
    +000000  COMP_VER:13156510       GPCB_IPCB@:0CFF1274     GPCB_NAME:0CE06E08
    +000010  GPCB_NAME_SZ:00000008   FLAGS:94    GPCB_CLLE:0CFE7C08
    +00001C  GPCB_ASC@:00000000      GPCB_FIBAA@:0CFF0A98
    +000024  GPCB_UPSI@:0CFE70E8     GPCB_ACSORD@:00000000
    +00002C  GPCB_ASCII2EBCDIC@:00000000   GPCB_EBCDIC2ASCII@:00000000
    +000034  GPCB_OUTDD:SYSOUT       GPCB_JVMPTR@:0CFE70F0

    StaticCall SSRangeChk UppCase

      IPCB:  0CFF1274
    +000000  IPCB_NUMENTS:00000001   FLAG:80     IPCB_ENT:0CE00000
    +00000C  IPCB_NUMPPROGS:00000000       IPCB_FCBAA@:0CFF0A88
    +000014  IPCB_FILEDEFS:00000004  IPCB_PGMPCB:0CFF1234

    PgmInit

      PPA1:  0CE08560 (Entry name:COB5PGRM)
      PPA2:  0CE08728
      PPA3:  0CE08698
      PPA4:  0CE08788 (CUName    :COB5PGRM)
  CEESTART:  0CE0A3D0
  CEEBLLST:  0CE0A598
   IEWBLIT:  0CE0AFF0

    COBOL version: 050100. Compiled Date and Time: 2013-12-12 17:35:43.
    STATIC MAP(RENT): 0CFEB058 25152(X'6240') bytes.
    COBOL Working-Storage resides in the STATIC MAP(RENT).
```

The names of the control blocks have changed in Enterprise COBOL V5.1. Table 27 on page 141 shows the correspondence with COBOL V4R2 and prior releases.

Table 27. Contents of COBOL-specific sections of LEDATA Output (Enterprise COBOL V5.1 and later releases)

Section Number and Heading	Contents
[1] COBEDB	Corresponds to RUNCOM, formats the COBOL enclave-level control block.
[2] COBPCB	Corresponds to THDCOM, formats the COBOL process-level control block.
[3] COBRCB	Corresponds to COBCOM, formats the COBOL region-level control block.
[4] CLLE	Formats the COBOL loaded program control block (same name).
[5] COBDSACB	Corresponds to TGT, program-level control block.

Understanding the PL/I-specific LEDATA output

The Language Environment IPCS VERBEXIT LEDATA generates formatted output of PL/I-specific control blocks from a system dump when the COMP(PLI), COMP(ALL) or ALL parameter is specified and PL/I is active in the dump. The following example illustrates the PL/I-specific output produced. The system dump being formatted was obtained by specifying the TERMTHDACT(UADUMP) runtime option. Table

28 on page 147 describes the information contained in the formatted output. For easy reference, the sections of the dump are numbered to correspond with the description of each section that follows.

```
 ********************************************************************************
                             PL/I FOR MVS & VM ENVIRONMENT DATA
 ********************************************************************************


[1] RXRCB:  00021000
   +000000  ID:ZRCB           LIBVEC:00013038   RSAP:00000000
   +000010  PSMA:00000000     PSLA:00000000
[2]  PRCB:  00021038
   +000000  ID:ZPRB           RCB:00021000      SYSP_FCB:00063004
   +000010  MSGF_FCB:00000000       PRV_INIT:00016B38
   +00001C  ENT_FCO:00000000        MSGFFLGS:00       FLAGS:B6000000
   +000030  DCL_LIST:00000000       DBG_STG:00000000
   +000038  DCL_LIST_LEN:00000000
[3]   TIA:  00056298
   +000000  TISA:00000000     TAPC:00000000     TERA:00000000     TINM:0000
   +00000E  TFL1:0030   TWTW:00000000     TEXF:00000000     TLFE:00000000
   +000020  TDUB:00056450     TDDS:00000000     TLWR:00000000
   +00002C  TASM:00000000     TSNM:........     TASR:00000000
   +00003C  TFEP:000571C8     TAST:00000000     TERC:00000000
   +000048  TCTF:00000000     TCTL:00000000     TATC:00033B88
   +000054  TABD:00000000     TRPS:00000000     TFL3:000000       TCPM:00
   +000060  TXRES:00000000    TXIIC:00000000    TXHIN:00000000
   +00006C  TXHIC:00000000    TXHAD:00000000    TXBOC:00000000
   +000078  TXLFE:00000000    TERN:00000000     FCB:00000000
   +000084  RC:00000000       REASON:00000000   ADBG:00000000
   +000090  PARM:00000000     PADDR:00000000    PLIST:00000000
   +00009C  STRLOC:00000000   STRLEN:0000       STRVAR:0000
   +0000A4  ZEROSTR:0000      PARM:00000000     PRECALL:00000000
   +0000B0  PRETERM:00000000        PIRPARM:00000000        CHECK:00000000
   +0000BC  USERWD:00000000   CCPARM:00000000   MAINLAN:0000
   +0000C6  MSG_LRECL:0000    MSG_RTN:00000000        TPMV:00000000
   +0000D0  TMSK:00000000     USERCODE:00000000       PREREINT:151016F0
   +0000DC  SYSP_DCL:00000000       PRVLEN:00000000   PG_ADDR:00000000
   +0000EC  PG_PLIST:00000000 00000000 00000000       PNUM:7FFFFFFF
   +0000FC  4K:00000000       BILC:00000000 00000000 00000000 00000000
   +00011C  SYSPRINT_OPCODE:15A3C04C      4K_HID:00000000
[4]  FECB:  000571C8
   +000000  CHAIN:00000000    PRVO:0A000000     NAME:IEFBR14
   +000010  CODE:50E0D068 58FF0014 41C0C000 0CEF58E0 D0680B0E
   +000024  EPA:00E73000      SAVE:00000000     END:00000008
   +000030  FLAGS:08000000    MENTRY:00000000   LOADPTR:00000000
```

```
+--------------------- start of data for file 1 -------------------+
|
|
            FILENAME:DDVSAM1
 [5] DCLCB:  15101750
   +000000  FCB:0000000C      ATT:02010400      OPA:01861800
   +00000C  ENV:15101770      GRA:0000    NMO:0014    FNLEN:0007
   +000016  FNAME:DDVSAM1.
 [6]   FCB:  00057404
   +000000  FFST:00020100 00000000        FAIS:0001A1A8     FATM:00064602
   +000010  FADL:15101750     FACB/FADB:00057484      FAFO:00057314
   +00001C  FAIL:00000000     FERR:0000   FCOM:0000   FATA:02210500
   +000028  FFLA:00011C00 02080000        FBKZ:0000   FKYL:0008
   +000034  FRCL:0000008C     FAFR:000574D8     FTYP:E5C7   FLEN:00D0
   +000040  FGAS:00000000     FBIF:00     FFST:00     FALU:00000000
   +000050  FACK:00000000     FIOC:000574D8     FALR:00000000     FEMT:E
   +00005D  FEFT:E      FRET:00     FAFB:00     FERM:0001A120     FGAM:0082
   +000066  FKLO:0000   FCCT:00000000     FAKY:00000000
   +000070  FIOS/FREL:0000019C        FXBA:00000000     FRTB:00000202
   +00007C  FOPT:92910000     FAWB:A010004C
    ATTRS:RECORD OUTPUT SEQ KEYED BUF
      ACB:  00057484
   +000000  ID:A0       STYP:10     LEN:004C    AMBLST:15A4D7F8
   +000008  INRTN:00FD7818    MACRF:5202  BSTNO:00    STRNO:01    BUFND:0000
   +000012  BUFNI:0000  BUFPL:00000000    RECFM:80    FLAGS:00    DSORG:0008
   +00001C  MSGAR:00000000    PASSW:00000000    EXLST:00000000    TIOT:00CC
   +00002A  INFL:00     AMETH:11    ERFL:00     DEB:8AEEA8  OFLGS:D2
   +000031  ERFLG:00    UJFCB:00000000    BUFSP:00000000    BLKSZ:0000
   +00003E  LRECL:0000  UAPTR:00000000    CBMWA:00000000    APID:00000000
[7]   IOB:  000574D8
   +000000  ICHN:00000000     INXT:00000000     IFLA:0000   IERR:0000
   +00000C  IRCB:00000000     IORD:00000000     IORL:00000000
```

```
   +000018  IREF:00000000 00000000        IEVT:00000000
   +000024  IECS:000575D8 00057664 0005766C 00000000 00000000 00000000
   +00003C  --->:00057588 00000000
      RPL:  00057588
   +000000  ID:00       STYP:10     REQ:00      LEN:4C      PLHPT:00000000
   +000008  ECB:00057510      FDBWD:00000000    KEYL:0008   STRID:0000
   +000014  CCHAR:00000000    ACB:00057484      TCBPT:00000000
   +000020  AREA:00000000     ARG:00057664      OPTCD:21800000
   +00002C  CHAIN:00000000    RLEN:00000000     BUFL:00000000
   +000038  OPTC2:00000000    RBAR:00000000 00000000        EXTDS:40
   +000045  ACTIV:00    EMLEN:0000  ERMSA:00000000
|                                                                  |
+---------------------  end of data for file  1 -------------------+
:
Exiting PL/I for MVS & VM Environment Data
```

```
******************************************************************************
                        ENTERPRISE PL/I ENVIRONMENT DATA
******************************************************************************
[8]   RCB:  15A3A000
   +000000  ID:VRCB           LIBVEC:00022038   DTPMTRN:00000000
   +000010  CICSFS:00000001
[9]   PCB:  15A3B000
   +000000  ID:IBMPLPCB       RCB:00000000      FCO:15A3B054
   +000010  INITMETHOD:15A3B286     METHODLEN:00000068      FLAGS:06800000
   +00001C  ORG_TCA:00033B88        IO_MOD:800283A0   IO_OPEN:000283F4
   +000028  IO_CLOSE:000284D4       IO_GET:00028592   IO_PUT:000285DA
   +000034  IO_PUTX:00028622        IO_WR_DM:0002866C
   +00003C  IO_WR_DI:00028818       IO_WR_SF:0002889E
   +000044  IO_RD_DI:00028938       IO_RD_SF:000289BE
   +00004C  IO_TPUT:00028A2C        IO_GTSIZE:00028A78
[10]  TCA:  000568F0
   +000000  PREV:00000000     FLAGS:00800000    APPTYPE:00000000
   +00000C  INITADDR:15A40CC8       INITSTOR:0000047B
   +000014  BEL_HEAPID:00000000     MAXPATHLEN:00000000     HEAPID:00000000
   +000020  FECB_ADDR:00056A6C      MIT:00000000      FILES_ADDR:00056A50
   +00002C  TABTAB:15479F08   DDMDLL:00000000   IOFLGS:00000000
   +000038  DDT:00000000      TWC:00000000      PFO_ANC:00000000
   +000044  DDB:00000000      CONV_FCO:00000000       SCB_PTR:00000000
   +000050  DMY_OCA:00056AF8        LAST_OCA:00056BC8       DEF_BIF_STR:0000
   +00005A  DEF_ONCHR:40      ASEM_HAND:00000000      DSEM_HAND:00000000
   +000064  OSEM_HAND:00000000      FSEM_HAND:00000000
   +00006C  XML_CHAIN:00000000      XML_EXIT:00000000
   +000078  CTL_LIST:00000000       SYSPRT_FCO:00000000
   +000080  FLUSH_RTN:153D6228      STDOUT_HAND:00000000    PARENT:00000000
   +000094  IO_MOD:800283A0   BTRV_RTN:00000000       ISAM_RTN:00000000
   +0000A0  CONV_RTN:00000000       DEC_VALID:00000000
   +0000A8  HEX_TRANS:00000000      NLS_BLOCK:00000000
   +0000B0  DBCS_MAP:00000000       CCS_CASE:00000000
   +0000B8  RAND_SEED:00000001      RETCODE:00000000
   +0000C0  DBG_TERM:00000000       DBG_FETCH:00000000
   +0000C8  DBG_EXCEP:00000000      SEM_HAND:00000000
   +0000D0  DBG_FRAME1:00000000     STMT_HOOK:00000000
   +0000D8  ENTRY_HOOK:00000000     CALL_PLITEST:00000000
   +0000E0  IBMPEACH:00000000       CICSPPMB:00000000
   +0000E8  ENCL_REC_CNT:00000000   ENCL_CNT:00000000
   +0000F0  DEF_LIB_HP:00000000     DEF_USR_HP:00000000
   +0000F8  CUR_USR_HP:00000000     ADMVS_GOTO:00000000 00000000 00000000
   +000108  THD_SPEC_USE:00000000   STG_TAB:15A41150        SYSTEM:00000002
   +000114  ANCH_BASE:00000000      API_ADDR:00000000
   +00011C  PBAS_ADDR:00000000      PDBG_STO:00000000       SNAP_ID:0000
   +00012E  SNAP_FLGS:0000    FETCH_WSA:00000000      DEF_ONWCHAR:0000
   +000138  MUTEX_ATTR:00000000     IO_OPEN:000283F4
   +000140  IO_CLOSE:000284D4       IO_GET:00028592   IO_PUT:000285DA
   +00014C  IO_PUTX:00028622        ASEM_MUTEX:00000000
   +000154  DSEM_MUTEX:00000000     OSEM_MUTEX:00000000
   +00015C  FSEM_MUTEX:00000000     FILES_AREA:15A445E8
   +000164  IO_WRDMY:0002866C       IO_WRDI:00028818
   +00016C  IO_WRSF:0002889E        IO_RDDI:00028938
   +000174  IO_RDSF:000289BE        AMODE_GLUE:00000000
   +00017C  FECB_AREA:15A418B8
[11] FECB:  15A418B8
   +000000  CHAIN:15A41888    HANDLE:00056CF0   LDHANDLE:8005A000
   +00000C  COUNT:00000001    FLAGS:80000000    MODNMSZ:00000004
   +000018  MODNAME:HELP      AMODESTG:00056CF0       PTOKEN:15A3C0DC
     FECB:  15A41888
   +000000  CHAIN:15A41858    HANDLE:00056CC8   LDHANDLE:00059E98
   +00000C  COUNT:00000001    FLAGS:80000000    MODNMSZ:00000006
   +000018  MODNAME:DELETE    AMODESTG:00056CC8       PTOKEN:15A3C0C0
     FECB:  15A41858
   +000000  CHAIN:00000000    HANDLE:00056CA0   LDHANDLE:00E73000
```

```
   +00000C  COUNT:00000001    FLAGS:80000000    MODNMSZ:00000007
   +000018  MODNAME:IEFBR14   AMODESTG:00056CA0       PTOKEN:15A3C0A4
[12]  OCA:  00056BC8
   +000000  EYE:OCA     VERSION:00  PREV:00056AF8     CID:0C      ERC:0B
   +00000A  SCI:20      HIGH_SCI:FF       COND_QLFR:00000000
   +000010  ONCODE:0140       VAL_FLAGS:0010    FLAGS:00000000
   +000018  ONCOUNT:00000000        SLD_ONFILE:00000000 00000000 00000000
   +000028  SLD_ONCHAR:00000000 00000000 00000000
   +000034  SLD_ONSOURCE:00000000 00000000 00000000
   +000040  SLD_ONKEY:00000000 00000000 00000000
   +00004C  SLD_DATAFIELD:00000000 00000000 00000000
   +000058  SLD_ONGSOURCE:00000000 00000000 00000000
   +000064  SLD_ONWSOURCE:00000000 00000000 00000000
   +000070  SLD_ONWCHAR:00000000 00000000 00000000
```

```
   +00007C  SLD_ONLOC:00000000 00000000 00000000      RES_EBP:00000000
   +00008C  RES_EIP:00000000        TRCBK_EBP:00000000
   +000094  TRCBK_EIP:00000000      EXIT_LABEL:00000000
   +00009C  RETRY_EBP:00000000      RETRY_EIP:00000000
   +0000A4  RETRY_ESP:00000000      EBP_HAND:00000000
   +0000AC  PLISRTX_RC:00000000     UNDEF_SUBC1:00000000
   +0000B4  UNDEF_SUBC2:00000000    TOKEN:000300C6 59C3C5C5 00000000
   +0000C4  AMODE_SWC_PTR:00000000        ONOFFSET:00000000
   +0000CC  ONLINE:00000000
      OCA:  00056AF8
   +000000  EYE:OCA     VERSION:00  PREV:00000000     CID:00      ERC:00
   +00000A  SCI:00      HIGH_SCI:FF       COND_QLFR:00000000
   +000010  ONCODE:0000       VAL_FLAGS:FFFF    FLAGS:00000000
   +000018  ONCOUNT:00000000        SLD_ONFILE:00056948 02040000 00000000
   +000028  SLD_ONCHAR:0005694A 02020000 00000001
   +000034  SLD_ONSOURCE:00056948 02040000 00000000
   +000040  SLD_ONKEY:00056948 02040000 00000000
   +00004C  SLD_DATAFIELD:00056948 02040000 00000000
   +000058  SLD_ONGSOURCE:00056948 02040000 00000000
   +000064  SLD_ONWSOURCE:00056948 020D0000 00000000
   +000070  SLD_ONWCHAR:00056A24 020D0000 00000001
   +00007C  SLD_ONLOC:00056948 02040000 00000000      RES_EBP:00000000
   +00008C  RES_EIP:00000000        TRCBK_EBP:00000000
   +000094  TRCBK_EIP:00000000      EXIT_LABEL:00000000
   +00009C  RETRY_EBP:00000000      RETRY_EIP:00000000
   +0000A4  RETRY_ESP:00000000      EBP_HAND:00000000
   +0000AC  PLISRTX_RC:00000000     UNDEF_SUBC1:00000000
   +0000B4  UNDEF_SUBC2:00000000    TOKEN:00000000 00000000 00000000
   +0000C4  AMODE_SWC_PTR:00000000        ONOFFSET:00000000
   +0000CC  ONLINE:00000000

 ⋮
+--------------------- start of data for file 2 -------------------+
|                                                                  |

            FILENAME:DDVSAM
    FNAME:  15A43E40
   +000000  NAMELEN:0006
[13]  PFO:  15A43E24
   +000000  ANCHOR:15A43E3C   DECLARED:00840801       INVALIDS:00600602
   +00000C  NAMEPTR:15A43E40        ENVPTR:151012A8   INT_TAG:00000000
    ATTRS:KEYED EXT SEQ RECORD
    INVLD:PRINT EXCL DIR TRANS STREAM
    ENV(GENKEY VSAM)
 SHAD_FCO:  15A43DA8
   +000000  SELF:15A43DA8     CHAIN:15A43B08    ANCESTOR:15A42C20
   +00000C  INV_STMT_METH:1541FD48        STMT_ERR_METH:1541FCF0
   +000014  DIAGNOSE_METH:1541F8D0        DONE_METH:1541FCF0
   +00001C  OPEN_METH:1541F7B0      CLOSE_METH:1541F738
   +000024  CONTROL_METH:1541F1F8   LOCATE_METH:1541EF98
   +00002C  WRITE_METH:1541F160     REWRITE_METH:1541F0C8
   +000034  DELETE_METH:1541F030    READ_METH:1541EF00
   +00003C  UNLOCK_METH:1541FCF0    WAIT_METH:1541FCF0
   +000044  PUT_METH:1541FCF0       GET_METH:1541FCF0
   +00004C  FLUSH_METH:1541F650     FINDUSE_METH:1541EE00
   +000060  SETTYPE_METH:1541ED78   QRYTYPE_METH:1541EC40
   +00006C  PATHNAME:1541FCF0       SHADOW_PFO:15A43E24
   +000074  INIT_PFO:00000000       INIT_PFO_ANC:00000000
[14]  FCO:  15A42C20
   +000000  SELF:15A42C20     CHAIN:00000000    ANCESTOR:15A43DA8
   +00000C  INV_STMT_METH:1541FD48        STMT_ERR_METH:15446640
   +000014  DIAGNOSE_METH:1541F8D0        DONE_METH:1541FCF0
   +00001C  OPEN_METH:1541F7B0      CLOSE_METH:1541F738
   +000024  CONTROL_METH:1541FD48   LOCATE_METH:1545A190
   +00002C  WRITE_METH:1545A190     REWRITE_METH:154599A8
   +000034  DELETE_METH:15459550    READ_METH:1545AB98
```

```
   +00003C  UNLOCK_METH:1541FCF0    WAIT_METH:1541FCF0
   +000044  PUT_METH:1541FCF0       GET_METH:1541FCF0
   +00004C  FLUSH_METH:1541F650     FINDUSE_METH:1541EE00
   +000060  SETTYPE_METH:1541ED78   QRYTYPE_METH:1541ECA8
   +00006C  PATHNAME:15A432C0       SHADOW_PFO:00000000
   +000074  INIT_PFO:00000000       INIT_PFO_ANC:00000000
   +00007C  VALIDITY:75001200       REQUIRED:00002000       ATTRS:01854801
```

```
   +000088  PFO:15A43E24      EHB:00000000      LENGTH:00000232
   +000094  DCB_ACB:15A43008        IO_BUF:15A43C28   BLKSIZE:00000000
   +0000A0  BLKXFER:00000000        BUF_OBJ:00000000
   +0000A8  BUF_LEFT:00000000       PRIOR_REC_L:00000000
   +0000B0  RECSIZE:0000008C        BUFSIZE:00000094
   +0000B8  BIG_IO_BUF:15A43CD0     DCBE:00000000     ERR_TYPE:00
   +0000C1  ERR_CODE:00       ENVIRON:40200000        PLATFORM:34000000
   +0000CC  FLAGS:80080000    RETRY:00000000    DELAY:00000000
   +0000D8  ICOSTATIC:15A43BB0      ICOFREE:15A43BB0
   +0000E0  ICOWAITING:15A43BB0     ICOACTIVE:15A43BB0
   +0000E8  KEYOFREF:15A43CC0       KEYLOC:00000000   KEYLEN:0008
   +0000F2  PREFIXLEN:0000    FLAGS:0008  BYTESREM:0000     RECICD:00000000
   +0000FC  EOB/AMRC:15A431D8       BYTESREAD:00000000
   +000104  CURRPTR:00000000        EOFPOS:00000000
   +00010C  PRIORLOCRECLEN:00000000       STATE:00000000
   +000114  RIOFLAGS:01804000       BUFOFF:00000000   INDEXAREA:00000000
   +000120  NCP:00000000
   +000124  RECDATA:00000000 00000000 00000000 00000000 00000000 00000000
   +00013C  ------>:00000000 00000000 00000000 15A42E60
   +0001DC  DD_ACCESS:00000000      DD_BLKSIZE:0000   DD_LRECL:0000
   +0001E4  DD_RETCODE:0000   DD_DDNAME:........      DD_RECFM:00
   +0001EF  DD_DISP:0000      DD_FLAGS:00
   +0001F2  DD_DSNAME:............................................
   +00021E  DD_ELNAME:........
   +000226  DS_BLKSIZE:0000   DS_LRECL:0000     DS_RETCODE:0000
   +00022C  DS_RECFM:00
    PATHNAME:A374585.IPCSPLIT.KSDS
    ATTRS:FILE KEYED EXT BUF OUTPUT SEQ RECORD
[16]ENV:INDEXED NONSCVAR UNSET
[17]  FCE:  15A43008
   +000000  TOTSTG:000002B8   ACB:15A430D0      RD_RPL:15A43128
   +00000C  WR_RPL:15A43180   READ:1545AB98     WRITE:1545A190
   +00001C  WR_RECL:00000064        RD_RECL:00000000        WR_BUF:00036490
   +000028  RD_BUF:00000000   WR_ARG:00000000   RD_ARG:00000000
   +000038  LAST_OP_RBA:00000000    GET_LEN:00000000
   +000040  PUT_LEN:00000064        NUM_RECS:00000000
   +000048  KEY_LEN:00000008        KEY_POS:00000000
   +000050  FDBK_RSN:00000000       CURR_RBA:00000000
   +000058  REPOS_RBA:00000000      SRCH_KEY_PTRNUM:00000000
   +000060  SRCH_KEY_LEN:00000000   BUF_STG:000001EC        VSAM_TYPE:02
   +000071  PREV_REQ:02       FLAGS:C0060200    CURR_RRN:00000000
   +000088  LAST_OP_KEY:00000000    SRCH_KEY_RRN:00000000
   +0000A0  NUM_DEL:00000000        NUM_INS:00000000
   +0000B4  XENDRBA:00000000 00000000
      ACB:  15A430D0
   +000000  ID:A0       STYP:10     LEN:004C    AMBLST:00062AB8
   +000008  INRTN:00FD7818    MACRF:5A02  BSTNO:00    STRNO:01    BUFND:0000
   +000012  BUFNI:0000  BUFPL:00000000    RECFM:80    FLAGS:00    DSORG:0008
   +00001C  MSGAR:15A431E4    PASSW:15A430B0    EXLST:00000000
   +000028  DDNAME:........   OFLGS:92    ERFLG:00    INFLG:0000
   +000034  UJFCB:00000000    BUFSP:00000000    BLKSZ:00D0  LRECL:0000
   +000040  UAPTR:00000000    CBMWA:00000000    APID:00000000
      RPL:  15A43128
   +000000  ID:00       STYP:10     REQ:00      LEN:4C      PLHPT:00000000
   +000008  ECB:00000000      FDBWD:00000000    KEYL:0000   STRID:0000
   +000014  CCHAR:00000000    ACB:15A430D0      TCBPT:00000000
   +000020  AREA:00000000     ARG:15A43060      OPTCD:20800000
   +00002C  CHAIN:00000000    RLEN:00000000     BUFL:00000094
   +000038  OPTC2:00000000    RBAR:00000000 00000000        EXTDS:40
   +000045  ACTIV:00    EMLEN:00D0  ERMSA:15A431E4
      RPL:  15A43180
   +000000  ID:00       STYP:10     REQ:01      LEN:4C      PLHPT:0005EA6C
   +000008  ECB:40000000      FDBWD:00000000    KEYL:0000   STRID:0000
   +000014  CCHAR:00000000    ACB:15A430D0      TCBPT:00000000
   +000020  AREA:00036490     ARG:15A43060      OPTCD:20800000
   +00002C  CHAIN:00000000    RLEN:00000064     BUFL:00000094
   +000038  OPTC2:00000000    RBAR:00000000 0000012C        EXTDS:40
   +000045  ACTIV:00    EMLEN:00D0  ERMSA:15A431E4

|                                                                  |
+---------------------  end of data for file  2 -------------------+
 ⋮
```

```
+--------------------- start of data for file 7 -------------------+
|                                                                   |

            FILENAME:SYSPRINT
    FNAME:  15A3B30A
   +000000  NAMELEN:0008
[13]  PFO:  15A3B2EE
   +000000  ANCHOR:15A3B306   DECLARED:00444042       INVALIDS:00A3AE01
   +00000C  NAMEPTR:15A3B30A        ENVPTR:00000000   INT_TAG:00000000
    ATTRS:PRINT EXT OUTPUT SYSPRINT STREAM
    INVLD:KEYED EXCL UNBUF BUF INPUT UPDATE SEQ DIR TRANS RECORD
[14]  FCO:  15A3B054
   +000000  SELF:15A3B054     CHAIN:00000000    ANCESTOR:00000000
   +00000C  INV_STMT_METH:1541FD48        STMT_ERR_METH:1541FCF0
   +000014  DIAGNOSE_METH:1541F8D0        DONE_METH:1541FCF0
   +00001C  OPEN_METH:1541F7B0      CLOSE_METH:1541F738
   +000024  CONTROL_METH:1546C650   LOCATE_METH:1541FD48
   +00002C  WRITE_METH:1541FD48     REWRITE_METH:1541FD48
   +000034  DELETE_METH:1541FD48    READ_METH:1541FD48
   +00003C  UNLOCK_METH:1541FCF0    WAIT_METH:1541FCF0
   +000044  PUT_METH:15467018       GET_METH:1541FD48
   +00004C  FLUSH_METH:1541F650     FINDUSE_METH:1541EE00
   +000060  SETTYPE_METH:1541ED78   QRYTYPE_METH:1541ED10
   +00006C  PATHNAME:15A42818       SHADOW_PFO:00000000
   +000074  INIT_PFO:00000000       INIT_PFO_ANC:00000000
   +00007C  VALIDITY:00000000       REQUIRED:00000000       ATTRS:00454842
   +000088  PFO:15A3B2EE      EHB:00000000      LENGTH:00000232
   +000094  DCB_ACB:00060004        IO_BUF:00061F7C   BLKSIZE:00000081
   +0000A0  BLKXFER:00000000        BUF_OBJ:00000000
   +0000A8  BUF_LEFT:00000000       PRIOR_REC_L:00000000
   +0000B0  RECSIZE:00000079        BUFSIZE:00000000
   +0000B8  BIG_IO_BUF:00000000     DCBE:15A4C000     ERR_TYPE:00
   +0000C1  ERR_CODE:00       ENVIRON:00080050        PLATFORM:20000000
   +0000CC  FLAGS:000A6000    RETRY:00000000    DELAY:00000000
   +0000D8  NORM_BUFF:00000000      PLWA:00000000     XMIT:1547D800
   +0000E4  NEXT_BYTE:00061F7D      COPY_BYTE:00000000
   +0000EC  COPY_PFO:00000000       SCB:00036568      TABTAB:15479F08
   +0000F8  RECCNT:00000000   BYTESINTO:00000010      BUFLEFTNORM:00000000
   +000104  BYTESINTONORM:00000000        PAGENOBIF:00000001
   +00010C  COUNTBIF:00000001       LINENOBIF:00000007      PAGESIZE:003C
   +000116  LINESIZE:0078     SIOFLAGS:000C0000       NORMAREASIZE:00000000
   +000120  TSONEXTBYTE:00000000    QSA:0005F004      DCB_LEN:0000006C
   +00012C  DCBE_LEN:00000038
   +0001DC  DD_ACCESS:00000001      DD_BLKSIZE:0000   DD_LRECL:0000
   +0001E4  DD_RETCODE:0000   DD_DDNAME:SYSPRINT      DD_RECFM:00
   +0001EF  DD_DISP:0081      DD_FLAGS:20
   +0001F2  DD_DSNAME:A374585.IPCSPLI2.J0005155.D0000119.?
   +00021E  DD_ELNAME:
   +000226  DS_BLKSIZE:0000   DS_LRECL:0000     DS_RETCODE:0004
   +00022C  DS_RECFM:00
[15]  SCB:  00036568
   +000000  SKIPLINE:00000001       IOBUFF:00000001   STR_PTR:154AC780
   +00000C  STR_DSC:00032814        SYMTAB:952F9A30   SRC:151010B8
   +000018  SRCDED:15100F9C   SRCDSC:15101270   TGT:0003FD49
   +000024  TGTDED:1510129C   TGTDSC:00000000   CMD:4A48    FMTCTL:0100
   +000030  RCODE:01    NESTING:00  FLAGS:0000  FCO:15A3B054
   +000038  CNT/BUFLEFT:00000001    SFI:954AC650      EFSE_SP:00000000
   +000044  EFSE_PREV:00000000      EFSE_TAB:151012A0
   +00004C  EFSE_ACT:151012A4       EFSE_RES:151012A0
   +000054  EFSE_FET:00000000       EFSE_USE:00000000
   +00005C  EFSE_FLGS:80000000      FMTTAB:151012A0
    PATHNAME:A374585.IPCSPLI2.J0005155.D0000119.?
    ATTRS:PRINT EXT BUF OUTPUT SEQ SYSPRINT STREAM
```

```
[16]ENV:CONSECUTIVEDEF CTLASA UNSET V B
      DCB:  00060004
   +000000  DCBE:15A4C000     KEYCN:00    FDAD:00000000 00000006
   +00000D  DVTBA:000000      KEYLE:00    DEVT:02     TRBAL:0000
   +000014  BUFCB:01061F70    BUFL:0081   DSORG:4000  IOBAD_ODEB:00006AA8
   +000020  BFALN:C6    EODAD:028AC8      RECFM:54    EXLST:028FA4
   +000028  TIOT:0040   MACRF:0048  IFLGS:00    DEBAD:8B1F28      OFLGS:92
   +000031  RD_WR:D3F618      OPTCD:00    CHECK:000001      IOBL:00
   +000039  SYNAD:028B3A      CIND:0809   BLKSIZE:0081      WR_CP:0000
   +000042  RW_CCW:0000       IOBA:00006948     EOBAD:00061FF5
   +00004C  RECAD:00061FF5    FLAGS:0000  LRECL:007D  EROPT:80
   +000055  CNTRL:00000100    PRECL:0000  EOB:00000100
     DCBE:  15A4C000
   +000000  ID:DCBE     LEN:0038    DCB:00060004      RELA:00000000
   +000010  FLAGS:C000  NSTR:0000   FLAGS:80    BLKSIZE:00000000 00000000
   +000020  SIZE:00000000 00000000        EODAD:00000000    SYNAD:00000000
```

```
   +000036  MACC:00     MSDN:00

|                                                                  |
+---------------------  end of data for file  7 -------------------+
Exiting Enterprise PL/I Environment Data
```

Table 28. Contents of PL/I-specific sections of LEDATA output

Section Number and Heading	Contents
[1] RXRCB	Formats the PL/I for MVS & VM region-level control block (RXRCB).
[2] PRCB	Formats the PL/I for MVS & VM process-level control block (PRCB).
[3] TIA	Formats the PL/I for MVS & VM thread-level control block (TIA).
[4] FECB	Formats the PL/I for MVS & VM fetch control block (FECB).
[5] DCLCB	Formats the PL/I for MVS & VM declare control block (DCLCB).
[6] FCB	Formats the PL/I for MVS & VM file control block (FCB).
[7] IOB	Formats the PL/I for MVS & VM I/O control block (IOB).
[8] RCB	Formats the Enterprise PL/I region-level control block (RCB).
[9] PCB	Formats the Enterprise PL/I process-level control block (PCB).
[10] TCA	Formats the Enterprise PL/I task communication control block (TCA).
[11] FECB	Formats the Enterprise PL/I fetch control block (FECB).
[12] OCA	Formats the Enterprise PL/I ON communications control block (OCA).
[13] PFO	Formats the Enterprise PL/I file object control block (PFO).
[14] FCO	Formats the Enterprise PL/I file control block (FCO).
[15] SCB	Formats the Enterprise PL/I stream I/O control block (SCB).
[16] ENV	Formats the Enterprise PL/I environment control block (ENV).
[17] FCE	Formats the Enterprise PL/I file control extension control block (FCE).

Formatting individual control blocks

In addition to the full LEDATA output, which contains many formatted control blocks, the IPCS Control block formatter can format individual Language Environment control blocks. The IPCS CBF command can be invoked from the "IPCS Subcommand Entry" screen, option 6 of the "IPCS PRIMARY OPTION MENU".

▸▸— CBF — *address* — STRUCTure — (— *cbname* —) —▸◂

address
: Address of the control block in the dump, which is determined by browsing the dump or running the LEDATA verb exit.

cbname
: The name of the control block to be formatted. The control blocks that can be individually formatted are listed in Table 29 on page 148. In general, the name of each control block is similar to that used by the LEDATA verb exit and is generally found in the control block's eyecatcher field. However, all control block names are prefixed with "CEE" to uniquely define the Language Environment control block names to IPCS.

For example, the following command produces the output shown in Figure 34 on page 148.

```
CBF 213F6B48 struct(CEECAA)
```

```
CEECAA:  213F6B48
+000000  FLAG0:00    LANGP:08    BOS:213FC018      EOS:2141C018
+000044  TORC:00000000     TOVF:80020300     ATTN:213EDF60
+00015C  HLLEXIT:00000000        HOOK:50C0D064 0DC058C0 C0060DCC
+0001A4  DIMA:0001824C     ALLOC:0700C3C8    STATE:0700C3C8
+0001B0  ENTRY:0700C3C8    EXIT:0700C3C8     MEXIT:0700C3C8
+0001BC  LABEL:0700C3C8    BCALL:0700C3C8    ACALL:0700C3C8
+0001C8  DO:0700C3C8       IFTRUE:0700C3C8   IFFALSE:0700C3C8
+0001D4  WHEN:0700C3C8     OTHER:0700C3C8    CGOTO:0700C3C8
+0001F0  CGENE:213F3CD8    CRENT:213F77F0    CTHD:213F19D0
+000210  EDCV:A1673000     CEDB:213F2A80     EDCOV:21A22A40
+000258  TCASRV_USERWORD:00000000      TCASRV_WORKAREA:213ED740
+000260  TCASRV_GETMAIN:00000000       TCASRV_FREEMAIN:00000000
+000268  TCASRV_LOAD:8001CCB0    TCASRV_DELETE:8001CBD0
+000270  TCASRV_EXCEPTION:00000000     TCASRV_ATTENTION:00000000
+000278  TCASRV_MESSAGE:00000000       LWS:00000000      SAVR:00000000
+0002AC  SYSTM:03    HRDWR:03    SBSYS:03    FLAG2:90    LEVEL:18
+0002B1  PM:04       GETLS:8001DFD8    CELV:A147D000     GETS:8001E080
+0002C0  LBOS:00000000     LEOS:00000000     LNAB:00000000
+0002CC  DMC:00000000      ABCODE:A1A97E18   RSNCODE:0000001F
+0002D8  ERR:213EFF18      GETSX:8001F7E8    DDSA:213F75F0
+0002E4  SECTSIZ:00000000        PARTSUM:00000000
+0002EC  SSEXPNT:00000000        EDB:213F57B0      PCB:213F5300
+0002F8  EYEPTR:213F6B30   PTR:213F6B48      GETS1:8001F890
+000304  SHAB:00000000     PRGCK:00000004    FLAG1:00    URC:00000000
+000314  ESS:2141BF18      LESS:00000000     OGETS:8001FE70
+000320  OGETLS:00000000   PICICB:00000000   GETSX:00000000    GOSMR:0000
+000330  LEOV:A15996C0     SIGSCTR:00000000        SIGSFLG:00000000
+00033C  THDID:80000000 00000000       DCRENT:00000000
+000348  DANCHOR:00000000        CTOC:00000000     RCB:213F50D0
+000354  CICSRSN:00000000        MEMBR:213F7690
+00035C  SIGNAL_STATUS:00000000        HCOM_REG7:00000000
+000364  STACKFLOOR:7FFFFFFF     HPGETS:00000000   EDCHPXV:00000000
+000370  FOR1:00000000     FOR2:00000000     THREADHEAPID:00000000
+00037C  SYS_RTNCODE:00000000    SYS_RSNCODE:00000000    GETFN:A15F0BA8
+000390  SIGNGPTR:213F6EDC       SIGNG:00000001    FORDBG:00000000
+00039C  AB_STATUS:F8      STACKDIRECTION:00       AB_GR0:00000001
+0003A4  AB_ICD1:00000004        AB_ABCC:840C4000        AB_CRC:00000004
+0003B0  GTS:8001D958      LERN5N1:00000000        HERP:A1535BB0
+0003BC  USTKBOS:00000000        USTKEOS:00000000
+0003C4  USERRTN:00000000        UDHOOK:A7F4FEE8 A7F40224
+0003D0  HPXV_B:A1522FB0   HPXV_M:A161C6A0   HPXV_L:A156F0F8
+0003DC  HPXV_O:A15E92D0   4VEC3:21738980    DLLF:00000000
+0003E8  SAVSTACK:00000000       USER_WORD:11223344
+0003F4  SAVSTACK_ASYNC:00000000       SMCB:213F73B8     ERRCM:213EDF18
+000538  MIB_PTR:00000000        STV:00      A_ISA:00000000
+000544  ISA_SIZE:00000000       PTATPTR:00000000        SIGSSDSA1:00
+00054D  SIGSSDSA2:00      STACKUNSTABLE:00  STACK_FLAG:00
+000550  SQELADDR:213F0158       VBA:00000000      TCS:00000000
+000564  THDSTATUS:00000000      TICB_PTR:213EF408
+0005AC  FWD_CHAIN:213F6B48      BKWD_CHAIN:213F6B48     TCB@:008F8368
+000804  SS_TOP_D:7FFFFFFF       SS_DSA_U:00000000       DLLFFLAG:00
```

Figure 34. CAA formatted by the CBFORMAT IPCS command

For more information about the IPCS CBF command, see CBFORMAT in *z/OS MVS IPCS Commands*.

Table 29. Language Environment Control blocks that can be individually formatted

Control Block	Description
CEEADHP	Additional Heap Control Block
CEECAA	Common Anchor Area
CEECIB	Condition Information Block
CEECIBH	Condition Information Block Header
CEECMXB	Message Services Block
CEEDSA	Dynamic Storage Area
CEEDLLF	DLL Failure Control Block
CEEDSATR	XPLINK Transition Area
CEEDSAX	Dynamic Storage Area (XPLINK style)
CEEEDB	Enclave Data Block
CEEENSM	Enclave Level Storage Management
CEEHANC	Heap Anchor Node

Table 29. Language Environment Control blocks that can be individually formatted (continued)

Control Block	Description
CEEHCOM	CEL Exception Manager Communications Area
CEEHPCB	Thread Level Heap Control Block
CEEHPSB	Heap Statistics Block
CEEMDST	Message Destination
CEEMGF	Mapping of the Message Formatter (IBM1MGF)
CEEPCB	Process Control Block
CEEPMCB	Program Management Control Block
CEERCB	Region Control Block
CEESKSB	Stack Statistics Block
CEESMCB	Storage Management Control Block
CEESTKH	Stack Header Block
CEESTKHX	Stack Header Block (xplink style)
CEESTSB	Storage Report Statistics Block
CEETMXB	Thread Level Messages Extension Block

Controlling access to CEEDUMPs and DYNDUMPs

Since Language Environment dumps may provide detailed information about the internal processing and data used by an authorized application, Language Environment enforces security rules to ensure that the users of these applications have permission to obtain dumps generated for them. These dumps include the following:

- CEEDUMP information that is generated based on the TERMTHDACT runtime option settings TRACE, DUMP, UATRACE, UADUMP.
- Dynamic transaction dumps generated based on the DYNDUMP runtime option.
- Formatted dumps requested by programming interfaces, including CEE3DMP, csnap(), __cdump(), ctrace(), PLIDUMP.

Language Environment will suppress these dumps for authorized applications under the following conditions:

- A user is running a Language Environment application as a RACF-controlled program on a system where the IEAABD.DMPAUTH resource has been defined in the FACILITY class, but the user has not been permitted access to this resource.
- A user is running an authorized key Language Environment application in a non-started task address space but the user has not been permitted access to the IEAABD.DMPAKEY resource in the FACILITY class.
- A user is running a Language Environment application in a non-started task address space that has the JSCBPASS indicator on, including applications whose PPT entry specifies bypassing security protection.

When Language Environment has suppressed a dump, message CEE3880I will be written to the application's programmer log. To allow the user to receive this dump, the user may need to be permitted to the IEAABD.DMPAUTH or IEAABD.DMPAKEY resource in the FACILITY class. For more information about CEE3880I, see Language Environment runtime messages in *z/OS Language Environment Runtime Messages*. Also see Using RACF to control access to program dumps in *z/OS Security Server RACF Security Administrator's Guide*.

Requesting a Language Environment trace for debugging

Language Environment provides an in-storage, wrapping trace facility that can reconstruct the events leading to the point where a dump is taken. The trace facility can record two types of events: entry and exit library calls and, if the POSIX runtime option is set to ON, user mutex and condition variable activity such as init, lock/unlock, and wait. Language Environment produces a trace table in its dump report under the following conditions:

- The CEE3DMP callable service is invoked with the BLOCKS option and the TRACE runtime option is set to ON.
- The TRACE runtime option is set to NODUMP and the TERMTHDACT runtime option is set to DUMP, UADUMP, TRACE, or UATRACE.
- The TRACE runtime option is set to DUMP (the default).

For more information about the CEE3DMP callable service, the TERMTHDACT runtime option, or the TRACE runtime option, see the following references:

- CEE3DMP—Generate dump in *z/OS Language Environment Programming Reference*
- TERMTHDACT in *z/OS Language Environment Programming Reference*
- TRACE in *z/OS Language Environment Programming Reference*

The TRACE runtime option activates Language Environment runtime library tracing and controls the size of the trace buffer, the type of trace events to record, and it determines whether a dump containing only the trace table should be unconditionally taken when the application (enclave) terminates. The trace table contents can be written out either upon demand or at the termination of an enclave.

The contents of the Language Environment dump depend on the values set in the TERMTHDACT runtime option. Table 30 on page 150 summarizes the dump contents that are generated under abnormal termination.

Table 30. TERMTHDACT runtime option settings and dump contents produced

TERMTHDACT value	Type of dump generated
TERMTHDACT(QUIET)	Language Environment dump containing the trace table only
TERMTHDACT(MSG)	Language Environment dump containing the trace table only
TERMTHDACT(TRACE)	Language Environment dump containing the trace table and the traceback
TERMTHDACT(DUMP)	Language Environment dump containing thread/enclave/process storage and control blocks (the trace table is included as an enclave control block)
TERMTHDACT(UAONLY)	System dump of the user address space and a Language Environment dump that contains the trace table
TERMTHDACT(UATRACE)	Language Environment dump that contains traceback information, and a system dump of the user address space
TERMTHDACT(UADUMP)	Language Environment dump containing thread/enclave/process storage and control blocks (the trace table is included as an enclave control block), and a user address space dump
TERMTHDACT(UAIMM)	System dump of the user address space of the original abend or program interrupt that occurred before the Language Environment condition manager processing the condition. Also contains a Language Environment dump, which contains the trace table. Under CICS, UAIMM yields UAONLY behavior. Under non-CICS, TRAP(ON,NOSPIE) must be in effect. When TRAP(ON,SPIE) is in effect, UAIMM yields UAONLY behavior. For software raised conditions or signals, UAIMM behaves the same as UAONLY.

Under normal termination, independent of the TERMTHDACT setting, Language Environment generates a dump containing the trace table only based on the TRACE runtime option

Language Environment quiesces all threads that are currently running except for the thread that issued the call to CEE3DMP. When you call CEE3DMP in a multithread environment, only the current thread is dumped. Enclave- and process-related storage could have changed from the time the dump request was issued.

Locating the trace dump

If your application calls CEE3DMP, the Language Environment dump is written to the file specified in the FNAME parameter of CEE3DMP (the default is CEEDUMP).

If your application is running under TSO or batch, and a CEEDUMP DD is not specified, Language Environment writes the CEEDUMP to the batch log (SYSOUT=* by default). You can change the SYSOUT class by specifying a CEEDUMP DD, or by setting the environment variable, _CEE_DMPTARG=SYSOUT(*x*), where *x* is the preferred SYSOUT class.

If your application is running under z/OS UNIX and is either running in an address space you issued a `fork()` to, or if it is invoked by one of the `exec` family of functions, the dump is written to z/OS UNIX file system. Language Environment writes the CEEDUMP to one of the following directories in the specified order:

1. The directory found in environment variable _CEE_DMPTARG, if found.
2. The current working directory, if the directory is not the root directory (/), the directory is writable, and the CEEDUMP path name does not exceed 1024 characters.
3. The directory found in environment variable TMPDIR (an environment variable that indicates the location of a temporary directory if it is not `/tmp`).
4. The `/tmp` directory.

The name of this file changes with each dump and uses the following format:

```
/path/Fname.Date.Time.Pid
```

path
Path determined from the preceding algorithm.

Fname
Name specified in the FNAME parameter on the call to CEE3DMP (default is CEEDUMP).

Date
Date the dump is taken, appearing in the format YYYYMMDD (such as 20090307 for March 7, 2009).

Time
Time the dump is taken, appearing in the format HHMMSS (such as 175501 for 05:55:01 p.m.).

Pid
Process ID the application is running in when the dump is taken.

Using the Language Environment trace table format in a dump report

The Language Environment trace table is established unconditionally at enclave initialization time if the TRACE runtime option is set to ON. All threads in the enclave share the trace table; there is no thread-specific table, nor can the table be dynamically extended or enlarged.

Understanding the trace table entry (TTE)

Each trace table entry is a fixed-length record consisting of a fixed-format portion (containing such items as the timestamp, thread ID, and member ID) and a member-specific portion. The member-specific portion has a fixed length, of which some (or all) can be unused. For information about how participating products use the trace table entry, see the product-specific documentation. The format of the trace table entry is as follows:

Time of Day	Thread ID	Member ID and flags	Member entry type	Mbr-specific info up to a maximum of 104 bytes
Char (8)	Char (8)	Char (4)	Char (4)	Char (104)

Figure 35. Format of the trace table entry

Time
The 64-bit value obtained from a store clock (STCK).

Thread ID
The 8-byte thread ID of the thread that is adding the trace table entry.

Member ID and Flags
Contains 2 fields:

Member ID
The 1-byte member ID of the member making the trace table entry, as follows:

ID
Name

01
CEL

03
C/C++

04
COBOL V5 (and later releases)

05
COBOL

07
Fortran

08
Reserved

10
PL/I

11
Enterprise PL/I

12
Sockets

Flags
24 flags reserved for internal use.

Member Entry Type
A number that indicates the type of the member-specific trace information that follows the field. To uniquely identify the information contained in a specific TTE, you must consider Member ID as well as Member Entry Type.

Member-Specific Information
Based on the member ID and the member entry type, this field contains the specific information for the entry, up to 104 bytes. For C/C++, the entry type of 1 is a record that records an invocation of a base C runtime library function. The entry consists of the name of the invoking function and the name of the invoked function. Entry type 2 is a record that records the return from the base library function. It contains the returned value and the value of errno.

Member-specific information in the trace table entry

Global tracing is activated by using the LE=n suboption of the TRACE runtime option. This requests all Language Environment members to generate trace records in the trace table. The settings for the global trace events are:

Level
Description

0
No global trace

1
Trace all runtime library (RTL) function entry and exits

2
Trace all RTL mutex init/destroy and lock/unlock

3
Trace all RTL function entry and exits, and all mutex init/destroy and lock/unlock

8
Trace all RTL storage allocation/deallocation

20
Trace all XPLINK/non-XPLINK transitions for AMODE 31 only. If `#pragma` linkage (xxxxxxxx, OS_UPSTACK) is specified, no transitions are recorded.

When LE=1 is specified

Table 31 on page 153 shows the C/C++ records that may be generated. For a detailed description of these records, see "C/C++ contents of the Language Environment trace tables" on page 195.

Table 31. LE=1 entry records

Member ID	Record Type	Description
03	00000001	Base C Library function Entry
03	00000002	Base C Library function Exit
03	00000003	Posix C Library function Entry
03	00000004	Posix C Library function Exit
03	00000005	XPLINK Base or Posix C Library function Entry
03	00000006	XPLINK Base or Posix C Library function Exit

When LE=2 is specified

Table 32 on page 153 shows the Language Environment records that may be generated.

Table 32. LE=2 entry records

Member ID	Record Type	Class	Event	Description
01	00000101	LT	A	Latch Acquire
01	00000102	LT	R	Latch Release
01	00000103	LT	W	Latch Wait
01	00000104	LT	AW	Latch Acquire after Wait
01	00000106	LT	I	Latch Increment (Recursive)
01	00000107	LT	D	Latch Decrement (Recursive)
01	000002FC	LE	EUO	Latch unowned (not released)
01	000002FD	LE	EO	Latch already owned (not acquired)

Table 32. LE=2 entry records (continued)

Member ID	Record Type	Class	Event	Description
01	00000301	MX	A	Mutex acquire
01	00000302	MX	R	Mutex release
01	00000303	MX	W	Mutex wait
01	00000304	MX	AW	Mutex acquire after wait
01	00000305	MX	B	Mutex busy (Trylock failed)
01	00000306	MX	I	Mutex increment (recursive)
01	00000307	MX	D	Mutex decrement (recursive)
01	00000315	MX	IN	Mutex initialize
01	00000316	MX	DS	Mutex destroy
01	0000031D	MX	BI	Shared memory lock init
01	0000031E	MX	BD	Shared memory lock destroy
01	0000031F	MX	BO	shared memory lock obtain
01	00000320	MX	BC	Shared memory lock obtain on condition
01	00000321	MX	BR	Shared memory lock release
01	00000324	MX	CIN	Call to SMC_INIT
01	00000325	MX	CSD	Call to SMC_DESTROY
01	00000326	MX	CSO	Shared resource obtain
01	00000327	MX	CSR	Shared resource release
01	00000328	MX	CST	Call to SMC_SetupToWait
01	00000329	MX	CSP	Call to SMC_POST
01	000004CC	ME	FFR	Error - Forced release (shared mutex)
01	000004CD	ME	FFD	Error - Forced decrement (shared mutex)
01	000004CE	ME	FBD	Error - BPX_SMC(DESTROY) error return
01	000004CF	ME	FBU	Error - BPX_SMC(fail) returns EBUSY
01	000004D0	ME	FIV	Error - BPX_SMC(fail) returns EINVAL
01	000004D4	ME	FDU	Error - Destroy failed (uninitialized) (shared mutex/CV)
01	000004D5	ME	FP	Error - Program check (shared mutex/CV)
01	000004DB	ME	ESC	Error - BPX1SMC error return
01	000004DE	ME	EDL	Shared memory lock returns deadlock
01	000004DF	ME	EIV	Shared memory lock returns invalid
01	000004E0	ME	EPM	Shared memory lock returns eperm
01	000004E1	ME	EAG	Shared memory lock returns eagain
01	000004E2	ME	EBU	Shared memory lock returns ebusy
01	000004E3	ME	ENM	Shared memory lock returns enomem
01	000004E4	ME	EBR	Shared memory lock release error
01	000004E5	ME	EBC	Shared memory lock obtain condition error
01	000004E6	ME	EBO	Shared memory lock obtain error

Table 32. LE=2 entry records (continued)

Member ID	Record Type	Class	Event	Description
01	000004E7	ME	EBD	Shared memory lock destroy error
01	000004E8	ME	EBI	Shared memory lock initialize error
01	000004E9	ME	EFR	Mutex forced release
01	000004EA	ME	EFD	Mutex forced decrement
01	000004EB	ME	EDD	Mutex destroy failed (damage)
01	000004EC	ME	EDB	Mutex destroy failed (busy)
01	000004ED	ME	EIA	Mutex initialize failed (attribute)
01	000004EE	ME	EIS	Mutex initialize failed (storage)
01	000004EF	ME	EF	Mutex release (forced by quiesce)
01	000004F0	ME	EP	Mutex program check
01	000004FA	ME	EDU	Mutex destroy failed (uninitialized)
01	000004FB	ME	EUI	Mutex uninitialized
01	000004FC	ME	EUO	Mutex unowned (not released)
01	000004FD	E	EO	Mutex already owned (not acquired)
01	000004FE	ME	EIN	Mutex initialization failed (duplicate)
01	00000508	CV	MR	CV release mutex
01	00000509	CV	MA	CV reacquire mutex
01	0000050A	CV	MW	CV mutex wait
01	0000050B	CV	MAW	CV reacquire mutex after wait
01	0000050C	CV	CW	CV condition wait
01	0000050D	CV	CTW	CV condition timeout
01	0000050E	CV	CWP	CV wait posted
01	0000050F	CV	CWI	CV wait interrupted
01	00000510	CV	CTO	CV wait timeout
01	00000511	CV	CSS	CV condition signal success
01	00000512	CV	CSM	CV condition signal miss
01	00000513	CV	CBS	CV condition broadcast success
01	00000514	CV	CBM	CV condition broadcast miss
01	00000515	CV	IN	CV initialize
01	00000516	CV	DS	CV destroy
01	00000522	CV	CIN	Call to SMC_INIT
01	00000523	CV	CSD	Call to SMC_DESTROY
01	00000529	CV	CSP	Call to SMC_POST
01	0000052A	CV	CSB	Call to SMC_POSTALL
01	0000052B	CV	CSW	Call to SMC_WAIT
01	0000052C	CV	DBM	Shared condition broadcast - miss
01	0000052D	CV	DBS	Shared condition broadcast - success

Table 32. LE=2 entry records (continued)

Member ID	Record Type	Class	Event	Description
01	0000052E	CV	DDS	Destroy (shared mutex/CV)
01	0000052F	CV	DIN	Initialize (shared mutex/CV)
01	00000530	CV	DSM	Condition signal - miss (shared CV)
01	00000531	CV	DSS	Condition signal - success (shared CV)
01	00000532	CV	DWI	Wait interrupted (shared CV)
01	00000533	CV	DTO	Wait timeout (shared CV)
01	00000534	CV	DWP	Wait posted (shared CV)
01	000006CB	CE	FBT	Error - Invalid system TOD (shared)
01	000006D1	CE	FRM	Error - Recursive mutex (shared)
01	000006D2	CE	FUO	Error - Shared mutex unowned
01	000006D3	CE	FDB	Error - Destroy failed (busy) (shared mutex/CV)
01	000006D4	CE	FDU	Error - Destroy failed (unitialized) (shared mutex/CV)
01	000006D5	CE	FP	Error - Program check (shared mutex/CV)
01	000006D6	CE	FUI	Error - Shared mutex or CV unitialized
01	000006D7	CE	ENV	Error - BPX1SMC(fail) returns EINVAL
01	000006D8	CE	EPE	Error - BPX1SMC(fail) returns EPERM
01	000006D9	CE	EAN	Error - BPX1SMC(fail) returns EAGAIN
01	000006DA	CE	EIB	Error - BPX1SMC failed (EBUSY)
01	000006DB	CE	ESC	Error - BPX1SMC failed
01	000006EB	CE	EDD	CV destroy failed (damage)
01	000006EC	CE	EDB	CV destroy failed (busy)
01	000006ED	CE	EIA	CV initialization failed (attribute)
01	000006EE	CE	EIS	CV initialization failed (storage)
01	000006EF	CE	EF	CV forced by quiesce
01	000006F0	CE	EP	CV program check
01	000006F1	CE	EBT	CV invalid system TOD
01	000006F2	CE	EBN	CV invalid timespec (nanoseconds)
01	000006F3	CE	EBS	CV invalid timespec (seconds)
01	000006F4	CE	EPO	CV condition post callable service fail
01	000006F5	CE	ETW	CV condition timed wait callable service fail
01	000006F6	CE	EWA	CV condition wait callable service fail
01	000006F7	CE	ESE	CV condition setup callable service fail
01	000006F8	CE	ERM	CV recursive mutex
01	000006F9	CE	EWM	CV wrong mutex
01	000006FA	CE	EDU	CV destroy failed (uninitialized)
01	000006FB	CE	EUI	CV mutex or CV uninitialized
01	000006FC	CE	EUO	CV mutex unowned

Table 32. LE=2 entry records (continued)

Member ID	Record Type	Class	Event	Description
01	000006FE	CE	EIN	CV initialization failed (duplicate)
01	00000702	RW	R	Release
01	00000704	RW	AW	Acquire after wait
01	00000706	RW	I	Increment (recursive)
01	00000707	RW	D	Decrement (recursive)
01	00000715	RW	IN	Initialize
01	00000716	RW	DS	Destroy
01	00000717	RW	RA	Read acquire
01	00000718	RW	WA	Write acquire
01	00000719	RW	RB	Read busy (tryread failed)
01	0000071A	RW	WB	Write busy (trywrite failed)
01	0000071B	RW	RW	Read wait
01	0000071C	RW	WW	Write wait
01	0000071D	RW	BI	Call to SLK_INIT
01	0000071E	RW	BD	Call to SLK_DESTROY
01	0000071F	RW	BO	Call to SLK_OBTAIN
01	00000720	RW	BC	Call to SLK_OBTAIN_COND
01	00000721	RW	BR	Call to SLK_RELEASE
01	000008DC	RE	EOW	Error - Already owned for write (not acquired)
01	000008DD	RE	EOR	Error - Already owned for read (not acquired)
01	000008DE	RE	EDL	Error - BPX1SLK(fail) returns EDEADLK
01	000008DF	RE	EIV	Error - BPX1SLK(fail) returns EINVAL
01	000008E0	RE	EPM	Error - BPX1SLK(fail) returns EPERM
01	000008E1	RE	EAG	Error - BPX1SLK(fail) returns EAGAIN
01	000008E2	RE	EBS	Error - BPX1SLK(fail) returns EBUSY
01	000008E3	RE	ENM	Error - BPX1SLK(fail) returns ENOMEM
01	000008E4	RE	EBR	Error - BPX1SLK(RELEASE) error return
01	000008E5	RE	EBC	Error - BPX1SLK(OBTAIN_COND) error return
01	000008E6	RE	EBO	Error - BPX1SLK(OBTAIN) error return
01	000008E7	RE	EBD	Error - BPX1SLK(DESTROY) error return
01	000008E8	RE	EBI	Error - BPX1SLK(INIT) error return
01	000008E9	RE	EFR	Error - Forced release
01	000008EA	RE	EFD	Error - Forced decrement
01	000008ED	RE	EIA	Error - Initialization failed (attribute)
01	000008EE	RE	EIS	Error - Initialization failed (storage)
01	000008EF	RE	EF	Error - Forced by quiesce
01	000008F0	RE	EP	Error - Program check

Table 32. LE=2 entry records (continued)				
Member ID	**Record Type**	**Class**	**Event**	**Description**
01	000008FB	RE	EUI	Error - Uninitialized
01	000008FC	RE	EUO	Error - Unowned (not released)
01	000008FD	RE	EO	Error - Already owned (not acquired)
01	000008FE	RE	EIN	Error - Initialization failed (duplicate)

Table 33 on page 158 shows the format for the Mutex – Condition Variable – Latch entries in the trace table.

Table 33. Format of the mutex/CV/latch records

Record fields							
Class	Source		Event		Object Addr	Name1	Name2
unused							

Class
Two character EBCDIC representation of the trace class.

LT
Latch

LE
Latch Exception

MX
Mutex

ME
Mutex Exception

CV
Condition Variable

CE
Condition Variable Exception

Source
One character EBCDIC representation of the event.

C
C/C++

S
Sockets

Blank
Blank character

Event
Two character EBCDIC representation of the event. See Table 32 on page 153.

Object Addr
Fullword address of the mutex object.

Name 1
Optional eight character field containing the name of the function or object to be recorded.

Name 2
Optional eight character field containing the name of the function or object to be recorded.

When LE=3 is specified

The trace table will include the records generated by both LE=1 and LE=2.

When LE=8 is specified

The trace table will contain only storage allocation records, as shown in Table 34 on page 159. Currently this is only supported by C/C++. For a detailed description of these records, see "C/C++ contents of the Language Environment trace tables" on page 195.

Table 34. LE=8 entry records

Member ID	Record Type	Description
03	00000001	Storage allocation entry
03	00000001	Storage allocation exit

When LE=20 is specified

Table 35 on page 159 shows the C/C++ records that might be generated. For a detailed description of these records, see "C/C++ contents of the Language Environment trace tables" on page 195.

Table 35. LE=20 entry records

Member ID	Record Type	Description
03	00000007	XPLINK calls non-XPLINK entry
03	00000008	non-XPLINK calls XPLINK entry

Sample dump for the trace table entry

The following sample shows an example of a dump of the trace table when you specify the LE=1 suboption (the library call/return trace).

```
     ⋮
Enclave Control Blocks:
  EDB: 0001E920
    +000000 0001E920  C3C5C5C5 C4C24040 C5000001 00020E68  0001F040 00000000 00000000 00000000  |CEEEDB  E.........0 ............|
     ⋮
  MEML: 00020E68
    +000000 00020E68  00000000 00000000 0007C5B8 00000000  00000000 00000000 0007C5B8 00000000  |..........E...............E.....|
     ⋮
  Language Environment Trace Table:
   Most recent trace entry is at displacement: 001B80

       Displacement                        Trace Entry in Hexadecimal                                   Trace Entry in EBCDIC
       ------------ ----------------------------------------------------------------------------   --------------------------------
         +000000    Time 21.41.57.595359    Date 2001.08.26    Thread ID... 8000000000000000
         +000010    Member ID.... 03    Flags..... 000000    Entry Type..... 00000001
         +000018    6D6DA289 9589A3F6 F46D6D83 82836D83  938296A2 F2F46D89 96A2A399 8581946D  |__sinit64__cbc_clbos24_iostream_|
         +000038    60606E4D F1F9F35D 406D6D87 85A38382  4D5D4040 40404040 40404040 40404040  |-->(193) __getcb()               |
         +000058    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
         +000078    40404040 40404040                                                         |                                |

         +000080    Time 21.41.57.595367    Date 2001.08.26    Thread ID... 8000000000000000
         +000090    Member ID.... 03    Flags..... 000000    Entry Type..... 00000002
         +000098    4C60604D F1F9F35D 40D9F1F5 7EF0F0F0  F0F0F0F0 F040C5D9 D9D5D67E F0F0F0F0  |<--(193) R15=00000000 ERRNO=0000|
         +0000B8    F0F0F0F0 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |0000............................|
         +0000D8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
         +0000F8    00000000 00000000                                                         |........                        |

         +000100    Time 21.41.57.595374    Date 2001.08.26    Thread ID... 8000000000000000
         +000110    Member ID.... 03    Flags..... 000000    Entry Type..... 00000003
         +000118    6D6DA289 9589A3F6 F46D6D83 82836D83  938296A2 F2F46D89 96A2A399 8581946D  |__sinit64__cbc_clbos24_iostream_|
         +000138    60606E4D F1F1F35D 406D6D89 A2D796A2  89A7D695 4D5D4040 40404040 40404040  |-->(113) __isPosixOn()          |
         +000158    40404040 40404040 40404040 40404040  40404040 40404040 40000000 00000000  |                         .......|
         +000178    00000000 00000000                                                         |........                        |
         +000180    Time 21.41.57.595380    Date 2001.08.26    Thread ID... 8000000000000000
         +000190    Member ID.... 03    Flags..... 000000    Entry Type..... 00000004
         +000198    4C60604D F1F1F35D 40D9F1F5 7EF0F0F0  F0F0F0F0 F040C5D9 D9D5D67E F0F0F0F0  |<--(113) R15=00000000 ERRNO=0000|
         +0001B8    F0F0F0F0 40C5D9D9 D5D6F27E F0F0F0F0  F0F0F0F0 00000000 00000000 00000000  |0000 ERRNO2=00000000............|
         +0001D8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
         +0001F8    00000000 00000000                                                         |........                        |

         +000200    Time 21.41.57.595638    Date 2001.08.26    Thread ID... 8000000000000000
         +000210    Member ID.... 03    Flags..... 000000    Entry Type..... 00000001
         +000218    D3968392 A27A7AC9 95A2A381 9583854D  5D404040 40404040 40404040 40404040  |Locks::Instance()               |
         +000238    60606E4D F1F2F45D 40948193 9396834D  F1F6F0F0 5D404040 40404040 40404040  |-->(124) malloc(1600)          |
         +000258    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
         +000278    40404040 40404040                                                         |                                |

         +000280    Time 21.41.57.595690    Date 2001.08.26    Thread ID... 8000000000000000
         +000290    Member ID.... 03    Flags..... 000000    Entry Type..... 00000002
         +000298    4C60604D F1F2F45D 40D9F1F5 7EF2F4C2  F6C4F8C5 F840C5D9 D9D5D67E F0F0F0F0  |<--(124) R15=24B6D8E8 ERRNO=0000|
         +0002B8    F0F0F0F0 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |0000............................|
         +0002D8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
         +0002F8    00000000 00000000                                                         |........                        |

         +000300    Time 21.41.57.595743    Date 2001.08.26    Thread ID... 8000000000000000
         +000310    Member ID.... 03    Flags..... 000000    Entry Type..... 00000001
         +000318    8785A394 9684856D 86999694 6D86844D  8995A35D 40404040 40404040 40404040  |getmode_from_fd(int)            |
         +000338    60606E4D F1F9F35D 406D6D87 85A38382  4D5D4040 40404040 40404040 40404040  |-->(193) __getcb()               |
         +000358    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
         +000378    40404040 40404040                                                         |                                |

         +000380    Time 21.41.57.595746    Date 2001.08.26    Thread ID... 8000000000000000
         +000390    Member ID.... 03    Flags..... 000000    Entry Type..... 00000002
         +000398    4C60604D F1F9F35D 40D9F1F5 7EF0F0F0  F0F0F0F0 F040C5D9 D9D5D67E F0F0F0F0  |<--(193) R15=00000000 ERRNO=0000|
         +0003B8    F0F0F0F0 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |0000............................|
         +0003D8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
```

```
          +0003F8    00000000 00000000                                                    |........                        |
   :
```

Requesting a UNIX System Services syscall trace for debugging

Signal SIGTRACE can be sent to a process or process group to start or stop a trace of the z/OS UNIX System Services syscalls made by the application. The signal is implemented as a toggle. With the trace turned on, the z/OS UNIX System Services kernel gathers the syscall trace records for the targeted processes. A system dump of the user address space can be generated by sending signal SIGDUMP to the same processes to capture the trace output.

Part 2. Debugging language-specific routines

This part provides specific information for debugging applications written in C/C++, COBOL, Fortran, and PL/I. It also discusses techniques for debugging under CICS.

Chapter 4. Debugging C/C++ routines

This chapter provides specific information to help you debug applications that contain one or more C/C++ routines. It also provides information about debugging C/C++ applications compiled with XPLINK. It includes the following topics:

- Debugging C/C++ I/O routines
- Using C/C++ compiler listings
- Generating a Language Environment dump of a C/C++ routine
- Generating a Language Environment dump of a C/C++ routine with XPLINK
- Finding C/C++ information in a Language Environment dump
- Debugging example of C/C++ routines
- Debugging example of C/C++ routines with XPLINK

There are several debugging features that are unique to C/C++ routines. Before examining the C/C++ techniques to find errors, you might want to consider the following areas of potential problems:

- If you suspect that you are using uninitialized storage, you may want to use the STORAGE runtime option.
- If you are using the `fetch()` function, see fetch() - Get a load module in *z/OS XL C/C++ Runtime Library Reference* to ensure that you are creating the fetchable module correctly.
- If you are using DLLs, see Building and using Dynamic Link Libraries (DLLs) in *z/OS XL C/C++ Programming Guide*.
- For non-System Programming C routines, ensure that the entry point of the load module is CEESTART.
- You should avoid:
  - Incorrect casting
  - Referencing an array element with a subscript outside the declared bounds
  - Copying a string to a target with a shorter length than the source string
  - Declaring but not initializing a pointer variable, or using a pointer to allocated storage that has already been freed

  If a routine exception occurred and you need more information than the condition handler provided, run your routine with the following runtime options: TRAP(ON, NOSPIE) and TERMTHDACT(UAIMM). Setting these runtime options generates a system dump of the user address space of the original abend or program interrupt prior to the Language Environment condition manager processing the condition. After the system dump is taken by the operating system, the Language Environment condition manager continues processing.

Debugging C/C++ programs

You can use C/C++ conventions such as `__amrc` and `perror()` when you debug C/C++ programs.

Using the __amrc and __amrc2 structures to debug input/output

`__amrc`, a structure defined in `stdio.h`, can help you determine the cause of errors resulting from an I/O operation, because it contains diagnostic information (for example, the return code from a failed VSAM operation). There are two structures:

- `__amrc` (defined by type `__amrc_type`
- `__amrc2` (defined by type `__amrc2_type`)

The `__amrc2_type` structure contains secondary information that C can provide.

Because any I/O function calls, such as `printf()`, can change the value of `__amrc` or `__amrc2`, make sure you save the contents into temporary structures of `__amrc_type` and `__amrc2_type` respectively, before dumping them.

Figure 36 on page 164 shows the structure as it appears in **stdio.h**.

```
    typedef struct __amrctype {

[1]    union {

[2]       long int __error;
          struct {
            unsigned short __syscode,
                           __rc;
[3]       } __abend;
          struct {
             unsigned char __fdbk_fill,
                           __rc,
                           __ftncd,
                           __fdbk;
[4]       } __feedback;
          struct {
             unsigned short __svc99_info,
                            __svc99_error;
[5]       } __alloc;
[1]    } __code;
[6]    unsigned long __RBA;
[7]    unsigned int      __last_op;
       struct {
        unsigned long  __len_fill; /* __len + 4       */
        unsigned long  __len;
        char           __str[120];
        unsigned long  __parmr0;
        unsigned long  __parmr1;
        unsigned long  __fill2[2];
        char           __str2[64];
[8]    } __msg;
[9]  #if __EDC_TARGET >= 0x22080000
    unsigned char        __rplfdbwd[4];
    #endif
[10] #if __EDC_TARGET >= 0x41080000
   #ifdef  __LP64
     unsigned long __XRBA;
   #elif defined(__LL)
     unsigned long long __XRBA;
   #else
     unsigned int __XRBA1;
     unsigned int __XRBA2;
   #endif
    unsigned char        __amrc_noseek_to_seek;
    char                 __amrc_pad[23];
 #endif
 } __amrc_type;
```

Figure 36. __amrc structure

Figure 37 on page 164 shows the `__amrc2` structure as it appears in `stdio.h`.

```
    struct {
[11]       long int   __error2;
                         char       __pad__error2[4];
[12]      FILE      *__fileptr;
[13]      long int   __reserved{6};
    }
```

Figure 37. __amrc2 structure

[1] union { ... } __code
The error or warning value from an I/O operation is in `__error`, `__abend`, `__feedback`, or `__alloc`. Look at `__last_op` to determine how to interpret the `__code` union.

[2] __error
A structure that contains error codes for certain macros or services your application uses. Look at __last_op to determine the error codes. __syscode is the system abend code.

[3] __abend
A structure that contains the abend code when errno is set to indicate a recoverable I/O abend. __rc is the return code. For more information about abend codes, see System completion codes in *z/OS MVS System Codes*.

[4] __feedback
A structure that is used for VSAM only. The __rc stores the VSAM register 15, __fdbk stores the VSAM error code or reason code, and __RBA stores the RBA after some operations.

[5] __alloc
A structure that contains errors during fopen or freopen calls when defining files to the system using SVC 99.

[6] __RBA
The RBA value returned by VSAM after an ESDS or KSDS record is written out. For an RRDS, it is the calculated value from the record number. It can be used in subsequent calls to flocate.

[7] __last_op
A field containing a value that indicates the last I/O operation being performed by C/C++ at the time the error occurred. These values are shown in Table 36 on page 166.

[8] __msg
May contain the system error messages from read or write operations emitted from the MVS SYNADAF macro instruction. Because the message can start with a hexadecimal address followed by a short integer, it is advisable to start printing at MSG+6 or greater so the message can be printed as a string. Because the message is not null-terminated, a maximum of 114 characters should be printed. This can be accomplished by specifying a printf format specifier as %.114s.

[9] __amrc_noseek_to_seek
This field contains the reason for the switch from QSAM (noseek) to BSAM with NOTE and POINT macros requested (seek) by the XL C/C++ Runtime Library. This field is set when system-level I/O macro processing triggers an ABEND condition. The macro name values (defined in stdio.h) for this field are as follows:

Macro	Definition
__AM_BSAM_NOSWITCH	No switch was made.
__AM_BSAM_UPDATE	The data set is open for update
__AM_BSAM_BSAMWRITE	The data set is already open for write (or update) in the same C process.
__AM_BSAM_FBS_APPEND	The data set is recfm=FBS and open for append
__AM_BSAM_LRECLX	The data set is recfm=LRECLX (used for VBS data sets where records span the largest blocksize allowed on the device)
__AM_BSAM_PARTITIONED_DIRECTORY	The data set is the directory for a regular or extended partitioned data set
__AM_BSAM_PARTITIONED_INDIRECT	The data set is a member of a partitioned data set, and the member name was not specified at allocation

[10] __XRBA
This is the 8 byte relative byte address returned by VSAM after an ESDS or KSDS record is written out. For an RRDS, it is the calculated value from the record number. It may be used in subsequent calls to flocate().

[11] __error2

A secondary error code. For example, an unsuccessful rename or remove operation places its reason code here.

[12] __fileptr

A pointer to the file that caused a SIGIOERR to be raised. Use an `fldata()` call to get the actual name of the file.

[13] __reserved

Reserved for future use.

__last_op values

The `__last_op` field is the most important of the `__amrc` fields. It defines the last I/O operation C/C++ was performing at the time of the I/O error. You should note that the structure is neither cleared nor set by non-I/O operations, so querying this field outside of a SIGIOERR handler should only be done immediately after I/O operations. Table 36 on page 166 lists `__last_op` values that you might receive and where to look for further information.

Table 36. __last_op values and diagnosis information

Value	More information
__IO_INIT	Will never be seen by SIGIOERR exit value given at initialization.
__BSAM_OPEN	Sets __error with return code from OS OPEN macro.
__BSAM_CLOSE	Sets __error with return code from OS CLOSE macro.
__BSAM_READ	No return code (either __abend (errno == 92) or __msg (errno == 66) filled in).
__BSAM_NOTE	NOTE returned 0 unexpectedly, no return code.
__BSAM_POINT	This will not appear as an error lastop.
__BSAM_WRITE	No return code (either __abend (errno == 92) or __msg (errno == 65) filled in).
__BSAM_CLOSE_T	Sets __error with return code from OS CLOSE TYPE=T.
__BSAM_BLDL	Sets __error with return code from OS BLDL macro.
__BSAM_STOW	Sets __error with return code from OS STOW macro.
__TGET_READ	Sets __error with return code from TSO TGET macro.
__TPUT_WRITE	Sets __error with return code from TSO TPUT macro.
__IO_DEVTYPE	Sets __error with return code from I/O DEVTYPE macro.
__IO_RDJFCB	Sets __error with return code from I/O RDJFCB macro.
__IO_TRKCALC	Sets __error with return code from I/O TRKCALC macro.
__IO_OBTAIN	Sets __error with return code from I/O CAMLST OBTAIN.
__IO_LOCATE	Sets __error with return code from I/O CAMLST LOCATE.
__IO_CATALOG	Sets __error with return code from I/O CAMLST CAT. The associated macro is CATALOG.
__IO_UNCATALOG	Sets __error with return code from I/O CAMLST UNCAT. The associated macro is CATALOG.
__IO_RENAME	Sets __error with return code from I/O CAMLST RENAME.
__SVC99_ALLOC	Sets __alloc structure with information and error codes from SVC 99 allocation.
__SVC99_ALLOC_NEW	Sets __alloc structure with information and error codes from SVC 99 allocation of NEW file.
__SVC99_UNALLOC	Sets __unalloc structure with information and error codes from SVC 99 unallocation.

Table 36. __last_op values and diagnosis information (continued)

Value	More information
__C_TRUNCATE	Set when C or C++ truncates output data. Usually, this is data written to a text file with no newline such that the record fills up to capacity and subsequent characters cannot be written. For a record I/O file this refers to an `fwrite()` writing more data than the record can hold. Truncation is always rightmost data. There is no return code.
__C_FCBCHECK	Set when C or C++ FCB is corrupted. This is due to a pointer corruption somewhere. File cannot be used after this.
__C_DBCS_TRUNCATE	This occurs when writing DBCS data to a text file and there is no room left in a physical record for anymore double byte characters. A new-line is not acceptable at this point. Truncation will continue to occur until an SI is written or the file position is moved. Cannot happen if MB_CUR_MAX is 1.
__C_DBCS_SO_TRUNCATE	This occurs when there is not enough room in a record to start any DBCS string or else when a redundant SO is written to the file before an SI. Cannot happen if MB_CUR_MAX is 1.
__C_DBCS_SI_TRUNCATE	This occurs only when there was not enough room to start a DBCS string and data was written anyways, with an SI to end it. Cannot happen if MB_CUR_MAX is 1.
__C_DBCS_UNEVEN	This occurs when an SI is written before the last double byte character is completed, thereby forcing C or C++ to fill in the last byte of the DBCS string with a padding byte X'FE'. Cannot happen if MB_CUR_MAX is 1.
__C_CANNOT_EXTEND	This occurs when an attempt is made to extend a file that allows writing, but cannot be extended. Typically this is a member of a partitioned data set being opened for update.
__VSAM_OPEN_FAIL	Set when a low level VSAM OPEN fails, sets __rc and __fdbk fields in the __amrc struct.
__VSAM_OPEN_ESDS	Does not indicate an error; set when the low level VSAM OPEN succeeds, and the file type is ESDS.
__VSAM_OPEN_RRDS	Does not indicate an error; set when the low level VSAM OPEN succeeds, and the file type is RRDS.
__VSAM_OPEN_KSDS	Does not indicate an error; set when the low level VSAM OPEN succeeds, and the file type is KSDS.
__VSAM_OPEN_ESDS_PATH	Does not indicate an error; set when the low level VSAM OPEN succeeds, and the file type is ESDS PATH.
__VSAM_OPEN_KSDS_PATH	Does not indicate an error; set when the low level VSAM OPEN succeeds, and the file type is KSDS PATH.
__VSAM_MODCB	Set when a low level VSAM MODCB macro fails, sets __rc and __fdbk fields in the __amrc struct.
__VSAM_TESTCB	Set when a low level VSAM TESTCB macro fails, sets __rc and __fdbk fields in the __amrc struct.
__VSAM_SHOWCB	Set when a low level VSAM SHOWCB macro fails, sets __rc and __fdbk fields in the __amrc struct.
__VSAM_GENCB	Set when a low level VSAM GENCB macro fails, sets __rc and __fdbk fields in the __amrc struct.
__VSAM_GET	Set when the last op was a low level VSAM GET; if the GET fails, sets __rc and __fdbk in the __amrc struct.
__VSAM_PUT	Set when the last op was a low level VSAM PUT; if the PUT fails, sets __rc and __fdbk in the __amrc struct.
__VSAM_POINT	Set when the last op was a low level VSAM POINT; if the POINT fails, sets __rc and __fdbk in the __amrc struct.

Value	More information
__VSAM_ERASE	Set when the last op was a low level VSAM ERASE; if the ERASE fails, sets __rc and __fdbk in the __amrc struct.
__VSAM_ENDREQ	Set when the last op was a low level VSAM ENDREQ; if the ENDREQ fails, sets __rc and __fdbk in the __amrc struct.
__VSAM_CLOSE	Set when the last op was a low level VSAM CLOSE; if the CLOSE fails, sets __rc and __fdbk in the __amrc struct.
__QSAM_GET	__error is not set (if abend (errno == 92), __abend is set, otherwise if read error (errno == 66), look at __msg.
__QSAM_PUT	__error is not set (if abend (errno == 92), __abend is set, otherwise if write error (errno == 65), look at __msg.
__QSAM_TRUNC	This is an intermediate operation. You will only see this if an I/O abend occurred.
__QSAM_FREEPOOL	This is an intermediate operation. You will only see this if an I/O abend occurred.
__QSAM_CLOSE	Sets __error to result of OS CLOSE macro.
__QSAM_OPEN	Sets __error to result of OS OPEN macro.
__CMS_OPEN	Sets __error to result of FSOPEN.
__CMS_CLOSE	Sets __error to result of FSCLOSE.
__CMS_READ	Sets __error to result of FSREAD.
__CMS_WRITE	Sets __error to result of FSWRITE.
__CMS_STATE	Sets __error to result of FSSTATE.
__CMS_ERASE	Sets __error to result of FSERASE.
__CMS_RENAME	Sets __error to result of CMS RENAME command.
__CMS_EXTRACT	Sets __error to result of DMS EXTRACT call.
__CMS_LINERD	Sets __error to result of LINERD macro.
__CMS_LINEWRT	Sets __error to result of LINEWRT macro.
__CMS_QUERY	__error is not set.
__HSP_CREATE	Indicates last op was a DSPSERV CREATE to create a hiperspace for a hiperspace memory file. If CREATE fails, stores abend code in __amrc__code__abend__syscode, reason code in __amrc__code__abend__rc.
__HSP_DELETE	Indicates last op was a DSPSERV DELETE to delete a hiperspace for a hiperspace memory file during termination. If DELETE fails, stores abend code in __amrc__code__abend__syscode, reason code in __amrc__code__abend__rc.
__HSP_READ	Indicates last op was a HSPSERV READ from a hiperspace. If READ fails, stores abend code in __amrc__code__abend__syscode, reason code in __amrc__code__abend__rc.
__HSP_WRITE	Indicates last op was a HSPSERV WRITE to a hiperspace. If WRITE fails, stores abend code in __amrc__code__abend__syscode, reason code in __amrc__code__abend__rc.
__HSP_EXTEND	Indicates last op was a HSPSERV EXTEND during a write to a hiperspace. If EXTEND fails, stores abend code in __amrc__code__abend__syscode, reason code in __amrc__code__abend__rc.
__CICS_WRITEQ_TD	Sets __error with error code from EXEC CICS WRITEQ TD.

Table 36. __last_op values and diagnosis information (continued)

Table 36. __last_op values and diagnosis information (continued)

Value	More information
__LFS_OPEN	Sets __error with reason code from z/OS UNIX services. Reason codes from z/OS UNIX services must be broken up. The low order 2 bytes can be looked up in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.
__LFS_CLOSE	Sets __error with reason code from z/OS UNIX services. Reason codes from z/OS UNIX services must be broken up. The low order 2 bytes can be looked up in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.
__LFS_READ	Sets __error with reason code from z/OS UNIX services. Reason codes from z/OS UNIX services must be broken up. The low order 2 bytes can be looked up in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.
__LFS_WRITE	Sets __error with reason code from z/OS UNIX services. Reason codes from z/OS UNIX services must be broken up. The low order 2 bytes can be looked up in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.
__LFS_LSEEK	Sets __error with reason code from z/OS UNIX services. Reason codes from z/OS UNIX services must be broken up. The low order 2 bytes can be looked up in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.
__LFS_FSTAT	Sets __error with reason code from z/OS UNIX services. Reason codes from z/OS UNIX services must be broken up. The low order 2 bytes can be looked up in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.

Using file I/O tracing to debug C/C++ file I/O problems

You can use file I/O tracing to debug C/C++ file I/O problems. For more information, see Debugging I/O programs in *z/OS XL C/C++ Programming Guide*.

Displaying an error message with the perror() function

To find a failing routine, check the return code of all function calls. After you have found the failing routine, use the `perror()` function after the routine to display the error message. `perror()` displays the string that you pass to it and an error message corresponding to the value of `errno`. `perror()` writes to the standard error stream (`stderr`). Figure 38 on page 169 is an example of a routine using `perror()`.

By default, the errno2 value will be appended to the end of the perror() string. If you do not want the errno2 value appended to the `perror()` string, set the _EDC_ADD_ERRNO2 environment variable to 0.

```
#include <stdio.h>
int main(void){
   FILE *fp;

   fp = fopen("myfile.dat", "w");
   if (fp == NULL)
      perror("fopen error");
}
```

Figure 38. Example of a routine using perror()

Using __errno2() to diagnose application problems

Use the __errno2() function when diagnosing problems in an application program. This function enables z/OS XL C/C++ application programs to access additional diagnostic information, `errno2` (`errnojr`), associated with `errno`. The `__errno2` may be set by the z/OS XL C/C++ runtime library, z/OS UNIX callable services, or other callable services. The `errno2` is intended for diagnostic display purposes only and is not a programming interface.

Note: Not all functions set errno2 when errno is set. In the cases where errno2 is not set, the __errno2() function may return a residual value. You may use the __err2ad() function to clear errno2 to reduce the possibility of a residual value being returned.

Figure 39 on page 170 is an example of a routine using `__errno2()`.

```
#pragma runopts(posix(on))
#define _EXT
#include <stdio.h>
#include <errno.h>

int main(void) {
  FILE *f;
  f = fopen("testfile.dat", "r");
  if (f==NULL) {
      perror("fopen() failed");
      printf("__errno2 = %08x\n", __errno2());
   }
   return 0;
}
```

Figure 39. Example of a routine using __errno2()

Figure 40 on page 170 shows the output from the sample routine in Figure 39 on page 170.

```
fopen() failed: EDC5129I No such file or directory. (errno2=0x05620062)
__errno2 = 05620062
```

Figure 40. Sample output of a routine using __errno2()

Figure 41 on page 170 is an example of a routine using the environment variable _EDC_ADD_ERRNO2.

```
#pragma runopts(posix(on))
#define _EXT
#include <stdio.h>
#include <errno.h>
#include <stdlib.h>

int main(void) {
  FILE *fp;
  /* do NOT add errno2 to perror message */
  setenv("_EDC_ADD_ERRNO2", "0", 1);
  fp = fopen("testfile.dat", "r");
  if (fp == NULL)
      perror("fopen() failed");
  return 0;
}
```

Figure 41. Example of a routine using _EDC_ADD_ERRNO2

Figure 42 on page 170 shows the sample output from the routine in Figure 41 on page 170.

```
fopen() failed: EDC5129I No such file or directory.
```

Figure 42. Sample output of a routine using _EDC_ADD_ERRNO2

Figure 43 on page 171 is an example of a routine using __err2ad() in combination with __errno2() .

```
#pragma runopts(posix(on))
#define _EXT
#include <stdio.h>
#include <errno.h>
#include <stdlib.h>

int main(void) {
  FILE *f;
  setenv("_EDC_ADD_ERRNO2", "0", 1);
  f = fopen("testfile.dat", "r");
  if (f == NULL) {
    perror("fopen() failed");
    printf("__errno2 = %08x\n", __errno2());
  }
  /* reset errno2 to zero */
  *__err2ad() = 0x0;
  printf("__errno2 = %08x\n", __errno2());
  f = fopen("testfile.dat", "r");

  if (f == NULL) {
    perror("fopen() failed");
    printf("__errno2 = %08x\n", __errno2());
  }
  return 0;
}
```

Figure 43. Example of a routine using __err2ad() in combination with __errno2()

Figure 44 on page 171 shows the sample output from the routine shown in Figure 43 on page 171.

```
fopen() failed: EDC5129I  No such file or directory.
__errno2 = 05620062
__errno2 = 00000000
fopen() failed: EDC5129I  No such file or directory.
__errno2 = 05620062
```

Figure 44. Sample output of routine using __err2ad() in combination with __errno2()

For more information about _EDC_ADD_ERRNO2, see _EDC_ADD_ERRNO2 in *z/OS XL C/C++ Programming Guide*.

For more information about __errno2() and __err2ad(), see __errno2() — Return reason code information and __err2ad() — Return address of reason code of last failure in *z/OS XL C/C++ Runtime Library Reference*.

Diagnosing DLL problems

Use the _EDC_DLL_DIAG environment variable to diagnose DLL problems. For more information about the environment variable, see Environment variables specific to the z/OS XL C/C++ library in *z/OS XL C/C++ Programming Guide*.

You can also see the diagnosis output in CEEDUMP and Verbexit LEDATA reports. For more information, see "Using the DLL failure control block" on page 79.

Using C/C++ listings

For a detailed description of available listings, see Listings, messages, and compiler information options in *z/OS XL C/C++ User's Guide*.

Finding variables

You can determine the value of a variable in the routine at the point of interrupt by using the compiled code listing as a guide to its address, then finding this address in the Language Environment dump. The method you use depends on the storage class of variable.

This method is generally used when no symbolic variables have been dumped (by using the TEST compiler option).

It is possible for the routine to be interrupted before the value of the variable is placed in the location provided for it. This can explain unexpected values in the dump.

Steps for finding automatic variables

Perform the following steps to find automatic variables in the Language Environment dump:

1. Identify the start of the stack frame. If a dump has been taken, each stack frame is dumped. The stack frames can be cross-referenced to the function name in the traceback.
2. Determine the value of the base register (in this example, GPR13) in the Saved Registers section for the function you are interested in.
3. Find the offset of the variable (which is given in decimal) in the storage offset listing.

   ```
   aa1    85-0:85   Class = automatic,  Offset = 164(r13),    Length = 40
   ```

4. Add this base address to the offset of the variable.

When you are done, the contents of the variable can be read in the DSA Frame section corresponding to the function the variable is contained in.

Locating the Writable Static Area (WSA)

The Writable Static Area (WSA) address is the base address of the writable static area which is available for all C and C++ programs except C programs compiled with the NORENT compiler option. If you have C code compiled with the RENT option or C++ code (hereafter called RENT code) you must determine the base address of the WSA if you want to calculate the address of a static or external variable. Use the following table to determine where to find the WSA base address:

Table 37. Finding the WSA base address

If you want the WSA base address for:	Locate the WSA base address in:
application code	the WSA address field in the Enclave Control Blocks section
a fetched module	the WSA address field of the Fetch() Information section for the fetch() function pointer for which you are interested
a DLL	the corresponding WSA address in the DLL Information section

Use the WSA base address to locate the WSA in the Enclave Storage section.

Steps for finding the static storage area

If you have C code compiled with the NORENT option (hereafter called `NORENT` code) you must determine the base address of the static storage area if you want to calculate the address of a static or external variable.

Perform the following steps to find the static storage area:

1. Name the static storage area CSECT by using the `pragma csect` directive. Once this is done, a CSECT is generated for the static storage area for each source file.
2. Determine the origin and length of the CSECT from the linker map.
3. Locate the external variables corresponding to the CSECT with the same name.
4. Determine the origin and length of the external variable CSECT from the linker map.

Note:

1. Address calculation for static and external variables uses the static storage area as a base address with 1 or more offsets added to this address.
2. The storage associated with these CSECTs is not dumped when an exception occurs. It is dumped when `cdump` or CEE3DMP is called, but it is written to a separate ddname called CEESNAP. For

information about cdump, CEE3DMP, and enabling the CEESNAP ddname, see "Generating a Language Environment dump of a C/C++ routine" on page 178.

Steps for finding RENT static variables

Before you begin: you need to know the WSA. To find this information, see "Locating the Writable Static Area (WSA)" on page 172. For this procedure's example, assume that the address of writable static is X'02D66E40'.

Perform the following steps to find RENT static variables:

1. Find the offset of @STATIC (associated with the file where the static variable is located) in the Writable Static Map section of the prelinker map. Figure 45 on page 173 shows an example; in this Writable Static Map section of a prelinker map, the offset is X'58'.

```
========================================================================
|                         Writable Static Map                          |
========================================================================

  OFFSET    LENGTH  FILE ID  INPUT NAME

       0         1   00001   DFHC0011
       4         1   00001   DFHC0010
       8         2   00001   DFHDUMMY
       C         2   00001   DFHB0025
      10         2   00001   DFHB0024
      14         2   00001   DFHB0023
      18         2   00001   DFHB0022
      1C         2   00001   DFHB0021
      20         2   00001   DFHB0020
      24         2   00001   DFHEIB0
      28         4   00001   DFHEIPTR
      2C         4   00001   DFHCP011
      30         4   00001   DFHCP010
      34         4   00001   DFHBP025
      38         4   00001   DFHBP024
      3C         4   00001   DFHBP023
      40         4   00001   DFHBP022
      44         4   00001   DFHBP021
      48         4   00001   DFHBP020
      4C         4   00001   DFHEICB
      50         4   00001   DFHEID0
      54         4   00001   DFHLDVER
      58       278   00001   @STATIC
     720        30   00002   @STATIC
```

Figure 45. Writable static map produced by prelinker

2. Add the offset to the WSA to get the base address of static variables, as shown.

```
X'02D66E40' + X'58' = X'2D66E98'
```

3. Find the offset of the static variable in the partial storage offset compiler listing. In the following example, the offset is 96 (X'60').

```
sa0  66-0:66 Class = static, Location = WSA + @STATIC + 96, Length = 4
```

4. Add the offset of the static variable in the partial storage offset compiler listing (found in step 3) to the base address of static variables (calculated in step 2).

```
X'2D66E98' + X'60' = X'2D66EF8'
```

When you are done, you have the address of the value of the static variable in the Language Environment dump.

Figure 46 on page 174 shows the path to locate RENT C++ and C static variables by adding the address of writable static, the offset of @STATIC, and the variable offset.

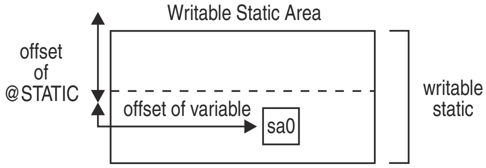


Figure 46. Location of RENT static variable in storage

Steps for finding external RENT variables

Before you begin: You need to know the WSA. To find this information see "Locating the Writable Static Area (WSA)" on page 172. For this procedure's example, the address of writable static is X'02D66E40'.

Perform the following steps to find external RENT variables:

1. Find the offset of the external variable in the Prelinker Writable Static Map. In the example shown in Figure 47 on page 174, the offset for `DFHEIPTR` is X'28'.

```
=========================================================================
|                         Writable Static Map                           |
=========================================================================

  OFFSET    LENGTH  FILE ID  INPUT NAME

       0         1   00001   DFHC0011
       4         1   00001   DFHC0010
       8         2   00001   DFHDUMMY
       C         2   00001   DFHB0025
      10         2   00001   DFHB0024
      14         2   00001   DFHB0023
      18         2   00001   DFHB0022
      1C         2   00001   DFHB0021
      20         2   00001   DFHB0020
      24         2   00001   DFHEIB0
      28         4   00001   DFHEIPTR
      2C         4   00001   DFHCP011
      30         4   00001   DFHCP010
      34         4   00001   DFHBP025
      38         4   00001   DFHBP024
      3C         4   00001   DFHBP023
      40         4   00001   DFHBP022
      44         4   00001   DFHBP021
      48         4   00001   DFHBP020
      4C         4   00001   DFHEICB
      50         4   00001   DFHEID0
      54         4   00001   DFHLDVER
      58       420   00001   @STATIC
```

Figure 47. Writable static map produced by prelinker

2. Add the offset of the external variable to the address of writable static, as shown below.

```
X'02D66E40' + X'28' = X'2D66E68'
```

When you are done, you have the address of the value of the external variable in the Language Environment dump.

Steps for finding NORENT static variables

Before you begin: You need to know the name and address of the static storage area. To find this information see "Steps for finding the static storage area" on page 172. For this procedure's example, the static storage area is called **STATSTOR** and has an address of X'02D66E40'.

Perform the following steps to find external RENT variables:

1. Find the offset of the static variable in the partial storage offset compiler listing. As shown in the following example, the offset is 96 (X'60').

```
sa0   66-0:66   Class = static,   Location = STATSTOR +96,   Length = 4
```

2. Add the offset to the base address of static variables, as shown in the following example:

```
X'2D66E40' + X'60' = X'2D66EA0'
```

When you are done, you have the address of the value of the static variable in the Language Environment dump.

Figure 48 on page 175 shows how to locate NORENT C static variables by adding the Static Storage Area CSECT address to the variable offset.

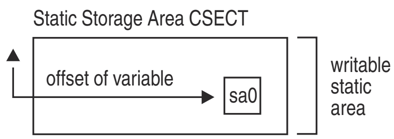


Figure 48. Location of NORENT static variable in storage

Steps for finding external NORENT variables

Before you begin: You need to find the address of the external variable CSECT. To find this information, see “Steps for finding the static storage area” on page 172. For this procedure's example, the address of the external variable CSECT is X'02D66E40'.

The address of the external variable CSECT is the address of the value of the external variable in the Language Environment dump.

Steps for finding the C/370 parameter list

Perform the following steps to locate a parameter in the Language Environment dump:

1. Identify the address of the start of the parameter list. A pointer to the parameter list is passed to the called function in register 1. This is the address of the start of the parameter list. Figure 49 on page 175 shows an example code for the parameter variable.

```
func0() {
⋮
 func1(a1,a2);
⋮
}
func1(int ppx, int pp0) {
⋮
}
```

Figure 49. Example code for parameter variable

Parameters *ppx* and *pp0* correspond to copies of *a1* and *a2* in the stack frame belonging to `func0`.

2. Use the address of the start of the parameter list to find the register and offset in the partial storage offset listing. As shown in the following example, the offset is 4 (X'4') from register 1.

```
pp0    62-0:62    Class = parameter,   Location = 4(r1),    Length = 4
```

3. Determine the value of GPR1 in the Saved Registers section for the function that called the function you are interested in.
4. Add this base address to the offset of the parameter.

When you are done, the contents of the variable can then be read in the DSA frame section corresponding to the function the parameter was passed from.

Steps for finding the C++ parameter list

Before you begin: To locate C++ functions with `extern C` attributes, see "Steps for finding the C/370 parameter list" on page 175.

Perform the following steps to find the C++ parameter list:

1. Identify the address of the start of the parameter list. A pointer to the parameter list is passed to the called function in register 1. This is the address of the start of the parameter list. Figure 50 on page 176 shows an example code for the parameter variable.

```
func0() {
⋮
 func1(a1,a2);
⋮
}

func1(int ppx, int pp0) {
⋮ }
```

Figure 50. Example code for parameter variable

   Parameters *ppx* and *pp0* correspond to copies of *a1* and *a2* in the stack frame belonging to `func1`.

2. Locate the value of the base register in the Saved Registers section of the function you are interested in.
3. Find the offset of the static variable in the partial storage offset compiler listing, as shown in Figure 51 on page 176.

```
ppx    62-0:62    Class = parameter,    Location = 188(r13),    Length = 4
pp0    62-0:62    Class = parameter,    Location = 192(r13),    Length = 4
```

Figure 51. Partial storage offset listing

4. Add the value of the base register to the offset.
5. Locate the parameter.

Restriction: When OPTIMIZE is on, the parameter value might never be stored, since the first few parameters might be passed in registers and there might be no need to save them.

Steps for finding members of aggregates

You can define aggregates in any of the storage classes or pass them as parameters to a called function. The first step is to find the start of the aggregate. You can compute the start of the aggregate as described in previous sections, depending on the type of aggregate used.

The aggregate map provided for each declaration in a routine can further assist in finding the offset of a specific variable within an aggregate. Structure maps are generated using the AGGREGATE compiler option. Figure 52 on page 176 shows an example of a static aggregate.

```
static struct {
    short int ss01;
    char      ss02[56];
    int       sz0[6];
    int       ss03;
} ss0;
```

Figure 52. Example code for structure variable

Figure 53 on page 177 shows an example aggregate map.

```
===============================================================================
| Aggregate map for:  ss0                                                      |
===============================================================================
|      Offset       |      Length       | Member Name                         |
|    Bytes(Bits)    |    Bytes(Bits)    |                                     |
===================|===================|======================================
|        0          |        2          |  ss01                               |
|        2          |       56          |  ss02[56]                           |
|       58          |        2          |  ***PADDING***                      |
|       60          |       24          |  sz0[6]                             |
|       84          |        4          |  ss03                               |
===============================================================================
```

Figure 53. Example of aggregate map

Assume the structure has been compiled as RENT. To find the value of variable *sz0[0]*:

1. Find the address of the writable static. For this example the address of writable static is X'02D66E40'.
2. Find the offset of @STATIC in the Writable Static Map. In this example, the offset is X'58'. Add this offset to the address of writable static. The result is X'2D66E98' (X'02D66E40' + X'58'). Figure 54 on page 177 shows the Writable Static Map produced by the prelinker.

```
======================================================================
|                         Writable Static Map                        |
======================================================================

  OFFSET    LENGTH  FILE ID  INPUT NAME

       0         1   00001   DFHC0011
       4         1   00001   DFHC0010
       8         2   00001   DFHDUMMY
       C         2   00001   DFHB0025
      10         2   00001   DFHB0024
      14         2   00001   DFHB0023
      18         2   00001   DFHB0022
      1C         2   00001   DFHB0021
      20         2   00001   DFHB0020
      24         2   00001   DFHEIB0
      28         4   00001   DFHEIPTR
      2C         4   00001   DFHCP011
      30         4   00001   DFHCP010
      34         4   00001   DFHBP025
      38         4   00001   DFHBP024
      3C         4   00001   DFHBP023
      40         4   00001   DFHBP022
      44         4   00001   DFHBP021
      48         4   00001   DFHBP020
      4C         4   00001   DFHEICB
      50         4   00001   DFHEID0
      54         4   00001   DFHLDVER
      58       320   00001   @STATIC
```

Figure 54. Writable static map produced by prelinker

3. Find the offset of the static variable in the storage offset listing. The offset is 96 (X'60'). The following is an example of a partial storage offset listing.

```
ss0     66-0:66    Class = static,    Location = GPR13(96),   Length = 4
```

   Add this offset to the result from step 2. The result is X'2D66EF8' (X'2D66E98' + X'60'). This is the address of the value of the static variable in the dump.
4. Find the offset of sz0 in the Aggregate Map, shown in Figure 53 on page 177. The offset is 60.

Add the offset from the Aggregate Map to the address of the ss0 struct. The result is X'60' (X'3C' + X'60'). This is the address of the values of sz0 in the dump.

Finding the timestamp

The timestamp is in the compile unit block. The address for the compile unit block is located at eight bytes past the function entry point. The compile unit block is the same for all functions in the same compilation. The fourth word of the compile unit block points to the timestamp. The timestamp is 16 bytes long and has the following format:

```
YYYYMMDDHHMMSSSS
```

Generating a Language Environment dump of a C/C++ routine

You can use the CEE3DMP callable service or the `cdump()`, `csnap()`, and `ctrace()` C/C++ functions to generate a Language Environment dump of C/C++ routines. These C/C++ functions call CEE3DMP with specific options.

To use these functions, you must add `#include <ctest.h>` to your C/C++ code. The dump is directed to output *dumpname* , which is specified in a `//CEEDUMP DD` statement in MVS/JCL.

`cdump()`, `csnap()`, and `ctrace()` all return a 1 code in the SPC environment because they are not supported in SPC.

For more information about these functions, see *z/OS XL C/C++ Runtime Library Reference*.

cdump()

If your routine is running under z/OS or CICS, you can generate useful diagnostic information by using the `cdump()` function. `cdump()` produces a main storage dump with the activation stack. This is equivalent to calling CEE3DMP with the option string:

```
TRACEBACK BLOCKS VARIABLES FILES STORAGE STACKFRAME(ALL) CONDITION ENTRY
```

When `cdump()` is invoked from a user routine, the C/C++ library issues an OS SNAP macro to obtain a dump of virtual storage. The first invocation of `cdump()` results in a SNAP identifier of 0. For each successive invocation, the ID is increased by one to a maximum of 256, after which the ID is reset to 0.

The output of the dump is directed to the CEESNAP data set. The DD definition for CEESNAP is as follows:

```
 //CEESNAP DD SYSOUT= *
```

If the data set is not defined, or is not usable for any reason, `cdump()` returns a failure code of 1. This occurs even if the call to CEE3DMP is successful. If the SNAP is not successful, the CEE3DMP DUMP file displays the following message:

```
Snap was unsuccessful
```

If the SNAP is successful, CEE3DMP displays the following message, where *nnn* corresponds to the SNAP identifier described above. An unsuccessful SNAP does not result in an incrementation of the identifier.

```
Snap was successful; snap ID = nnn
```

Because `cdump()` returns a code of 0 only if the SNAP was successful or 1 if it was unsuccessful, you cannot distinguish whether a failure of `cdump()` occurred in the call to CEE3DMP or SNAP. A return code of 0 is issued only if both SNAP and CEE3DMP are successful.

Support for SNAP dumps using the `_cdump` function is provided only under z/OS and z/VM. SNAP dumps are not supported under CICS; no SNAP is produced in this environment. A successful SNAP results in a large quantity of output. A routine calling `cdump()` under CICS receives a return code of 0 if the ensuing call to CEE3DMP is successful. In addition to a SNAP dump, a Language Environment formatted dump is also taken.

csnap()

The `csnap()` function produces a condensed storage dump. `csnap()` is equivalent to calling CEE3DMP with the option string:

```
TRACEBACK FILES BLOCKS VARIABLES NOSTORAGE STACKFRAME(ALL) CONDITION ENTRY
```

ctrace()

The `ctrace()` function produces a traceback and includes the offset addresses from which the calls were made. `ctrace()` is equivalent to calling CEE3DMP with the option string:

```
TRACEBACK NOFILES NOBLOCKS NOVARIABLES NOSTORAGE STACKFRAME(ALL) NOCONDITION NOENTRY
```

Sample C routine that calls cdump()

The code examplebelow shows a sample C routine that uses the `cdump` function to generate a dump. The samplehere shows the dump output.

```
#include <stdio.h>
#include <signal.h>
#include <stdlib.h>

void hsigfpe(int);
void hsigterm(int);
void atf1(void);

typedef int (*FuncPtr_T)(void);

int st1    =  99;
int st2    = 255;
int xcount =   0;

int main(void) {
  /*
   * 1) Open multiple files
   * 2) Register 2 signals
   * 3) Register 1 atexit function
   * 4) Fetch and execute a module
   */

  FuncPtr_T fetchPtr;
  FILE*     fp1;
  FILE*     fp2;
  int       rc;
  fp1 = fopen("myfile.data", "w");
  if (!fp1) {
    perror("Could not open myfile.data for write");
    exit(101);
  }

  fprintf(fp1, "record 1\n");
  fprintf(fp1, "record 2\n");
  fprintf(fp1, "record 3\n");

  fp2 = fopen("memory.data", "wb,type=memory");
  if (!fp2) {
    perror("Could not open memory.data for write");
    exit(102);
  }
```

```
  fprintf(fp2, "some data");
  fprintf(fp2, "some more data");
```

```
  fprintf(fp2, "even more data");
  signal(SIGFPE , hsigfpe);
  signal(SIGTERM, hsigterm);

  rc = atexit(atf1);
  if (rc) {
    fprintf(stderr, "Failed on registration of atexit function atf1\n");
    exit(103);
  }

  fetchPtr = (FuncPtr_T) fetch("MODULE1");
  if (!fetchPtr) {
    fprintf(stderr, "Failed to fetch MODULE1\n");
    exit(104);
  }
  fetchPtr();
  return(0);
}

void hsigfpe(int sig) {
  ++st1;
  return;
}

void hsigterm(int sig) {
  ++st2;
  return;
}

void atf1() {
  ++xcount;
}
```

Figure 55 on page 180 shows a fetched C module.

```
#include <ctest.h>

#pragma linkage(func1, fetchable)
int func1(void) {
  cdump("This is a sample dump");
  return(0);
}
```

Figure 55. Fetched module for C routine

Sample C++ routine that generates a Language Environment dump

Figure 56 on page 180 shows a sample C++ routine that uses a protection exception to generate a dump.

```
#include <iostream.h>
#include <ctest.h>
#include "stack.h"

int main() {
  cout << "Program starting:\n";
  cerr << "Error report:\n";

  Stack<int> x;
  x.push(1);
  cout << "Top value on stack : " << x.pop() << '\n';
  cout << "Next value on stack: " << x.pop() << '\n';
  return(0);
}
```

Figure 56. Example C++ routine with protection exception generating a dump

Figure 57 on page 181 shows the template file stack.c

```
#ifndef __STACK__
  #include "stack.h"
#endif

template <class T> T Stack<T>::pop() {
  T value = head->value;
  head = head->next;

  return(value);
}
template <class T> void Stack<T>::push(T value) {
  Node* newNode  = new Node;
  newNode->value = value;
  newNode->next  = head;
  head = newNode;
}
```

Figure 57. Template file STACK.C

Figure 58 on page 181 shows the header file **stack.h**.

```
#ifndef __STACK_
  #define __STACK__
  template <class T> class Stack {
    public:
      Stack() {
        char* badPtr = 0; badPtr -= (0x01010101);
        head = (Node*) badPtr; /* head initialized to 0xFEFEFEFF */
      }
      T pop();
      void push(T);
    private:
      struct Node {
        T value;
        struct Node* next;
      }* head;
  };
#endif
```

Figure 58. Header file STACK.H

Sample Language Environment dump with C/C++-specific information

The sample dump below was produced by compiling the routine in thissample with the TEST(SYM) compiler option, then running it. Notice the sequence of calls in the traceback section - EDCZMINV is the C-C++ management module that invokes `main` and @@FECBMODULE1 fetches the user-defined function `func1`, which in turn calls the library routine `__cdump`.

If source code is compiled with the GONUMBER or TEST compile option, statement numbers are shown in the traceback. If source code is compiled with the `TEST(SYM)` compile option, variables and their associated type and value are dumped out. Note that the high half of register 14 at entry to CEE3DMP is not available and is shown in the dump as ********. For more information about C/C++-specific information contained in a dump, see "Finding C/C++ information in a Language Environment dump" on page 185.

```
CEE3DMP V1 R12.0: This is a sample dump                                    03/07/10 1:12:11 PM                  Page:    1
ASID: 0041   Job ID: JOB12852   Job name: CSAMPLE    Step name: STEP1      UserID: HEALY

CEE3845I CEEDUMP Processing started.
CEE3DMP called by program unit  (entry point __cdump) at offset +0000017C.

Snap was unsuccessful

Registers on Entry to CEE3DMP:

  PM....... 0100
  GPR0..... 00000000_20E56AF4  GPR1..... 00000000_20FCB5A0  GPR2..... 00000000_00000001  GPR3..... 00000000_20E56752
  GPR4..... 00000000_A0FCB5B8  GPR5..... 00000000_20FCB5C4  GPR6..... 00000000_00000014  GPR7..... 00000000_20902760
  GPR8..... 00000000_00000030  GPR9..... 00000000_20FC7038  GPR10.... 00000000_A0900310  GPR11.... 00000000_A0900310
  GPR12.... 00000000_209139B0  GPR13.... 00000000_20FCB508  GPR14.... ********_A0E56896  GPR15.... 00000000_A09F0898
  FPR0..... 26100000  00000000            FPR2..... 18000000  00000000
  FPR4..... 00000000  00000000            FPR6..... 00000000  00000000
  VR0...... 26100000 00000000 00000000 00000000        VR1...... 00000000 00000000 00000000 00000000
  VR2...... 18000000 00000000 00000000 00000000        VR3...... 00000000 00000000 00000000 00000000
  VR4...... 00000000 00000000 00000000 00000000        VR5...... 00000000 00000000 00000000 00000000
```

```
  VR6...... 00000000 00000000 00000000 00000000        VR7...... 00000000 00000000 00000000 00000000
  VR8...... 00000000 00000000 00000000 00000000        VR9...... 00000000 00000000 00000000 00000000
  VR10..... 00000000 00000000 00000000 00000000        VR11..... 00000000 00000000 00000000 00000000
  VR12..... 00000000 00000000 00000000 00000000        VR13..... 00000000 00000000 00000000 00000000
  VR14..... 00000000 00000000 00000000 00000000        VR15..... 00000000 00000000 00000000 00000000
  VR16..... 00000000 00000000 00000000 00000000        VR17..... 00000000 00000000 00000000 00000000
  VR18..... 00000000 00000000 00000000 00000000        VR19..... 00000000 00000000 00000000 00000000
  VR20..... 00000000 00000000 00000000 00000000        VR21..... 00000000 00000000 00000000 00000000
  VR22..... 00000000 00000000 00000000 00000000        VR23..... 00000000 00000000 00000000 00000000
  VR24..... 00000000 00000000 00000000 00000000        VR25..... 00000000 00000000 00000000 00000000
  VR26..... 00000000 00000000 00000000 00000000        VR27..... 00000000 00000000 00000000 00000000
  VR28..... 00000000 00000000 00000000 00000000        VR29..... 00000000 00000000 00000000 00000000
  VR30..... 00000000 00000000 00000000 00000000        VR31..... 00000000 00000000 00000000 00000000
⋮
  Information for enclave main

  Information for thread 8000000000000000

  Registers on Entry to CEE3DMP:
    PM....... 0100
    GPR0..... 00000000_20E56AF4  GPR1..... 00000000_20FCB5A0  GPR2..... 00000000_00000001  GPR3..... 00000000_20E56752
    GPR4..... 00000000_A0FCB5B8  GPR5..... 00000000_20FCB5C4  GPR6..... 00000000_00000014  GPR7..... 00000000_20902760
    GPR8..... 00000000_00000030  GPR9..... 00000000_20FC7038  GPR10.... 00000000_A0900310  GPR11.... 00000000_A0900310
    GPR12.... 00000000_209139B0  GPR13.... 00000000_20FCB508  GPR14.... ********_A0E56896  GPR15.... 00000000_A09F0898
    FPR0..... 26100000  00000000            FPR2..... 18000000  00000000
    FPR4..... 00000000  00000000            FPR6..... 00000000  00000000
    VR0...... 26100000 00000000 00000000 00000000        VR1...... 00000000 00000000 00000000 00000000
    VR2...... 18000000 00000000 00000000 00000000        VR3...... 00000000 00000000 00000000 00000000
    VR4...... 00000000 00000000 00000000 00000000        VR5...... 00000000 00000000 00000000 00000000
    VR6...... 00000000 00000000 00000000 00000000        VR7...... 00000000 00000000 00000000 00000000
    VR8...... 00000000 00000000 00000000 00000000        VR9...... 00000000 00000000 00000000 00000000
    VR10..... 00000000 00000000 00000000 00000000        VR11..... 00000000 00000000 00000000 00000000
    VR12..... 00000000 00000000 00000000 00000000        VR13..... 00000000 00000000 00000000 00000000
    VR14..... 00000000 00000000 00000000 00000000        VR15..... 00000000 00000000 00000000 00000000
    VR16..... 00000000 00000000 00000000 00000000        VR17..... 00000000 00000000 00000000 00000000
    VR18..... 00000000 00000000 00000000 00000000        VR19..... 00000000 00000000 00000000 00000000
    VR20..... 00000000 00000000 00000000 00000000        VR21..... 00000000 00000000 00000000 00000000
    VR22..... 00000000 00000000 00000000 00000000        VR23..... 00000000 00000000 00000000 00000000
    VR24..... 00000000 00000000 00000000 00000000        VR25..... 00000000 00000000 00000000 00000000
    VR26..... 00000000 00000000 00000000 00000000        VR27..... 00000000 00000000 00000000 00000000
    VR28..... 00000000 00000000 00000000 00000000        VR29..... 00000000 00000000 00000000 00000000
    VR30..... 00000000 00000000 00000000 00000000        VR31..... 00000000 00000000 00000000 00000000

⋮
  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     __cdump     +0000017C              CEEEV003                                            D1908:e  Call
    2     func1       +0000006E  5           MODULE1              MODULE1                                 Call
    3     @@FECBMODULE1
                      -002BD99E                                                                           Call
    4     @@GETFN     +000000C2              CEEEV003                                                     Call
    5     main        +00000392  64          CSAMPLE              CSAMPLE                                 Call
    6     EDCZMINV    +000000C2              CEEEV003                                                     Call
    7     CEEBBEXT    +000001B6              CEEPLPKA             CEEBBEXT                       D1908    Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     20FCB508   20E56718   20E56718   +0000017C  20061215   LIBRARY   EBCDIC  HFP
    2     20FCB468   20900310   20900310   +0000006E  19970314   C/C++
    3     20FCB378   20FEBF90   20FEBF90   -002BD99E             LIBRARY
    4     20FCB2C0   20C0E3C0   20C0E468   +0000001A  12/15/06   LIBRARY
    5     20FCB208   20901078   20901078   +00000392  19970314   C/C++
    6     20FCB0F0   20E699EE   20E699EE   +000000C2  20061215   LIBRARY
    7     20FCB030   20992208   20992208   +000001B6  20061215   CEL

    Fully Qualified Names
    DSA   Entry       Program Unit                                        Load Module
    2     func1       POSIX.CRTL.C(MODULE1)                               MODULE1
    5     main        POSIX.CRTL.C(CSAMPLE)                               CSAMPLE

      Parameters, Registers, and Variables for Active Routines:
⋮
    main (DSA address 20FCB208):
      UPSTACK DSA
      Saved Registers:
        GPR0..... 20FEBE30  GPR1..... A0D2FE64  GPR2..... A0E69AB0  GPR3..... A09010C6
        GPR4..... A09922EC  GPR5..... 20FC7098  GPR6..... 20FEBE30  GPR7..... 20902760
        GPR8..... 00000030  GPR9..... 80000000  GPR10.... A0E699E2  GPR11.... A0992208
        GPR12.... 209139B0  GPR13.... 20FCB208  GPR14.... A090140C  GPR15.... 20C0E3C0
⋮
      Local Variables:
        fetchPtr         signed int (*) (void)
                                            0x20FEBE30
        fp2              struct __ffile *   0x20FF5AFC
        fp1              struct __ffile *   0x20FF4024
        rc               signed int                  0
⋮
```

```
  Control Blocks for Active Routines:
⋮
    DSA for func1: 20FCB468
      +000000  FLAGS.... 1000      member... 0000      BKC...... 20FCB378  FWC...... D4D6C4E4  R14...... A0900380
      +000010  R15...... 20E56718  R0....... 20FCB508  R1....... 20FCB500  R2....... A0D2E5F2  R3....... A090035E
      +000024  R4....... A09922EC  R5....... 20FEBF70  R6....... 20FEBE30  R7....... 20902760  R8....... 00000030
      +000038  R9....... 20FC7038  R10...... A0900310  R11...... A0900310  R12...... 209139B0  reserved. 00000000
      +00004C  NAB...... 20FCB508  PNAB..... A099DD88  reserved. 20FCB378  20900B08
      +000064  reserved. 20900990  reserved. 00000000  MODE..... 20FCB390  reserved. 00000000
      +000078  reserved. 20991D52  reserved. A0915770
⋮
  [1]Storage for Active Routines:
⋮
    DSA frame: 20FCB468
      +000000 20FCB468  10000000 20FCB378 D4D6C4E4 A0900380  20E56718 20FCB508 20FCB500 A0D2E5F2  |........MODU.....V...........KV2|
      +000020 20FCB488  A090035E A09922EC 20FEBF70 20FEBE30  20902760 00000030 20FC7038 A0900310  |...;.r.............-............|
      +000040 20FCB4A8  A0900310 209139B0 00000000 20FCB508  A099DD88 20FCB378 20FCB534 20900B08  |.....j...........r.h............|
      +000060 20FCB4C8  20FCB378 20900990 00000000 20FCB390  00000000 00000000 20991D52 A0915770  |.........................r...j..|
      +000080 20FCB4E8  A0991A28 209139B0 00000000 20FCB5A0  20C4D1F2 00000400 20FEBF70 00000009  |.r...j...........DJ2............|
```

```
⋮
  [2]Control Blocks Associated with the Thread:
    CAA: 209139B0
      +000000 209139B0  00000800 00000000 20FCB018 20FEB018  00000000 00000000 00000000 00000000  |................................|
      +000020 209139D0  00000000 00000000 20910A58 00000000  00000000 00000000 00000000 00000000  |.........j......................|
      +000040 209139F0  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000060 20913A10  00000000 00000000 00000000 00000000  00000000 80014608 00000000 00000000  |................................|
      +000080 20913A30  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
⋮

    [2A]C-C++ CAA information :
    C-C++ Specific CTHD......... 2090E858
    C-C++ Specific CEDB......... 2090F8D8

    C-C++ Specific Thread block: 2090E858
      +000000 2090E858  C3E3C8C4 00000380 2090E858 00000000  20D15090 00000000 00000000 00000000  |CTHD......Y......J&.............|
      +000020 2090E878  00000000 00000000 00000000 000000C4  2090EDE0 00000000 00000000 00000000  |...............D................|
      +000040 2090E898  00000000 00000000 00000000 2090E728  2090E830 00000000 00000000 00000001  |..............X...Y.............|
      +000060 2090E8B8  00000001 00000000 00000000 00000000  00000000 00000000 20FEBF50 20FEBF4C  |...........................&...<|
      +000080 2090E8D8  20FEBF48 20FEBF44 20FEBF38 20FEBF3C  20FEBF58 00000000 00000000 00000000  |................................|
⋮
      +000320 2090EB78  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000340 2090EB98 - +00037F 2090EBD7             same as above
    C-C++ Specific EDB block: 2090F8D8
      +000000 2090F8D8  C3C5C4C2 000007C0 2090F8D8 20902B40  00030000 20911210 20911560 20901078  |CEDB......8Q... .....j...j.-....|
      +000020 2090F8F8  00000080 20900FD8 00000000 00000000  00000000 209100A0 20D164F0 20D15A18  |.......Q.............j...J.0.J!.|
      +000040 2090F918  20FEBF90 2090F9B0 2090F9C4 20FC71B8  2090F6BC 2090F28C 2090F4A4 20D1B242  |......9...9D......6...2...4u.J..|
      +000060 2090F938  00004650 20910130 40400000 00000000  00100000 00000000 00000000 00000000  |...&.j..  ......................|
      +000080 2090F958  7FFFFFFF FFFFFFFF 71FFFFFF FFFFFFFF  3C100000 00000000 34100000 00000000  |"...............................|
⋮
      +000780 20910058  00000000 00000000 00000000 0001D100  00002E80 00000000 00000000 00000000  |..............J.................|
      +0007A0 20910078  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
```

```
    [2B]errno value................. 0
    memory file block chain..... 20FF5D18
    open FCB chain.............. 20FF5B10
    GTAB table.................. 2090EBE0

    [3]signal information :
    SIGFPE   :
    function pointer... 20901D20    WSA address... A0FC7038     function name... hsigfpe

    SIGTERM  :
    function pointer... 20901E90    WSA address... A0FC7038     function name... hsigterm

  Enclave variables:
    *.*.C(CSAMPLE):>hsigterm
                     void ()            0x20901E90
    *.*.C(CSAMPLE):>hsigfpe
                     void ()            0x20901D20
    *.*.C(CSAMPLE):>xcount
                     signed int                   0
    *.*.C(CSAMPLE):>main
                     signed int (void)
                                        0x20901078
    *.*.C(CSAMPLE):>atf1
                     void (void)        0x20901FF8
    *.*.C(CSAMPLE):>st2
                     signed int                 255
    *.*.C(CSAMPLE):>st1
                     signed int                  99
    *.*.C(MODULE1):>func1
                     signed int (void)
                                        0x20900310

  Enclave Control Blocks:
    EDB: 20912648
      +000000 20912648  C3C5C5C5 C4C24040 C0000001 20913870  20912D50 00000000 00000000 00000000  |CEEEDB  .....j...j.&............|
      +000020 20912668  20912B58 20912B88 A0915770 20912198  00000000 00000000 20912768 00000000  |.j...j.h.j...j.q.........j......|
      +000040 20912688  00000000 00000000 00006F58 00000000  00000000 A0A33B58 2090A880 20FEBF60  |..........?..........t....y....-|
      +000060 209126A8  0000F460 00000000 20911E58 00000000  20914550 00000000 20AF4660 209139B0  |..4-.....j.......j.&.......-.j..|
      +000080 209126C8  50000000 0000FAF6 00000000 00000000  00000001 00000000 00006FF0 008FF4E8  |&......6..................?0..4Y|
      +0000A0 209126E8  00000001 00000100 2090A988 209126F0  00000000 00000000 00000000 00000001  |..........zh.j.0................|
    MEML: 20913870
      +000000 20913870  00000000 00000000 209945B0 00000000  00000000 00000000 209945B0 00000000  |.........r...............r......|
      +000020 20913890  00000000 00000000 209945B0 00000000  2090F8D8 00000000 A0B07F78 00000000  |.........r........8Q......".....|
      +000040 209138B0  00000000 00000000 209945B0 00000000  00000000 00000000 209945B0 00000000  |.........r...............r......|
      +000060 209138D0 - +00011F 2091398F             same as above

    [4]WSA address................20FC7038

    [5]atexit information :
    function pointer... A0901FF8    WSA address... 20FC7038     function name... atf1

    [6]fetch information :
    fetch pointer     : 20FEBF90
    function pointer... A0900310    WSA address... 20FEBF18

  Enclave Storage:
    Initial (User) Heap                                             : 20FEB018
      +000000 20FEB018  C8C1D5C3 20912B28 20912B28 00000000  A0FEB018 20FEC070 00008000 00006FA8  |HANC.j...j....................?y|
      +000020 20FEB038  20FEB018 00000120 20FEB160 20FEB348  20FEB385 20FEB3C2 20FEB3FF 20FEB43C  |...........-.......e...B........|
      +000040 20FEB058  20FEB479 20FEB4B6 20FEB4F3 20FEB900  20FEB93D 00000000 00000000 00000000  |...........3....................|
⋮
      +001080 20FEC098  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +0010A0 20FEC0B8 - +007FFF 20FF3017             same as above
    LE/370 Anywhere Heap                                            : 20FC7000
      +000000 20FC7000  C8C1D5C3 21007000 20912B58 20912B58  A0FC7000 20FCAE60 00004000 000001A0  |HANC.....j...j.........-.. .....|
      +000020 20FC7020  20FC7000 00000190 00000000 00000000  00000000 00000000 00000000 2090F4A4  |..............................4u|
      +000040 20FC7040  2090F28C 2090F6BC 00000000 00000000  00000000 00000000 00000000 00000000  |..2...6.........................|
⋮
      +003F40 20FCAF40  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +003F60 20FCAF60 - +003FFF 20FCAFFF             same as above
    LE/370 Anywhere Heap                                            : 21007000
      +000000 21007000  C8C1D5C3 20912B58 20FC7000 20912B58  21007000 00000000 00004A50 00000000  |HANC.j.......j.............&....|
      +000020 21007020  21007000 00004A30 01000080 F2404040  404086A4 9583F140 40404040 4040D7D6  |...........2     func1       PO|
      +000040 21007040  E2C9E74B C3D9E3D3 4BC34DD4 D6C4E4D3  C5F15D40 40404040 40404040 40404040  |SIX.CRTL.C(MODULE1)             |
```

```
⋮
     +000240 21007240  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
     +000260 21007260 - +004A5F 2100BA5F             same as above
```

```
      Additional Heap, heapid = 20FCAE2C                             : 2100C000
     +000000 2100C000  C8C1D5C3 20FCAE2C 20FCAE2C 20FCAE2C  2100C000 2100C3D0 000003E8 00000018  |HANC..................C....Y....|
     +000020 2100C020  2100C000 00000050 00000000 209003AC  20900310 2100C098 20FEBF90 46F11000  |.......&...............q.....1..|
     +000040 2100C040  00000003 20900580 00020000 2100C078  00000000 20900310 20900310 00000000  |................................|
⋮
     +0003C0 2100C3C0  00000000 209014F8 20901C78 00000000  00000000 00000000 00000000 00000000  |.......8........................|
     +0003E0 2100C3E0  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|

    [7]File Status and Attributes:
   File Control Block: 20FF5B10
     +000000 20FF5B10  20FF5F0D 00000000 000003DB 20FF5BE0  20FF5C00 10000000 20FF5CCC 00000011  |..^...........$...*.......*.....|
     +000020 20FF5B30  00000044 00000000 00000000 20FF4038  00000000 20FF5B10 00000000 00000000  |.............. .......$.........|
     +000040 20FF5B50  00000000 FFFFFFFF 00080055 20FF5C44  20FF5C44 20CCCDA0 20CCCB90 20CCC7B0  |.............*...*...........G.|
     +000060 20FF5B70  20CCC558 20C41548 00000000 00000400  00000400 00000000 00000000 00000400  |..E..D..........................|
     +000080 20FF5B90  20FF5EE8 20FF5EE8 00000000 00000000  00000000 00000000 00000000 00000000  |..;Y..;Y........................|
     +0000A0 20FF5BB0  00000000 00000000 00000000 00000000  20C3C4C8 00000000 00000000 00000000  |................CDH.............|
     +0000C0 20FF5BD0  43020008 40001100 00000000 2090DE68  58FF0008 07FF0000 20C3C830 00000000  |.... ....................CH.....|
     +0000E0 20FF5BF0  00000000 00000000 00000000 00000000  58FF0008 07FF0000 20CCEF00 00000000  |................................|
     +000100 20FF5C10  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
     +000120 20FF5C30  00000000 00000000 00000000 00000000  00000000 D4C5D4D6 20FF5D18 20FF5D8C  |....................MEMO..)...).|

   fldata FOR FILE:   HEALY.MEMORY.DATA
   __recfmF:1........ 1
   __recfmV:1........ 0
   __recfmU:1........ 0
   __recfmS:1........ 0
   __recfmBlk:1...... 0
   __recfmASA:1...... 0
   __recfmM:1........ 0
   __recfmPO:1....... 0
   __dsorgPDSmem:1... 0
   __dsorgPDSdir:1... 0
   __dsorgPS:1....... 0
   __dsorgConcat:1... 0
   __dsorgMem:1...... 1
   __dsorgHiper:1.... 0
   __dsorgTemp:1..... 0
   __dsorgVSAM:1..... 0
   __dsorgHFS:1...... 0
   __openmode:2...... 1
   __modeflag:4...... 2
   __dsorgPDSE:1..... 0
   __reserve2:4...... 0
   __device.......... 8
   __blksize......... 1024
   __maxreclen....... 1024
   __access_method... 0(0)
   __noseek_to_seek.. 0(0)
   __dsname.......... HEALY.MEMORY.DATA

   FILE pointer........ 20FF5AFC

   Buffer at current file position: 20FF5EE8
     +000000 20FF5EE8  A2969485 408481A3 81A29694 85409496  99854084 81A38185 A5859540 94969985  |some datasome more dataeven more|
     +000020 20FF5F08  408481A3 81000000 00000000 00000000  00000000 00000000 00000000 00000000  | data...........................|
     +000040 20FF5F28  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
     +000060 20FF5F48 - +0003FF 20FF62E7             same as above
   Saved Buffer........ NULL

   File Control Block: 20FF4038
     +000000 20FF4038  20FF4314 00000000 00000400 20FF4108  20FF4128 90000000 20FF41F4 00000011  |..........................4....|
     +000020 20FF4058  00000044 00000000 00000000 2090E100  20FF5B10 20FF4038 00000000 E2E8E2F0  |..................$... .....SYS0|
     +000040 20FF4078  F0F0F0F1 FFFFFFFF 0000003C 20FF416C  20FF416C 20CB4490 20CB7A58 20CB1240  |0001...........%...%......:.... |
     +000060 20FF4098  20CB3928 20CB0270 00000000 00000404  00001800 20FF5AEA 00000000 00001801  |......................!.........|
     +000080 20FF40B8  20FF42E8 20FF4314 20FF4314 00000000  00000000 00000000 00000000 00000000  |...Y............................|
     +0000A0 20FF40D8  0000001B 00000000 00000000 00000000  20C3C4C8 00000000 00000000 00000000  |................CDH.............|
     +0000C0 20FF40F8  43120020 28440100 00000000 2090DE68  58FF0008 07FF0000 20C3C830 00000000  |........................CH.....|
     +0000E0 20FF4118  00000000 00000000 00000000 00000000  58FF0008 07FF0000 20CB8278 00000000  |..........................b.....|
     +000100 20FF4138  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
     +000120 20FF4158  00000000 00000000 00000000 00000000  00000000 D6E2E5C6 20C3C830 20CB8278  |....................OSVF.CH...b.|
```

```
 fldata FOR FILE:   'HEALY.MYFILE.DATA'
   __recfmF:1........ 0
   __recfmV:1........ 1
   __recfmU:1........ 0
   __recfmS:1........ 0
   __recfmBlk:1...... 1
   __recfmASA:1...... 0
   __recfmM:1........ 0
   __recfmPO:1....... 0
   __dsorgPDSmem:1... 0
   __dsorgPDSdir:1... 0
   __dsorgPS:1....... 1
   __dsorgConcat:1... 0
   __dsorgMem:1...... 0
   __dsorgHiper:1.... 0
   __dsorgTemp:1..... 0
   __dsorgVSAM:1..... 0
   __dsorgHFS:1...... 0
   __openmode:2...... 0
   __modeflag:4...... 2
   __dsorgPDSE:1..... 0
   __reserve2:4...... 0
   __device.......... 0
   __blksize......... 6144
   __maxreclen....... 1024
   __access_method... 1(1)
   __noseek_to_seek.. 0(0)
   __dsname.......... HEALY.MYFILE.DATA

   FILE pointer........ 20FF4024
   ddname............. SYS00001
```

```
Buffer at current file position: 20FF42E8
      +000000 20FF42E8  00280000 000C0000 99858396 998440F1  000C0000 99858396 998440F2 000C0000  |........record 1....record 2....|
      +000020 20FF4308  99858396 998440F3 00040000 00000000  00000000 00000000 00000000 00000000  |record 3........................|
      +000040 20FF4328  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000060 20FF4348 - +0003FF 20FF46E7            same as above
    Saved Buffer........ NULL

    Write Data Control Block: 00015020
      +000000 00015020  20FF42A8 00000000 000B0003 00E02026  002FE5A2 00000001 00004000 00006D40  |...y.............Vs...... ..._ |
      +000020 00015040  86000000 500157D0 00CC2424 008CED84  12B745B8 00B7E220 0A000000 00001800  |f...&..........d......S.........|
      +000040 00015060  30013030 00006DB0 01C45470 00C45470  00000404 00C45A08 90ECD00C 18BF58A0  |......_..D...D.......D!.........|
    read/update DCB..... NULL

    Write Data Control Block Extension: 20FF42A8
      +000000 20FF42A8  C4C3C2C5 00380000 00015020 00000000  C0880000 00000000 00000000 00000000  |DCBE......&......h..............|
      +000020 20FF42C8  00000000 00000000 20B74AB2 20B74A54  00000000 00000100 80001810 20FF4000  |.............................. .|
    read/update DCBE.... NULL

    Job File Control Block: 000157E8
      +000000 000157E8  C8C5C1D3 E84BD4E8 C6C9D3C5 4BC4C1E3  C1404040 40404040 40404040 40404040  |HEALY.MYFILE.DATA               |
      +000020 00015808  40404040 40404040 40404040 40404040  40404040 80000000 00000000 00000000  |                    ............|
      +000040 00015828  00000200 00000000 00000000 00000000  6B000A00 00000040 00000000 00000000  |................,...... ........|
      +000060 00015848  00000000 00000000 00000000 00000000  00000000 0001E2D3 F8C2F1F3 40404040  |......................SL8B13    |
      +000080 00015868  40404040 40404040 40404040 40404040  40404040 000003AF 00000000 00000000  |                    ............|
      +0000A0 00015888  00000000 00000000 00000000 00000100  80000038 00015000 000158A0 20FF42E8
|......................&........Y|
```

```
        [8]__amrc_type structure: 20FCDAB8
      +000000 20FCDAB8  00000000 00000000 00000007 00000000  00000000 00000000 00000000 00000000  |................................|
      +000020 20FCDAD8  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000040 20FCDAF8 - +0000FF 20FCDBB7            same as above
    amrc __code union fields
    __error................. 0(0)
    __abend.__syscode....... 0(0)
    __abend.__rc............ 0(0)
    __feedback.rc........... 0(0)
    __feedback.__ftncd...... 0(0)
    __feedback.__fdbk....... 0(0)
    __alloc.__svc99_info.... 0(0)
    __alloc.__svc99_error... 0(0)

    __RBA............... 0(0)
    __last_op........... 7(7)
    __msg.__str......... NULL
    __msg.__parmr0...... 0(0)
    __msg.__parmr1...... 0(0)
    __msg.__str2........ NULL
    __rplfdbwd.............. 0x00000000
    __amrc_noseek_to_seek... 0(0)
    __XRBA.................. 0(0000000000000000)
    __amrc2_type structure: 20FCD9B8
      +000000 20FCD9B8  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
    __error2............ 0(0)
    __fileptr........... NULL

Process Control Blocks:

  PCB: 20912198
    +000000 20912198  C3C5C5D7 C3C24040 03030288 00000000  00000000 00000000 209123D0 A0AF74D0  |CEEPCB  ...h.............j......|
    +000020 209121B8  A0AEDB50 A0AF4A08 A0AF4528 20908AE8  20911F68 00000000 00000000 20912648  |...&...........Y.j...........j..|
    +000040 209121D8  A0AF4858 7F800000 00000000 000141D4  00000000 80000000 00000000 00000000  |...."..........M................|

  MEML: 209123D0
    +000000 209123D0  00000000 00000000 209945B0 00000000  00000000 00000000 209945B0 00000000  |.........r...............r......|
    +000020 209123F0  00000000 00000000 209945B0 00000000  2090DE68 00000000 A0B07F78 20FC7000  |.........r................".....|
    +000040 20912410  00000000 00000000 209945B0 00000000  00000000 00000000 209945B0 00000000  |.........r...............r......|
    +000060 20912430 - +00011F 209124EF            same as above

Additional Language Specific Information:

  [9]errno information :
  Thread Id .... 8000000000000000 Errno ...... 0 Errnojr .... 00000000
CEE3846I CEEDUMP Processing completed.
```

Finding C/C++ information in a Language Environment dump

When a Language Environment traceback or dump is generated for a COBOL routine, information is provided that is unique to COBOL routines. COBOL-specific information includes:

- Control block information for active routines
- Condition information for active routines
- Enclave level data

Each of the unique COBOL sections of the Language Environment dump are described in Table 38 on page 186.

Table 38. Contents of the COBOL sections of Language Environment

<table>
<tr><th>Section Number and Heading</th><th>Contents</th></tr>
<tr><td>[1] Storage for Active Routines</td><td>Shows the DSAs for the active C and C++ routines. To relate a DSA frame to a particular function name, use the address associated with the frame to find the corresponding DSA. In this example, the function <code>func1</code> DSA address is X'20FCB468'.</td></tr>
<tr><td>[2] Control Blocks Associated with the Active Thread</td><td>Contains the following information:
Fields from the CAA
Fields specific from the CTHD and CEDB
Signal information</td></tr>
<tr><td>[2A] C/C++ CAA Fields</td><td>Contains several fields that the C/C++ programmer can use to find information about the runtime environment. For each COBOL program, there is a C-C++ Specific Thread area and a C-C++ Specific Enclave area.</td></tr>
<tr><td>[2B] C-C++ Specific CAA</td><td>The C-C++ specific CAA fields that are of interest to users are described below.
errno value
A variable used to display error information. Its value can be set to a positive number that corresponds to an error message. The functions <code>perror()</code> and <code>strerror()</code> print the error message that corresponds to the value of <code>errno</code>.
Memory file control block
You can use the memory file control block (MFCB) to locate additional information about memory files. This control block resides at the COBOL thread level. For more information about the MFCB, see “Memory file control block” on page 187.
Open FCB chain
A pointer to the start of a linked list of open file control blocks (FCBs). For more information about FCBs, see File Control Block Information.</td></tr>
<tr><td>[3] Signal Information</td><td>When the POSIX(OFF) runtime option is specified, signal information is provided in the dump to aid you in debugging. For each signal that is disabled with <code>SIG_IGN</code>, an entry value of 00000001 is made in the first field of the Signal Information field for the specified signal name.

For each signal that has a handler registered, the signal name and the handler name are listed. If the handler is a fetched C function, the value <code>@@FECB</code> is entered as the function name and the address of the fetched pointer is in the first field.

If you compile a C routine as <code>NORENT</code>, the WSA address is not available (<code>N/A</code>). For more information about the <code>signal</code> function, see z/OS XL C/C++ Programming Guide.</td></tr>
<tr><td>[4] WSA Address</td><td>The <code>WSA Address</code> is the base address of the writable static area which is available for all C and C++ programs except C programs compiled with the <code>NORENT</code> compile option.</td></tr>
<tr><td>[5] atexit() Information</td><td>Lists the functions registered with the <code>atexit()</code> function that would be run at normal termination. The functions are listed in chronological order of registration.

If you compile a C routine as <code>NORENT</code>, the WSA address is not available (<code>N/A</code>). For more information about the <code>atexit()</code> function, see atexit() — Register program termination function in z/OS XL C/C++ Runtime Library Reference.</td></tr>
<tr><td>[6] fetch() Information</td><td>Shows information about modules that you have dynamically loaded using <code>fetch()</code>. For each module that was fetched, the <code>fetch()</code> pointer and the function pointer are included.<pre>ptr1 = fetch("MOD");</pre>If you compile a C routine as <code>NORENT</code>, the WSA address is not available (<code>N/A</code>). For more information about the <code>fetch()</code> function, see z/OS XL C/C++ Programming Guide.</td></tr>
</table>

Table 38. Contents of the COBOL sections of Language Environment (continued)

Section Number and Heading	Contents
[7] File Control Block Information	Includes the file control block (FCB) information for each C/C++ file. The FCB contains file status and attributes for files open during C/C++ active routines. You can use this information to find the data set or file name. The FCB is a handle that points to the following file information, which is displayed when applicable, for the file: • Access method control block (ACB) address • Data control block (DCB) address • Data control block extension (DCBE) address • Job file control block (JFCB) address • RPL address • Current buffer address • Saved buffer address • ddname Not all FCB fields are always filled in. For example, RPLs are used only for VSAM data sets. The ddname field contains blanks if it is not used. The save block buffer represents auxiliary buffers that are used to save the contents of the main buffers. Such saving occurs only when a reposition is performed and there is new data; for example, an incomplete text record or an incomplete fixed-block standard (FBS) block in the buffers that cannot be flushed out of the system. Because the main buffers represent the current position in the file, while the save buffers merely indicate a save has occurred, check the save buffers only if data appears to be missing from the external device and is not found in the main buffers. Also, do not infer that the presence of save buffers means that data present there belongs at the end of the file. (The buffers remain, even when the data is eventually written.) For information about the job file control block, see *z/OS MVS Data Areas* in the z/OS Internet library (www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosInternetLibrary).
[8] Information for __amrc	`__amrc` is a structure defined in the `stdio.h` header file to assist in determining errors resulting from I/O operations. The contents of `__amrc` can be checked for system information, such as the return code for VSAM. Certain fields of the `__amrc` structure can provide useful information about what occurred previously in your routine. For more information about `__amrc`, see "Debugging C/C++ programs" on page 163 and Using the __amrc structure in *z/OS XL C/C++ Programming Guide*.
[9] Errno Information	Shows the thread ID of the thread that generated the dump and the settings of the errno and errnojr variables for that thread. Both the errno and the errnojr variables contain the return code of the last failing z/OS UNIX system service call. These variables provide z/OS UNIX application programs access to diagnostic information returned from an underlying z/OS UNIX callable service. For more information about these return and reason codes, see Return codes (errnos) and Reason codes in *z/OS UNIX System Services Messages and Codes*.

Memory file control block

This section of the dump holds the following memory file control block information for each memory file the routine uses. A sample memory file control block is shown in Figure 59 on page 188.

Memory file name
: The name assigned to this memory file.

First memory data space
: A dump of the first 1K maximum of actual user data associated with this memory file.

```
Memory File Control Block: 046F5CD0
  +000000 046F5CD0  046F5D40 00000001 00000000 00000000  046F5BA8 00010000 046F5E48 00000013  |.?) ............?$y.....?;.....|
  +000020 046F5CF0  00000014 00000000 00000000 00000000  00000000 046F5BA8 00000000 00000000  |.....................?$y........|
  +000040 046F5D10  046F5CD0 00000000 00000000 00000000  00000000 00000000 00000000 046F5D40  |.?*..........................?) |
  +000060 046F5D30  00010000 00000000 00000000 00000000  00000000 00000000 046F5E68 00000001  |.........................?;.....|
memory file name......... TSOID.MEMORY.DATA
First memory data space: 046F5E68
  +000000 046F5E68  93899585 40F19389 958540F2 93899585  40F30000 00000000 00000000 00000000  |line 1line 2line 3.............|
```

Figure 59. Memory file control block

Additional Floating-Point registers

The Language Environment dump formats Additional Floating Point (AFP) registers and Floating Point Control (FPC) registers when the AFP suboption of the FLOAT XL C/C++ compiler option is specified and the registers are needed. These floating-point registers are displayed in three sections of the CEEDUMP: Registers on Entry to CEE3DMP; Parameters, Registers, and Variables; and Condition Information for Active Routines. Samples of each section are given. For information on the FLOAT XL C/C++ compiler option, see *z/OS XL C/C++ User's Guide*.

Registers on entry to CEE3DMP

This section of the Language Environment dump displays the sixteen floating-point registers. Figure 60 on page 188 shows sample output. Note that the high half of general purpose register 14 at entry to CEE3DMP is not available and is shown in the dump as ********.

```
⋮
CEE3DMP called by program unit ./celdll.c (entry point dump_n_perc) at statement 34 (offset +0000017A).

Registers on Entry to CEE3DMP:

  PM....... 0100
  GPR0..... 00000000_183F8BE8  GPR1..... 00000000_00023D38  GPR2..... 00000000_00023E98  GPR3..... 00000000_1840E792
  GPR4..... 00000000_00023D98  GPR5..... 00000000_183F8CD0  GPR6..... 00000000_00023D48  GPR7..... 00000000_0002297F
  GPR8..... 00000000_17F4553D  GPR9..... 00000000_183F6870  GPR10.... 00000000_17F4353F  GPR11.... 00000000_17FA0550
  GPR12.... 00000000_00015920  GPR13.... 00000000_00023CA0  GPR14.... ********_800180E2  GPR15.... 00000000_97F57FE8
  FPC...... 40084000
  FPR0..... 40260000  00000000           FPR1..... 41086A00  00000000
  FPR2..... 00000000  00000000           FPR3..... 3F8CAC08  3126E979
  FPR4..... 3FF33333  33333333           FPR5..... 40C19400  00000000
  FPR6..... 3F661E4F  765FD8AE           FPR7..... 3FF06666  66666666
  FPR8..... 3FF33333  33333333           FPR9..... 00000000  00000000
  FPR10.... 3FF33333  33333333           FPR11.... 00000000  00000000
  FPR12.... 40260000  00000000           FPR13.... 00000000  00000000
  FPR14.... 40220000  00000000           FPR15.... 00000000  00000000
⋮
```

Figure 60. Registers on entry to CEE3DMP

Parameters, registers, and variables for active routines

This section of the Language Environment dump displays the non-volatile floating-point registers that are saved in the stack frame. The registers are only displayed if the program owning the stack frame saved them. Dashes are displayed in the registers when the register values are not saved. A sample output is shown.

```
  Parameters, Registers, and Variables for Active Routines:
⋮
    goo (DSA address 000213B0):
      Saved Registers:
        GPR0..... 183F6CC0  GPR1..... 00021278  GPR2..... 183F6870  GPR3..... 17F01DC2
        GPR4..... 000000F8  GPR5..... 183F6968  GPR6..... 17F02408  GPR7..... 000212EC
        GPR8..... 000212F0  GPR9..... 80000000  GPR10.... 98125022  GPR11.... 80007F98
        GPR12.... 00015920  GPR13.... 000213B0  GPR14.... 97F01E1E  GPR15.... 0000002F
        FPR8..... 3FF33333  33333333            FPR9..... --------  --------
        FPR10.... 3FF33333  33333333            FPR11.... --------  --------
        FPR12.... 40260000  00000000            FPR13.... --------  --------
        FPR14.... 40220000  00000000            FPR15.... --------  --------
    GPREG STORAGE:
      Storage around GPR0 (183F6CC0)
⋮
```

Figure 61. Parameters, registers, and variables for active routines

Condition information for active routines

This section of the Language Environment dump displays the floating-point registers when they are saved in the machine state; Figure 62 on page 189 shows sample output.

```
⋮
      Condition Information for Active Routines
      Condition Information for ./celsamp.c (DSA address 000213B0)
        CIB Address: 00021F90
        Current Condition:
          CEE3224S The system detected an IEEE division-by-zero exception.
        Location:
          Program Unit: ./celsamp.c
          Program Unit:Entry:        goo Statement: 78 Offset: +000000BA
        Machine State:
          ILC..... 0004    Interruption Code..... 0007
          PSW..... 078D0400 97F01E46
          GPR0..... 00000000_183F6CC0  GPR1..... 00000000_00021278  GPR2..... 00000000_183F6870  GPR3..... 00000000_17F01DC2
          GPR4..... 00000000_000000F8  GPR5..... 00000000_183F6968  GPR6..... 00000000_17F02408  GPR7..... 00000000_000212EC
          GPR8..... 00000000_000212F0  GPR9..... 00000000_80000000  GPR10.... 00000000_98125022  GPR11.... 00000000_80007F98
          GPR12.... 00000000_00015920  GPR13.... 00000000_000213B0  GPR14.... 00000000_97F01E1E  GPR15.... 00000000_0000002F
          FPC...... 40084000
          FPR0..... 40260000  00000000            FPR1..... 41086A00  00000000
          FPR2..... 00000000  00000000            FPR3..... 3F8CAC08  3126E979
          FPR4..... 3FF33333  33333333            FPR5..... 40C19400  00000000
          FPR6..... 3F661E4F  765FD8AE            FPR7..... 3FF06666  66666666
          FPR8..... 3FF33333  33333333            FPR9..... 00000000  00000000
          FPR10.... 3FF33333  33333333            FPR11.... 00000000  00000000
          FPR12.... 40260000  00000000            FPR13.... 00000000  00000000
          FPR14.... 40220000  00000000            FPR15.... 00000000  00000000
      Storage dump near condition, beginning at location: 17F01E32
        +000000 17F01E32  68201008 5810D0F0 68401010 B31B0024  B31D0002 B3050000 5820D0F4 584031C2
&Lv;.......0. .................4. .B&Lv;
⋮
```

Figure 62. Condition information for active routines

Vector registers

The Language Environment dump formats vector registers when the vector registers are needed. These vector registers are displayed in three sections of the CEEDUMP: Registers on Entry to CEE3DMP; Parameters, Registers, and Variables; and Condition Information for Active Routines. Samples of each section are given.

Registers on entry to CEE3DMP

This section of the Language Environment dump displays the 32 vector registers. Figure 63 on page 190 shows sample output.

```
⋮
CEE3845I CEEDUMP Processing started.
CEE3DMP called by program unit  (entry point gen_ceedump) at offset +000001F2.

Registers on Entry to CEE3DMP:

  PM....... 0100
  GPR0..... 00000000_25F2A6B0  GPR1..... 00000000_25F2A4F8  GPR2..... FFFFFFFF_25F2A5AC  GPR3..... FFFFFFFF_25700C7C
  GPR4..... FFFFFFFF_25F2A55C  GPR5..... FFFFFFFF_25702CE0  GPR6..... FFFFFFFF_000000CC  GPR7..... FFFFFFFF_2570F4D8
  GPR8..... FFFFFFFF_00000030  GPR9..... FFFFFFFF_80000000  GPR10.... FFFFFFFF_A5EEB602  GPR11.... FFFFFFFF_A57D50A8
  GPR12.... FFFFFFFF_25722170  GPR13.... 00000000_25F2A460  GPR14.... ********_A5700AAC  GPR15.... 00000000_A5743830
  FPC...... 0000FE00
  FPR0..... 00000000  33330000            FPR1..... 01000000  33330000
  FPR2..... 02000000  33330000            FPR3..... 03000000  33330000
  FPR4..... 04000000  33330000            FPR5..... 05000000  33330000
  FPR6..... 06000000  33330000            FPR7..... 07000000  33330000
  FPR8..... 08000000  33330000            FPR9..... 09000000  33330000
  FPR10.... 0A000000  33330000            FPR11.... 0B000000  33330000
  FPR12.... 0C000000  33330000            FPR13.... 0D000000  33330000
  FPR14.... 0E000000  33330000            FPR15.... 0F000000  33330000
  VR0...... 00000000 33330000 00000000 33330000        VR1...... 01000000 33330000 01000000 33330000
  VR2...... 02000000 33330000 02000000 33330000        VR3...... 03000000 33330000 03000000 33330000
  VR4...... 04000000 33330000 04000000 33330000        VR5...... 05000000 33330000 05000000 33330000
  VR6...... 06000000 33330000 06000000 33330000        VR7...... 07000000 33330000 07000000 33330000
  VR8...... 08000000 33330000 08000000 33330000        VR9...... 09000000 33330000 09000000 33330000
  VR10..... 0A000000 33330000 0A000000 33330000        VR11..... 0B000000 33330000 0B000000 33330000
  VR12..... 0C000000 33330000 0C000000 33330000        VR13..... 0D000000 33330000 0D000000 33330000
  VR14..... 0E000000 33330000 0E000000 33330000        VR15..... 0F000000 33330000 0F000000 33330000
  VR16..... 10000000 33330000 10000000 33330000        VR17..... 11000000 33330000 11000000 33330000
  VR18..... 12000000 33330000 12000000 33330000        VR19..... 13000000 33330000 13000000 33330000
  VR20..... 14000000 33330000 14000000 33330000        VR21..... 15000000 33330000 15000000 33330000
  VR22..... 16000000 33330000 16000000 33330000        VR23..... 17000000 33330000 17000000 33330000
  VR24..... 18000000 33330000 18000000 33330000        VR25..... 19000000 33330000 19000000 33330000
  VR26..... 1A000000 33330000 1A000000 33330000        VR27..... 1B000000 33330000 1B000000 33330000
  VR28..... 1C000000 33330000 1C000000 33330000        VR29..... 1D000000 33330000 1D000000 33330000
  VR30..... 1E000000 33330000 1E000000 33330000        VR31..... 1F000000 33330000 1F000000 33330000
⋮
```

Figure 63. Registers on entry to CEE3DMP

Parameters, registers, and variables for active routines

This section of the Language Environment dump displays the non-volatile vector registers that are saved in the stack frame. The registers are only displayed if the program owning the stack frame saved them. Asterisks are displayed in the registers when the register values are not saved. A sample output is shown.

```
  Parameters, Registers, and Variables for Active Routines:
⋮
    goo (DSA address 000213B0):
      Saved Registers:
        GPR0..... 183F6CC0 GPR1..... 00021278 GPR2..... 183F6870 GPR3..... 17F01DC2
        GPR4..... 000000F8 GPR5..... 183F6968 GPR6..... 17F02408 GPR7..... 000212EC
        GPR8..... 000212F0 GPR9..... 80000000 GPR10.... 98125022 GPR11.... 80007F98
        GPR12.... 00015920 GPR13.... 000213B0 GPR14.... 97F01E1E GPR15.... 0000002F
        FPR8..... 3FF33333 33333333 FPR9..... ******** ********
        FPR10.... 3FF33333 33333333 FPR11.... ******** ********
        FPR12.... 40260000 00000000 FPR13.... ******** ********
        FPR14.... 40220000 00000000 FPR15.... ******** ********
        VR16..... 01600000 33330000 01600000 33330000        VR17..... 11000000 33330000 11000000 33330000
        VR18..... ******** ******** ******** ********        VR19..... ******** ******** ******** ********
        VR20..... ******** ******** ******** ********        VR21..... ******** ******** ******** ********
        VR22..... ******** ******** ******** ********        VR23..... ******** ******** ******** ********
    GPREG STORAGE:
      Storage around GPR0 (183F6CC0)
⋮
```

Figure 64. Parameters, registers, and variables for active routines

Condition information for active routines

This section of the Language Environment dump displays the vector registers when they are saved in the machine state; Figure 65 on page 191 shows sample output.

```
⋮
Condition Information for Active Routines
Condition Information for (DSA address 25F27230)
CIB Address: 25F28560
    Current Condition:
CEE3224S The system detected an IEEE division-by-zero exception.
Location:
  Program Unit:Entry: goo Statement: 78 Offset: +000000BA
Machine State:
    ILC..... 0004 Interruption Code..... 0007
    PSW..... 078D0400 A570093C
    GPR0..... 00000000_183F6CC0 GPR1..... 00000000_00021278 GPR2..... 00000000_183F6870 GPR3..... 00000000_17F01DC2
    GPR4..... 00000000_000000F8 GPR5..... 00000000_183F6968 GPR6..... 00000000_17F02408 GPR7..... 00000000_000212EC
    GPR8..... 00000000_000212F0 GPR9..... 00000000_80000000 GPR10.... 00000000_98125022 GPR11.... 00000000_80007F98
    GPR12.... 00000000_00015920 GPR13.... 00000000_000213B0 GPR14.... 00000000_97F01E1E GPR15.... 00000000_0000002F
    FPC...... 40084000
    FPR0..... 40260000 00000000 FPR1..... 41086A00 00000000
    FPR2..... 00000000 00000000 FPR3..... 3F8CAC08 3126E979
    FPR4..... 3FF33333 33333333 FPR5..... 40C19400 00000000
    FPR6..... 3F661E4F 765FD8AE FPR7..... 3FF06666 66666666
    FPR8..... 3FF33333 33333333 FPR9..... 00000000 00000000
    FPR10.... 3FF33333 33333333 FPR11.... 00000000 00000000
    FPR12.... 40260000 00000000 FPR13.... 00000000 00000000
    FPR14.... 40220000 00000000 FPR15.... 00000000 00000000
    VR0...... 40260000 00000000 00000000 33330000       VR1...... 41086A00 00000000 01000000 33330000
    VR2...... 00000000 00000000 02000000 33330000       VR3...... 3F8CAC08 3126E979 03000000 33330000
    VR4...... 3FF33333 33333333 04000000 33330000       VR5...... 40C19400 00000000 05000000 33330000
    VR6...... 3F661E4F 765FD8AE 06000000 33330000       VR7...... 3FF06666 66666666 07000000 33330000
    VR8...... 3FF33333 33333333 08000000 33330000       VR9...... 00000000 00000000 09000000 33330000
    VR10..... 3FF33333 33333333 0A000000 33330000       VR11..... 00000000 00000000 0B000000 33330000
    VR12..... 40260000 00000000 0C000000 33330000       VR13..... 00000000 00000000 0D000000 33330000
    VR14..... 40220000 00000000 0E000000 33330000       VR15..... 00000000 00000000 0F000000 33330000
    VR16..... 10000000 33330000 10000000 33330000       VR17..... 11000000 33330000 11000000 33330000
    VR18..... 12000000 33330000 12000000 33330000       VR19..... 13000000 33330000 13000000 33330000
    VR20..... 14000000 33330000 14000000 33330000       VR21..... 15000000 33330000 15000000 33330000
    VR22..... 16000000 33330000 16000000 33330000       VR23..... 17000000 33330000 17000000 33330000
    VR24..... 18000000 33330000 18000000 33330000       VR25..... 19000000 33330000 19000000 33330000
    VR26..... 1A000000 33330000 1A000000 33330000       VR27..... 1B000000 33330000 1B000000 33330000
    VR28..... 1C000000 33330000 1C000000 33330000       VR29..... 1D000000 33330000 1D000000 33330000
    VR30..... 1E000000 33330000 1E000000 33330000       VR31..... 1F000000 33330000 1F000000 33330000

Storage dump near condition, beginning at location: 25700928
+000000 25700928 513C500 D09C0DEF 5810D0A0 41000005  50001000 58F03004 41405158 4110D098  &Lv;......
⋮
```

Figure 65. Condition information for active routines

Sample Language Environment dump with XPLINK-specific information

The programs `tranmain` (Figure 66 on page 192) and `trandll` (Figure 67 on page 192) were used to produce a Language Environment dump. The Language Environment dump produced by running these program is shown in "Example dump of calling between XPLINK and non-XPLINK programs" on page 192. The dump shows XPLINK-compiled routines calling NOXPLINK-compiled routines, and NOXPLINK-compiled routines calling XPLINK-compiled routines. The program `tranmain` was compiled XPLINK and `trandll` was compiled NOXPLINK. Each was link-edited as a separate program object with the sidedeck from the other. Explanations for some of the sections are in "Finding XPLINK information in a Language Environment dump" on page 194.

```
#pragma runopts(TRACE(ON,1M,NODUMP,LE=1),XPLINK(ON),TERMTHDACT(UADUMP))
#include <stdio.h>
#pragma export(tran2)

int tran1(int, int, int, long double, int);
int tran3(int, int, int, long double, int);

void main(void) {

int         parm1 = 0x11111111;
int         parm2 = 0x22222222;
int         parm3 = 0x33333333;
long double parm4 = 1234.56789;
int         parm5 = 0x55555555;
int         retval;

   printf("Main: Call Tran1\n");
   retval = tran1(parm1,parm2,parm3,parm4,parm5);
   printf("Main: Return value from Tran1 = %d\n",retval);
}
int tran2(int parm1,int parm2,int parm3,long double parm4,int parm5) {

int         retval;

   printf("Tran2: Call Tran3\n");
   retval = tran3(parm1,parm2,parm3,parm4,parm5);
   printf("Tran2: Return value from Tran3 = %d\n",retval);
   return retval;
}
```

Figure 66. Sample XPLINK-compiled program (tranmain) which calls a NOXPLINK-compiled program

```
#include <stdio.h>
#include <ctest.h>
#include <leawi.h>
#pragma export(tran1)
#pragma export(tran3)

int tran2(int, int, int, long double, int);
int tran1(int parm1,int parm2,int parm3,long double parm4,int parm5) {

int         retval;

   printf("Tran1: Call Tran2\n");
   retval = tran2(parm1,parm2,parm3,parm4,parm5);
   printf("Tran1: Return value from Tran2 = %d\n",retval);
   return retval;

}
int tran3(int parm1,int parm2,int parm3,long double parm4,int parm5) {

_INT4 code, timing;

   code = 1001;   /* Abend code to issue */
   timing = 1;
   printf("Tran3: About to ABEND\n");
   CEE3ABD(&code,&timing);

   return parm1 + parm2 + parm3;
}
```

Figure 67. Sample NOXPLINK-compiled program (trandll) which calls an XPLINK-compiled program

Example dump of calling between XPLINK and non-XPLINK programs

This article displays an example dump of calling between XPLINK and non-XPLINK programs.

```
CEE3DMP V1 R12.0: Condition processing resulted in the unhandled condition.         03/18/10 3:58:00 PM                 Page:    1
ASID: 0041   Job ID: JOB26310   Job name: XNTRAN     Step name: STEP1      UserID: HEALY

CEE3845I CEEDUMP Processing started.

Information for enclave main

  Information for thread 8000000000000000

  [1]Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     CEEHDSP     +00004030              CEEPLPKA             CEEHDSP                        D1908    Call
    2     CEL4ABD0    +0000024C              CEEPLPKA             CEL4ABD0                       D1908    Exception
    3     CEEHABD     +00000074              CEEPLPKA             CEEHABD                        D1908    Call
```

```
    4     tran3       +000000D6  26         XNTDLL              trandll.c                               Call
    5     CEEVRONU    +00001026             CEEPLPKA            CEEVRONU                      D1908     Call
    6     tran2       +00000070  27         XNTRAN              tranmain.c                              Call
    7     CEEVROND    +000011FA             CEEPLPKA                                                    Call
    8     tran1       +000000F2  14         XNTDLL              trandll.c                               Call
    9     CEEVRONU    +00001026             CEEPLPKA            CEEVRONU                      D1908     Call
    10    main        +0000008C  18         XNTRAN              tranmain.c                              Call
    11    CEEVROND    +000011FA             CEEPLPKA                                                    Call
    12    EDCZHINV    +000000B4             CELHV003            EDCZHINV                      D1908     Call
    13    CEEBBEXT    +000001B6             CEEPLPKA            CEEBBEXT                      D1908     Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     2110CB08   209C4238   209C4238   +00004030  20061215   CEL
    2     2110CA60   20AFCA08   20AFCA08   +0000024C  20061215   CEL
    3     2110C9C8   209BFCD0   209BFCD0   +00000074  20061215   CEL
    4     2110C910   212BB8C0   212BB8C0   +000000D6  20000505   C/C++
    5     2110C750   20ACCA58   20ACCA58   +00001026  20061215   CEL
    6     212B6530   209000E8   209000E8   +00000070  20000421   C/C++    XPLINK EBCDIC  HFP
    7     212B65B0   20ACAAA0   20ACAA48   +00001252  20061215   CEL      XPLINK EBCDIC  HFP
    8     2110C500   212BBA40   212BBA40   +000000F2  20000505   C/C++
    9     2110C340   20ACCA58   20ACCA58   +00001026  20061215   CEL
    10    212B6680   20900218   20900218   +0000008C  20000421   C/C++    XPLINK EBCDIC  HFP
    11    212B6720   20ACAAA0   20ACAA48   +00001252  20061215   CEL      XPLINK EBCDIC  HFP
    12    2110C0F0   20C386A8   20C386A8   +000000B4  20061214   LIBRARY
    13    2110C030   20992208   20992208   +000001B6  20061215   CEL

    Fully Qualified Names
    DSA   Entry       Program Unit                                        Load Module
    4     tran3       ./trandll.c                                         XNTDLL
    6     tran2       ./tranmain.c                                        XNTRAN
    8     tran1       ./trandll.c                                         XNTDLL
    10    main        ./tranmain.c                                        XNTRAN


    Condition Information for Active Routines
      Condition Information for CEL4ABD0 (DSA address 2110CA60)
        CIB Address: 2110D428
        Current Condition:
          CEE0198S The termination of a thread was signaled due to an unhandled condition.
        Original Condition:
          CEE3250C The system or user abend U1001 R=00000000 was issued.
        Location:
          Program Unit: CEL4ABD0 Entry: CEL4ABD0 Statement:  Offset: +0000024C
        Machine State:
          ILC..... 0002    Interruption Code..... 000D
          PSW..... 078D1400 A0AFCC54
          GPR0..... 00000000_84000000  GPR1..... 00000000_840003E9  GPR2..... 00000000_00000000  GPR3..... 00000000_2110C9B0
          GPR4..... 00000000_00000001  GPR5..... 00000000_20914E10  GPR6..... 00000000_00000002  GPR7..... 00000000_00000000
          GPR8..... 00000000_A0900003  GPR9..... 00000000_212BB868  GPR10.... 00000000_209BFDAC  GPR11.... 00000000_20AFCA08
          GPR12.... 00000000_209139B0  GPR13.... 00000000_2110CA60  GPR14.... 00000000_A09BFD46  GPR15.... 00000000_00000000
          ABEND code: 000003E9 Reason code: 00000000
      Storage dump near condition, beginning at location: 20AFCC44
        +000000 20AFCC44  88100008 41000084 89000018 16100A0D  58D0D004 98ECD00C 07FE0000 D7C1E3C3  |h......di...........q.......PATC|
      GPREG STORAGE:
        Storage around GPR0 (04000000)
          -0020 03FFFFE0    Inaccessible storage.
          +0000 04000000    Inaccessible storage.
          +0020 04000020    Inaccessible storage.

.
.
.
```

```
  [2]Parameters, Registers, and Variables for Active Routines:
    tran3 (DSA address 2110C910):
      UPSTACK DSA
      Parameters:
        parm5           signed int          1431655765
        parm4           long double      1.234567889999999977135303197E+03
        parm3           signed int           858993459
        parm2           signed int           572662306
        parm1           signed int           286331153
      Saved Registers:
        GPR0..... 20914D70  GPR1..... 2110C9A8  GPR2..... 2110C9B4  GPR3..... 212BB8FA
        GPR4..... 2110C9B0  GPR5..... 20914E10  GPR6..... 00000000  GPR7..... 00000000
        GPR8..... A0900003  GPR9..... 212BB868  GPR10.... 212BB8C0  GPR11.... 20ACDF1C
        GPR12.... 209139B0  GPR13.... 2110C910  GPR14.... A12BB998  GPR15.... A09BFCD0
    GPREG STORAGE:
      Storage around GPR0 (20914D70)
        -0020 20914D50  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
        +0000 20914D70  180F58FF 001007FF 212BB3A0 20914D70  212BB3B0 00000000 00000000 00000000  |.............j(.................|
        +0020 20914D90  180F58FF 001007FF 212BB0B0 20914D70  212BB3B0 00000000 00000000 00000000  |.............j(.................|

.
.
.
      Storage around GPR15(209BFCD0)
        -0020 209BFCB0  209BFA00 F2F0F0F6 F1F2F1F5 F1F1F5F2  F0F0F0F1 F0F9F0F0 0005C4F1 F9F0F800  |....20061215115200010900..D1908.|
        +0000 209BFCD0  47F0F014 00C3C5C5 00000098 000000E0  47F0F001 90ECD00C 18BF5800 B0D05810  |.00..CEE...q.....00.............|
        +0020 209BFCF0  D04C1E01 5500C00C 47D0B034 58F0C2BC  05EF181F 5000104C D7011000 100018FD  |.<...........0B.....&..<P.......|
      Local Variables:
        timing          signed long int             1
        code            signed long int          1001
    CEEVRONU (DSA address 2110C750):
      TRANSITION DSA
      Saved Registers:
        GPR0..... 20914D70  GPR1..... 212B6D70  GPR2..... 212BBE18  GPR3..... 0000001F
        GPR4..... 212B6530  GPR5..... 21109718  GPR6..... 00000000  GPR7..... 00000000
        GPR8..... A0900003  GPR9..... 212BB868  GPR10.... 212BB8C0  GPR11.... 20ACDF1C
        GPR12.... 209139B0  GPR13.... 2110C750  GPR14.... A0ACDA80  GPR15.... 212BB8C0
.
.
.
    tran2 (DSA address 212B6530):
      DOWNSTACK DSA
      Parameters:
        parm5           signed int          1431655765
```

```
        parm4           long double      1.23456788999999977135303197E+03
        parm3           signed int           858993459
        parm2           signed int           572662306
        parm1           signed int           286331153
      Saved Registers:
        GPR0..... 55555555  GPR1..... 11111111  GPR2..... 22222222  GPR3..... 33333333
        GPR4..... 212B6530  GPR5..... 21109718  GPR6..... 20ACCAD8  GPR7..... A090015A
        GPR8..... A09000F2  GPR9..... 20914E80  GPR10.... 209000B8  GPR11.... A0ACAA48
        GPR12.... 209139B0  GPR13.... 2110C5C8  GPR14.... 209000B8  GPR15.... 0000000C
.
.
.
      Local Variables:
        retval          signed int          -455613482
    CEEVROND (DSA address 212B65B0):
      TRANSITION DSA
      Saved Registers:
        GPR0..... ********  GPR1..... ********  GPR2..... ********  GPR3..... ********
        GPR4..... 212B65B0  GPR5..... 20914E80  GPR6..... 209000E8  GPR7..... A0ACBC9C
        GPR8..... 209000B8  GPR9..... 20ACBA47  GPR10.... ********  GPR11.... ********
        GPR12.... ********  GPR13.... ********  GPR14.... ********  GPR15.... ********
.
.
.
    tran1 (DSA address 2110C500):
      UPSTACK DSA
      Saved Registers:
        GPR0..... 211080A8  GPR1..... 2110C598  GPR2..... 55555555  GPR3..... 212BBA7A
        GPR4..... 33333333  GPR5..... 20914E10  GPR6..... 22222222  GPR7..... 11111111
        GPR8..... A0900203  GPR9..... 212BB9E8  GPR10.... 212BBA40  GPR11.... 20ACDF1C
        GPR12.... 209139B0  GPR13.... 2110C500  GPR14.... A12BBB34  GPR15.... A0ACAA48
.
.
.
```

```
  [3]Control Blocks for Active Routines:
.
.
.
    DSA for tran3: 2110C910
      +000000  FLAGS.... 1010      member... 803C      BKC...... 2110C750  FWC...... 2110C9C8  R14...... A12BB998
      +000010  R15...... A09BFCD0  R0....... 20914D70  R1....... 2110C9A8  R2....... 2110C9B4  R3....... 212BB8FA
      +000024  R4....... 2110C9B0  R5....... 20914E10  R6....... 00000000  R7....... 00000000  R8....... A0900003
      +000038  R9....... 212BB868  R10...... 212BB8C0  R11...... 20ACDF1C  R12...... 209139B0  reserved. 00000000
      +00004C  NAB...... 2110C9C8  PNAB..... 00000001  reserved. 20914E70  209011DC
      +000064  reserved. A0A9AED0  reserved. 209139B0  MODE..... 20A9CD06  reserved. 20912668
      +000078  reserved. A0A8299C  reserved. 00000000
    DSA for CEEVRONU: 2110C750
      +000000  FLAGS.... 0000      member... 0000      BKC...... FFFFFFFF  FWC...... 2110C910  R14...... A0ACDA80
      +000010  R15...... 212BB8C0  R0....... 20914D70  R1....... 212B6D70  R2....... 212BBE18  R3....... 0000001F
      +000024  R4....... 212B6530  R5....... 21109718  R6....... 00000000  R7....... 00000000  R8....... A0900003
      +000038  R9....... 212BB868  R10...... 212BB8C0  R11...... 20ACDF1C  R12...... 209139B0  reserved. 00000000
      +00004C  NAB...... 2110C910  PNAB..... 2110C910  reserved. 00000000  00000000
      +000064  reserved. 2110C7D0  reserved. 00000000  MODE..... 00000000  reserved. 00000000
      +000078  reserved. 00000000  reserved. 00000000
    DSA for CEEVRONU: 2110C7D0
      +000000  EYE...... DOWNTOUP  TRTYPE... 00000003  BOS...... 00000000  STACKFLR. 00000000  SSTOPD... 212B6680
      +000018  SSDSAU... 2110C750  TRANEP... 20ACCA58  TR_R0.... 55555555  TR_R1.... 11111111  TR_R2.... 22222222
      +00002C  TR_R3.... 33333333  TR_R4.... 212B6530  TR_R5.... 21109718  TR_R6.... 20ACCAD8  TR_R7.... A090015A
      +000040  TR_R8.... A09000F2  TR_R9.... 20914E80  TR_R10... 209000B8  TR_R11... A0ACAA48  TR_R12... 209139B0
      +000054  TR_R13... 2110C5C8  TR_R14... 209000B8  TR_R15... 0000000C  CRENT.... 00000000  ROND_DSA. 2110C5C8
      +000068  INTF_MAP. 018F1000
    DSA for tran2: 212B6D30
      +000000  R4....... 212B65B0  R5....... 20914E80  R6....... 209000E8  R7....... A0ACBC9C  R8....... 209000B8
      +000014  R9....... 20ACBA47  R10...... 209000B8  R11...... A0ACAA48  R12...... 209139B0  R13...... 2110C5C8
      +000028  R14...... 209000B8  R15...... 0000000C  reserved. 00000A68  reserved. 20F2E0C7  HPTRAN... 00000000
      +00003C  reserved. 55555555  reserved. 11111111
    DSA for CEEVROND: 212B6DB0
      +000000  R4....... E3D9C1D5  R5....... 00000000  R6....... 20ACAAA0  R7....... 00000000  R8....... 2110C8B0
      +000014  R9....... 00000000  R10...... 00000000  R11...... A0A82AE8  R12...... 00000000  R13...... 00000000
      +000028  R14...... 212B6E10  R15...... 00000000  reserved. 20914E1C  reserved. 2110C5C0  HPTRAN... 212B6E10
      +00003C  reserved. 000000D0  reserved. 11111111
    DSA for CEEVROND: 212B6E10
      +000000  EYE...... UPTODOWN  TRTYPE... 00000002  BOS...... 00000000  STACKFLR. 00000000  SSTOPD... 212B6680
      +000018  SSDSAU... 2110C340  TRANEP... 20ACAAA0  TR_R0.... 00000000  TR_R1.... 00000000  TR_R2.... 00000000
      +00002C  TR_R3.... 00000000  TR_R4.... 2110C500  TR_R5.... 00000000  TR_R6.... 00000000  TR_R7.... A12BBB34
      +000040  TR_R8.... 00000000  TR_R9.... 00000000  TR_R10... 00000000  TR_R11... 00000000  TR_R12... 00000000
      +000054  TR_R13... 00000000  TR_R14... 00000000  TR_R15... 00000000  CRENT.... A0ACAA48  ROND_DSA. 00000000
      +000068  INTF_MAP. 00000000
    DSA for tran1: 2110C500
      +000000  FLAGS.... 1000      member... 0000      BKC...... 2110C340  FWC...... 2110C8B0  R14...... A12BBB34
      +000010  R15...... A0ACAA48  R0....... 211080A8  R1....... 2110C598  R2....... 55555555  R3....... 212BBA7A
      +000024  R4....... 33333333  R5....... 20914E10  R6....... 22222222  R7....... 11111111  R8....... A0900203
      +000038  R9....... 212BB9E8  R10...... 212BBA40  R11...... 20ACDF1C  R12...... 209139B0  reserved. 00000000
      +00004C  NAB...... 2110C5C8  PNAB..... 00000000  reserved. 00000000  2110C4A8
      +000064  reserved. 2110C584  reserved. 20912658  MODE..... 2110C5A4  reserved. 21135000
      +000078  reserved. 00000001  reserved. 21108020
.
.
.
CEE3846I CEEDUMP Processing completed.
```

Finding XPLINK information in a Language Environment dump

Table 39 on page 195 describes the specific XPLINK information in sections of the Language Environment dump.

Table 39. Contents of XPLINK information in a Language Environment dump

Section Number and Heading	Contents
[1] Traceback	When an XPLINK-compiled routine calls a NOXPLINK-compiled routine, a glue routine gets control to convert the linkage conventions of the XPLINK caller to those of the NOXPLINK callee. In the sample dump, this routine is CEEVRONU and it appears between `main()` and tran1() and again between `tran2()` and `tran3()`. When a NOXPLINK-compiled routine calls an XPLINK-compiled routine, a glue routine gets control to convert the linkage conventions of the NOXPLINK caller to those of the XPLINK callee. In the sample dump, this routine is CEEVROND and it appears between EDCZHINV and `main()` and again between `tran1()` and `tran2()`.
[2] Parameters, Registers, and Variables for Active Routines	In this section, each DSA is identified as one of the following: **UPSTACK DSA** The DSA format is that for a NOXPLINK-compiled program that uses an upward growing stack. **DOWNSTACK DSA** The DSA format is that for ax XPLINK-compiled program that uses an downward growing stack. **TRANSITION DSA** The DSA format is that of its callee. A transition DSA can occur between an UPSTACK DSA and a DOWNSTACK DSA where it represents a transition from one linkage convention to another. A transition DSA can also occur between two DOWNSTACK DSAs where it represents a transition from one stack segment to another (a stack overflow).
[3] Control Blocks for Active Routines	In this section, DSAs are formatted. Those previously identified as UPSTACK DSAs will have one format and those identified as DOWNSTACK DSAs will have a different format. Those identified as TRANSITION DSAs will have two parts; the first will be either the downstack or upstack format, the second is unique to transition DSAs and contains information about the transition. It is important to understand that the registers saved in an upstack DSA are those saved by a routine that the DSA-owning routine called. Typically register 15 is the entry point of the routine that was called, and register 14 is the return address into the DSA-owning routine. In contrast, the registers saved in an downstack DSA are those saved by the DSA-owning routine on entry. Register 7 is the return address back to the caller of the DSA-owning routine. Register 6 may be the entry point of the DSA-owning routine. (This is not true when the Branch Relative and Save instruction is used to implement the call.)

C/C++ contents of the Language Environment trace tables

Language Environment provides the following C/C++ trace table entry types that contain character data. For more information about the Language Environment trace table format, see "Understanding the trace table entry (TTE)" on page 151.

- Trace entry 1 occurs when a base C library function is called.
- Trace entry 2 occurs when a base C library function returns.
- Trace entry 3 occurs when a POSIX C library function is called.
- Trace entry 4 occurs when a POSIX C library function returns.
- Trace entry 5 occurs when an XPLINK base C or POSIX C library function is called.
- Trace entry 6 occurs when an XPLINK base C or POSIX C library function returns.
- Trace entry 7 occurs when an XPLINK function calls a non-XPLINK function.
- Trace entry 8 occurs when a non-XPLINK function calls an XPLINK function.

The format for trace table entry 1 is:

```
NameOfCallingFunction
-->(xxx) NameOfCalledFunction
```

or, for called functions calloc, free, malloc, and realloc:

```
NameOfCallingFunction
-->(xxx) NameOfCalledFunction<(input_parameters)>
```

In addition, when the call is due to one of these C++ operators:

```
-new,
-new[],
-delete,
-delete[]
```

then, the C++ operator will appear and the format becomes:

```
NameOfCallingFunction
-->(xxx) NameOfCalledFunction<(input_parameters)>

NameOfC++Operator
```

The format for trace table entry 2 is:

```
<--(xxx) R15=value ERRNO=value
```

The format for trace table entry 3 is:

```
NameOfCallingFunction
-->(xxx) NameOfCalledFunction
```

The format for trace table entry 4 is:

```
<--(xxx) R15=value ERRNO=value ERRNO2=value
```

The format for trace table entry 5, which is shown below, is just like trace table entry 1. The `input_parameters` and `NameOfC++Operator` only appear for the appropriate functions. The angle brackets (<>) indicate that this information does not always appear.

```
NameOfCallingFunction
-->(xxxx) NameOfCalledFunction<(input_parameters)>
```

The format for trace table entry 6 is:

```
<--(xxxx) R1=xxxxxxxx R2=xxxxxxxx R3=xxxxxxxx ERRNO=xxxxxxxx ERRNO2=xxxxxxxx
```

In all entry types, `(xxx)` and `(xxxx)` are numbers associated with the called library function and are used to associate a specific entry record with its corresponding return record.

For entry types 5 and 6, the number will be the same as the number of the function as seen in the C runtime library definition side-deck, SCEELIB dataset member CELHS003, on the IMPORT statement for that function.

The format for trace table entry 7 is:

```
ModuleNameOfCallingFunction:NameOfCallingXplinkFunction
-->ModuleNameOfCalledFunction:NameOfCalledNonXplinkFunction
```

The format for trace table entry 8 is:

```
ModuleNameOfCallingFunction:NameOfCallingNonXplinkFunction
-->ModuleNameOfCalledFunction:NameOfCalledXplinkFunction
```

For entry types 7 and 8, 16 bytes is for the module name and 32 bytes is for the function name. If the name is longer than 16 or 32 bytes, an extra trace entry is taken. The name is truncated and only the first 32/64(16/32) bytes will appear in the trace table entry. Also, a module name might not always be located, such as when a DLL is freed. If that occurs, "UNKNOWN" appears for the module name in the trace table entry.

The below trace table shows a non-XPLINK trace that has examples of C/C++ trace table entry types 1 thru 4.

```
⋮
   Language Environment Trace Table:

    Most recent trace entry is at displacement: 02D500

        Displacement                        Trace Entry in Hexadecimal                                Trace Entry in
EBCDIC
        ------------ -----------------------------------------------------------------------
--------------------------------
          +000000    Time 20.52.46.666280    Date 2001.08.26    Thread ID... 8000000000000000
          +000010    Member ID.... 03    Flags..... 000000    Entry Type..... 00000001
          +000018    94818995 40404040 40404040 40404040  40404040 40404040 40404040 40404040
|main                            |
          +000038    60606E4D F1F3F95D 40A2A399 8397A84D  5D404040 40404040 40404040 40404040  |-->(139)
strcpy()               |
          +000058    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040
|                                |
          +000078    40404040 40404040
|                                |

          +000080    Time 20.52.46.666286    Date 2001.08.26    Thread ID... 8000000000000000
          +000090    Member ID.... 03    Flags..... 000000    Entry Type..... 00000002
          +000098    4C60604D F1F3F95D 40D9F1F5 7EF2F4C2  F7F3F1C4 F840C5D9 D9D5D67E F0F0F0F0  |<--(139) R15=24B731D8
ERRNO=0000|
          +0000B8    F0F0F0F0 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|0000............................|
          +0000D8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
          +0000F8    00000000 00000000
|........                        |

          +000100    Time 20.52.46.666289    Date 2001.08.26    Thread ID... 8000000000000000
          +000110    Member ID.... 03    Flags..... 000000    Entry Type..... 00000001
          +000118    94818995 40404040 40404040 40404040  40404040 40404040 40404040 40404040
|main                            |
          +000138    60606E4D F1F3F95D 40A2A399 8397A84D  5D404040 40404040 40404040 40404040  |-->(139)
strcpy()               |
          +000158    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040
|                                |
          +000178    40404040 40404040
|                                |

          +000180    Time 20.52.46.666293    Date 2001.08.26    Thread ID... 8000000000000000
          +000190    Member ID.... 03    Flags..... 000000    Entry Type..... 00000002
          +000198    4C60604D F1F3F95D 40D9F1F5 7EF2F4C2  F7F3F2F2 F840C5D9 D9D5D67E F0F0F0F0  |<--(139) R15=24B73228
ERRNO=0000|
          +0001B8    F0F0F0F0 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|0000............................|
          +0001D8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
          +0001F8    00000000 00000000
|........                        |

          +000200    Time 20.52.46.666303    Date 2001.08.26    Thread ID... 8000000000000000
          +000210    Member ID.... 03    Flags..... 000000    Entry Type..... 00000003
          +000218    C98785A3 97819994 A2404040 40404040  40404040 40404040 40404040 40404040
|Igetparms                       |
          +000238    60606E4D F0F5F25D 4089A281 A3A3A84D  5D404040 40404040 40404040 40404040  |-->(052)
isatty()               |
          +000258    40404040 40404040 40404040 40404040  40404040 40404040 40000000 00000000
|                         .......|
```

```
          +000278    00000000 00000000
|........                       |

          +000280    Time 20.52.46.673289    Date 2001.08.26    Thread ID... 8000000000000000
          +000290    Member ID.... 03    Flags..... 000000    Entry Type..... 00000004
          +000298    4C60604D F0F5F25D 40D9F1F5 7EF0F0F0  F0F0F0F0 F040C5D9 D9D5D67E F0F0F0F0  |<--(052) R15=00000000
ERRNO=0000|
          +0002B8    F0F0F7F1 40C5D9D9 D5D6F27E F0F5C6C3  F0F1F1C3 00000000 00000000 00000000  |0071
ERRNO2=05FC011C............|
          +0002D8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
          +0002F8    00000000 00000000
|........                       |

          +000300    Time 20.52.46.673296    Date 2001.08.26    Thread ID... 8000000000000000
          +000310    Member ID.... 03    Flags..... 000000    Entry Type..... 00000003
          +000318    C98785A3 97819994 A2404040 40404040  40404040 40404040 40404040 40404040
|Igetparms                      |
          +000338    60606E4D F0F5F25D 4089A281 A3A3A84D  5D404040 40404040 40404040 40404040  |-->(052)
isatty()        |
          +000358    40404040 40404040 40404040 40404040  40404040 40404040 40000000 00000000
|                        .......|
          +000378    00000000 00000000
|........                       |

          +000380    Time 20.52.46.673334    Date 2001.08.26    Thread ID... 8000000000000000
          +000390    Member ID.... 03    Flags..... 000000    Entry Type..... 00000004
          +000398    4C60604D F0F5F25D 40D9F1F5 7EF0F0F0  F0F0F0F0 F040C5D9 D9D5D67E F0F0F0F0  |<--(052) R15=00000000
ERRNO=0000|
          +0003B8    F0F0F7F1 40C5D9D9 D5D6F27E F0F5C6C3  F0F1F1C3 00000000 00000000 00000000  |0071
ERRNO2=05FC011C............|
          +0003D8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
          +0003F8    00000000 00000000
|........                       |

          +000400    Time 20.52.46.673338    Date 2001.08.26    Thread ID... 8000000000000000
          +000410    Member ID.... 03    Flags..... 000000    Entry Type..... 00000003
          +000418    C98785A3 97819994 A2404040 40404040  40404040 40404040 40404040 40404040
|Igetparms                      |
          +000438    60606E4D F0F5F25D 4089A281 A3A3A84D  5D404040 40404040 40404040 40404040  |-->(052)
isatty()        |
          +000458    40404040 40404040 40404040 40404040  40404040 40404040 40000000 00000000
|                        .......|
          +000478    00000000 00000000
|........                       |
```

```
          +000480    Time 20.52.46.673373    Date 2001.08.26    Thread ID... 8000000000000000
          +000490    Member ID.... 03    Flags..... 000000    Entry Type..... 00000004
          +000498    4C60604D F0F5F25D 40D9F1F5 7EF0F0F0  F0F0F0F0 F040C5D9 D9D5D67E F0F0F0F0  |<--(052) R15=00000000
ERRNO=0000|
          +0004B8    F0F0F7F1 40C5D9D9 D5D6F27E F0F5C6C3  F0F1F1C3 00000000 00000000 00000000  |0071
ERRNO2=05FC011C............|
          +0004D8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
          +0004F8    00000000 00000000
|........                       |

          +000500    Time 20.52.46.673379    Date 2001.08.26    Thread ID... 8000000000000000
          +000510    Member ID.... 03    Flags..... 000000    Entry Type..... 00000001
          +000518    C98785A3 97819994 A2404040 40404040  40404040 40404040 40404040 40404040
|Igetparms                      |
          +000538    60606E4D F1F2F95D 408785A3 8595A54D  5D404040 40404040 40404040 40404040  |-->(129)
getenv()        |
          +000558    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040
|                               |
          +000578    40404040 40404040
|                               |

          +000580    Time 20.52.46.673392    Date 2001.08.26    Thread ID... 8000000000000000
          +000590    Member ID.... 03    Flags..... 000000    Entry Type..... 00000002
          +000598    4C60604D F1F2F95D 40D9F1F5 7EF0F0F0  F0F0F0F0 F040C5D9 D9D5D67E F0F0F0F0  |<--(129) R15=00000000
ERRNO=0000|
          +0005B8    F0F0F7F1 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|0071............................|
          +0005D8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
          +0005F8    00000000 00000000
|........                       |

          +000600    Time 20.52.46.673401    Date 2001.08.26    Thread ID... 8000000000000000
          +000610    Member ID.... 03    Flags..... 000000    Entry Type..... 00000001
          +000618    C9A285A3 A4974040 40404040 40404040  40404040 40404040 40404040 40404040
|Isetup                         |
          +000638    60606E4D F1F9F15D 408685A3 83884D5D  40404040 40404040 40404040 40404040  |-->(191)
fetch()         |
          +000658    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040
|                               |
          +000678    40404040 40404040
|                               |

          +000680    Time 20.52.47.553343    Date 2001.08.26    Thread ID... 8000000000000000
```

```
          +000690    Member ID.... 03    Flags..... 000000    Entry Type..... 00000002
          +000698    4C60604D F1F9F15D 40D9F1F5 7EF2F4C2  F7F6F0F6 F040C5D9 D9D5D67E F0F0F0F0  |<--(191) R15=24B76060
ERRNO=0000|
          +0006B8    F0F0F7F1 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|0071............................|
          +0006D8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
          +0006F8    00000000 00000000
|........                        |

          +000700    Time 20.52.47.553355    Date 2001.08.26    Thread ID... 8000000000000000
          +000710    Member ID.... 03    Flags..... 000000    Entry Type..... 00000001
          +000718    C9A285A3 A4974040 40404040 40404040  40404040 40404040 40404040 40404040
|Isetup                          |
          +000738    60606E4D F1F2F45D 40948193 9396834D  F2F0F6F8 5D404040 40404040 40404040  |-->(124)
malloc(2068)            |
          +000758    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040
|                                |
          +000778    40404040 40404040
|                                |

          +000780    Time 20.52.47.553366    Date 2001.08.26    Thread ID... 8000000000000000
          +000790    Member ID.... 03    Flags..... 000000    Entry Type..... 00000002
          +000798    4C60604D F1F2F45D 40D9F1F5 7EF2F4C2  F7F6F2F3 F040C5D9 D9D5D67E F0F0F0F0  |<--(124) R15=24B76230
ERRNO=0000|
          +0007B8    F0F0F7F1 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|0071............................|
          +0007D8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
          +0007F8    00000000 00000000
|........                        |
⋮
```

The code below shows an XPLINK trace that has examples of the trace entries 5 and 6.

```
⋮
  Language Environment Trace Table:

    Most recent trace entry is at displacement: 000D80

        Displacement                        Trace Entry in Hexadecimal                                Trace Entry in
EBCDIC
        ------------ ---------------------------------------------------------------------
--------------------------------
          +000000    Time 22.41.35.433944    Date 2001.08.30    Thread ID... 26C70D0000000000
          +000010    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
          +000018    4C60604D F0F0F5F9 5D40D9F1 7EF2F3C6  C6C3C1C2 F040D9F2 7EF2F3C3 F5F8F9C4  |<--(0059) R1=23FFCAB0
R2=23C589D|
          +000038    F040D9F3 7EF2F3C6 C6C4F0F0 F040C5D9  D9D5D67E F0F0F0F0 F0F0F7F4 40C5D9D9  |0 R3=23FFD000
ERRNO=00000074 ERR|
          +000058    D5D6F27E F0F0F0F0 F0F0F0F0 00000000  00000000 00000000 00000000 00000000
|NO2=00000000....................|
          +000078    00000000 00000000
|........                        |

          +000080    Time 22.41.35.433948    Date 2001.08.30    Thread ID... 26C70D0000000000
          +000090    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
          +000098    C9D9E3D3 D985A296 A4998385 7A7AA1C9  D9E3D3D9 85A296A4 9983854D 5D404040
|IRTLResource::.IRTLResource()   |
          +0000B8    60606E4D F0F2F0F4 5D4097A3 88998581  846D94A4 A385A76D 8485A2A3 9996A84D  |-->(0204)
pthread_mutex_destroy(|
          +0000D8    5D404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040
|)                               |
          +0000F8    40404040 40404040
|                                |

          +000100    Time 22.41.35.433952    Date 2001.08.30    Thread ID... 26C70D0000000000
          +000110    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
          +000118    4C60604D F0F2F0F4 5D40D9F1 7EF2F3C6  C6C3C1F3 C340D9F2 7EF2F3C3 F5F8F9C4  |<--(0204) R1=23FFCA3C
R2=23C589D|
          +000138    F040D9F3 7EF0F0F0 F0F0F0F0 F040C5D9  D9D5D67E F0F0F0F0 F0F0F7F4 40C5D9D9  |0 R3=00000000
ERRNO=00000074 ERR|
          +000158    D5D6F27E F0F0F0F0 F0F0F0F0 00000000  00000000 00000000 00000000 00000000
|NO2=00000000....................|
          +000178    00000000 00000000
|........                        |

          +000180    Time 22.41.35.433957    Date 2001.08.30    Thread ID... 26C70D0000000000
          +000190    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
          +000198    C9D9E3D3 D985A296 A4998385 7A7AA1C9  D9E3D3D9 85A296A4 9983854D 5D404040
|IRTLResource::.IRTLResource()   |
          +0001B8    60606E4D F0F0F5F9 5D408699 85854DF0  A7F2F4F0 F0F4C3F2 F05D4040 40404040  |-->(0059)
free(0x24004C20)        |
          +0001D8    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040
|                                |
          +0001F8    84859385 A3854040
|delete                          |

          +000200    Time 22.41.35.433959    Date 2001.08.30    Thread ID... 26C70D0000000000
          +000210    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
```

```
         +000218    4C60604D F0F0F5F9 5D40D9F1 7EF2F3C6  C6C3C1C2 F040D9F2 7EF2F3C3 F5F8F9C4  |<--(0059) R1=23FFCAB0 
R2=23C589D|
         +000238    F040D9F3 7EF2F3C6 C6C4F0F0 F040C5D9  D9D5D67E F0F0F0F0 F0F0F7F4 40C5D9D9  |0 R3=23FFD000 
ERRNO=00000074 ERR|
         +000258    D5D6F27E F0F0F0F0 F0F0F0F0 00000000  00000000 00000000 00000000 00000000  
|NO2=00000000....................|
         +000278    00000000 00000000  
|........                        |

         +000280    Time 22.41.35.433963    Date 2001.08.30    Thread ID... 26C70D0000000000
         +000290    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
         +000298    C9D9E3D3 D985A296 A4998385 7A7AA1C9  D9E3D3D9 85A296A4 9983854D 5D404040  
|IRTLResource::.IRTLResource()   |
         +0002B8    60606E4D F0F2F0F4 5D4097A3 88998581  846D94A4 A385A76D 8485A2A3 9996A84D  |-->(0204) 
pthread_mutex_destroy(|
         +0002D8    5D404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  
|)                               |
         +0002F8    40404040 40404040  
|                                |

         +000300    Time 22.41.35.433967    Date 2001.08.30    Thread ID... 26C70D0000000000
         +000310    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
         +000318    4C60604D F0F2F0F4 5D40D9F1 7EF2F3C6  C6C3C1F3 C340D9F2 7EF2F3C3 F5F8F9C4  |<--(0204) R1=23FFCA3C 
R2=23C589D|
         +000338    F040D9F3 7EF0F0F0 F0F0F0F0 F040C5D9  D9D5D67E F0F0F0F0 F0F0F7F4 40C5D9D9  |0 R3=00000000 
ERRNO=00000074 ERR|
         +000358    D5D6F27E F0F0F0F0 F0F0F0F0 00000000  00000000 00000000 00000000 00000000  
|NO2=00000000....................|
         +000378    00000000 00000000  
|........                        |

         +000380    Time 22.41.35.433972    Date 2001.08.30    Thread ID... 26C70D0000000000
         +000390    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
         +000398    C9D9E3D3 D985A296 A4998385 7A7AA1C9  D9E3D3D9 85A296A4 9983854D 5D404040  
|IRTLResource::.IRTLResource()   |
         +0003B8    60606E4D F0F0F5F9 5D408699 85854DF0  A7F2F4F0 F0F4C3F3 F85D4040 40404040  |-->(0059) 
free(0x24004C38)       |
         +0003D8    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  
|                                |
         +0003F8    84859385 A3854040  
|delete                          |

         +000400    Time 22.41.35.433974    Date 2001.08.30    Thread ID... 26C70D0000000000
         +000410    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
         +000418    4C60604D F0F0F5F9 5D40D9F1 7EF2F3C6  C6C3C1C2 F040D9F2 7EF2F3C3 F5F8F9C4  |<--(0059) R1=23FFCAB0 
R2=23C589D|
         +000438    F040D9F3 7EF2F3C6 C6C4F0F0 F040C5D9  D9D5D67E F0F0F0F0 F0F0F7F4 40C5D9D9  |0 R3=23FFD000 
ERRNO=00000074 ERR|
         +000458    D5D6F27E F0F0F0F0 F0F0F0F0 00000000  00000000 00000000 00000000 00000000  
|NO2=00000000....................|
         +000478    00000000 00000000  
|........                        |
⋮
```

Figure 68 on page 200 shows an example of the format of the trace table entry type 7 and 8.

```
Calculator      :calculatethesumoftwointegers    -->
exceptionhandler:exceptionhandlersub1
```

Figure 68. Trace table with trace table entry types 7 and 8

The following is an example of a dump of the trace table when you specify the LE=20 suboption.

```
  Language Environment Trace Table:

    Most recent trace entry is at displacement: 000800

        Displacement                        Trace Entry in Hexadecimal                                Trace Entry in 
EBCDIC
        ------------ ---------------------------------------------------------------------- 
--------------------------------
         +000000    Time 22.10.56.799195    Date 2005.05.01    Thread ID... 21DEC83000000000
         +000010    Member ID.... 03    Flags..... 000000    Entry Type..... 00000008
         +000018    C3C5D3C8 E5F0F0F3 40404040 40404040  7AC5C4C3 E9C8C9D5 E5404040 40404040  |
CELHV003        :EDCZHINV       |
         +000038    40404040 40404040 40404040 40404040  4060606E 81F8F5F9 83F4F1A7 40404040  |               --
>a859c41x    |
         +000058    40404040 7A948189 95404040 40404040  40404040 40404040 40404040 40404040  
|    :main                       |
         +000078    40404040 404040F1                                                         |
1                |

         +000080    Time 22.10.56.804695    Date 2005.05.01    Thread ID... 21DEC83000000000
         +000090    Member ID.... 03    Flags..... 000000    Entry Type..... 00000007
         +000098    C3C5C5D7 D3D7D2C1 40404040 40404040  7AC3C5C5 D7C8E3D3 C3404040 40404040  |
CEEPLPKA        :CEEPHTLC       |
         +0000B8    40404040 40404040 40404040 40404040  4060606E C3C5C5D7 D3D7D2C1 40404040  |               --
```

```
>CEEPLPKA    |
           +0000D8    40404040 7AC3C5C5 D7E3D3D6 D9404040  40404040 40404040 40404040 40404040
|    :CEEPTLOR               |
           +0000F8    40404040 404040F1                                                         |
1                           |

           +000100    Time 22.10.56.825094    Date 2005.05.01    Thread ID... 21DEC83000000000
           +000110    Member ID.... 03    Flags..... 000000    Entry Type..... 00000007
           +000118    81F8F5F9 83F4F1A7 40404040 40404040  7A948189 95404040 40404040 40404040  |
a859c41x        :main           |
           +000138    40404040 40404040 40404040 40404040  4060606E 81F8F5F9 83F4F186 9593F3F4  |                  --
>a859c41fnl34|
           +000158    40404040 7A86A495 83A38996 956D9581  94856D93 859587A3 886D8598 A48193A2
|    :function_name_length_equals|
           +000178    6DA3966D F04040F1                                                         |_to_0
1                           |

           +000180    Time 22.10.56.825094    Date 2005.05.01    Thread ID... 21DEC83000000000
           +000190    Member ID.... 03    Flags..... 000000    Entry Type..... 00000007
           +000198    40404040 40404040 40404040 40404040  7A404040 40404040 40404040 40404040
|            :               |
           +0001B8    40404040 40404040 40404040 40404040  4060606E 40404040 40404040 40404040  |                  --
>            |
           +0001D8    40404040 7AF3F440 40404040 40404040  40404040 40404040 40404040 40404040  |
:34                            |
           +0001F8    40404040 404040F2                                                         |
2                           |

           +000200    Time 22.10.56.826629    Date 2005.05.01    Thread ID... 21DEC83000000000
           +000210    Member ID.... 03    Flags..... 000000    Entry Type..... 00000008
           +000218    81F8F5F9 83F4F186 9593F3F4 40404040  7A86A495 83A38996 956D9581 94856D93  |
a859c41fnl34    :function_name_l|
           +000238    859587A3 886D8598 A48193A2 6DA3966D  F060606E C3C5D3C8 E5F0F0F3 40404040  |ength_equals_to_0--
>CELHV003    |
           +000258    40404040 7A979989 95A38640 40404040  40404040 40404040 40404040 40404040
|    :printf                 |
           +000278    40404040 404040F1                                                         |
1                           |

           +000280    Time 22.10.56.826629    Date 2005.05.01    Thread ID... 21DEC83000000000
           +000290    Member ID.... 03    Flags..... 000000    Entry Type..... 00000008
           +000298    40404040 40404040 40404040 40404040  7AF3F440 40404040 40404040 40404040  |
:34             |
           +0002B8    40404040 40404040 40404040 40404040  4060606E 40404040 40404040 40404040  |                  --
>            |
           +0002D8    40404040 7A404040 40404040 40404040  40404040 40404040 40404040 40404040
|    :                       |
           +0002F8    40404040 404040F2                                                         |
2                           |

           +000300    Time 22.10.56.826670    Date 2005.05.01    Thread ID... 21DEC83000000000
           +000310    Member ID.... 03    Flags..... 000000    Entry Type..... 00000008
           +000318    81F8F5F9 83F4F186 9593F3F4 40404040  7A86A495 83A38996 956D9581 94856D93  |
a859c41fnl34    :function_name_l|
           +000338    859587A3 886D8598 A48193A2 6DA3966D  F060606E C3C5D3C8 E5F0F0F3 40404040  |ength_equals_to_0--
>CELHV003    |
           +000358    40404040 7A979989 95A38640 40404040  40404040 40404040 40404040 40404040
|    :printf                 |
           +000378    40404040 404040F1                                                         |
1                           |

           +000380    Time 22.10.56.826670    Date 2005.05.01    Thread ID... 21DEC83000000000
           +000390    Member ID.... 03    Flags..... 000000    Entry Type..... 00000008
           +000398    40404040 40404040 40404040 40404040  7AF3F440 40404040 40404040 40404040  |
:34             |
           +0003B8    40404040 40404040 40404040 40404040  4060606E 40404040 40404040 40404040  |                  --
>            |
           +0003D8    40404040 7A404040 40404040 40404040  40404040 40404040 40404040 40404040
|    :                       |
           +0003F8    40404040 404040F2                                                         |
2                           |
```

```
           +000400    Time 22.10.56.826697    Date 2005.05.01    Thread ID... 21DEC83000000000
           +000410    Member ID.... 03    Flags..... 000000    Entry Type..... 00000008
           +000418    81F8F5F9 83F4F186 9593F3F4 40404040  7A86A495 83A38996 956D9581 94856D93  |
a859c41fnl34    :function_name_l|
           +000438    859587A3 886D8598 A48193A2 6DA3966D  F060606E C3C5D3C8 E5F0F0F3 40404040  |ength_equals_to_0--
>CELHV003    |
           +000458    40404040 7A979989 95A38640 40404040  40404040 40404040 40404040 40404040
|    :printf                 |
           +000478    40404040 404040F1                                                         |
1                           |

           +000480    Time 22.10.56.826697    Date 2005.05.01    Thread ID... 21DEC83000000000
           +000490    Member ID.... 03    Flags..... 000000    Entry Type..... 00000008
           +000498    40404040 40404040 40404040 40404040  7AF3F440 40404040 40404040 40404040  |
:34             |
           +0004B8    40404040 40404040 40404040 40404040  4060606E 40404040 40404040 40404040  |                  --
>            |
           +0004D8    40404040 7A404040 40404040 40404040  40404040 40404040 40404040 40404040
|    :                       |
           +0004F8    40404040 404040F2                                                         |
```

```
2                        |

          +000500    Time 22.10.56.836542    Date 2005.05.01    Thread ID... 21DEC83000000000
          +000510    Member ID.... 03    Flags..... 000000    Entry Type..... 00000008
          +000518    81F8F5F9 83F4F186 9593F3F4 40404040  7A86A495 83A38996 956D9581 94856D93  |
a859c41fnl34    :function_name_l|
          +000538    859587A3 886D8598 A48193A2 6DA3966D  F060606E 81F8F5F9 83F4F186 9593F3F5  |ength_equals_to_0--
>a859c41fnl35|
          +000558    40404040 7A86A495 83A38996 956D9581  94856D93 859587A3 886D8598 A48193F3
|    :function_name_length_equal3|
          +000578    F56DA285 834040F1                                                        |5_sec
1                        |

          +000580    Time 22.10.56.836543    Date 2005.05.01    Thread ID... 21DEC83000000000
          +000590    Member ID.... 03    Flags..... 000000    Entry Type..... 00000008
          +000598    40404040 40404040 40404040 40404040  7AF3F440 40404040 40404040 40404040  |
:34            |
          +0005B8    40404040 40404040 40404040 40404040  4060606E 40404040 40404040 40404040  |                --
>           |
          +0005D8    40404040 7A969584 40404040 40404040  40404040 40404040 40404040 40404040
|    :ond                        |
          +0005F8    40404040 404040F2                                                        |
2                        |

          +000600    Time 22.10.56.836579    Date 2005.05.01    Thread ID... 21DEC83000000000
          +000610    Member ID.... 03    Flags..... 000000    Entry Type..... 00000008
          +000618    81F8F5F9 83F4F186 9593F3F4 40404040  7A86A495 83A38996 956D9581 94856D93  |
a859c41fnl34    :function_name_l|
          +000638    859587A3 886D8598 A48193A2 6DA3966D  F060606E C3C5D3C8 E5F0F0F3 40404040  |ength_equals_to_0--
>CELHV003    |
          +000658    40404040 7A979989 95A38640 40404040  40404040 40404040 40404040 40404040
|    :printf                     |
          +000678    40404040 404040F1                                                        |
1                        |

          +000680    Time 22.10.56.836579    Date 2005.05.01    Thread ID... 21DEC83000000000
          +000690    Member ID.... 03    Flags..... 000000    Entry Type..... 00000008
          +000698    40404040 40404040 40404040 40404040  7AF3F440 40404040 40404040 40404040  |
:34            |
          +0006B8    40404040 40404040 40404040 40404040  4060606E 40404040 40404040 40404040  |                --
>           |
          +0006D8    40404040 7A404040 40404040 40404040  40404040 40404040 40404040 40404040
|    :                           |
          +0006F8    40404040 404040F2                                                        |
2                        |

          +000700    Time 22.10.56.836605    Date 2005.05.01    Thread ID... 21DEC83000000000
          +000710    Member ID.... 03    Flags..... 000000    Entry Type..... 00000008
          +000718    81F8F5F9 83F4F186 9593F3F4 40404040  7A86A495 83A38996 956D9581 94856D93  |
a859c41fnl34    :function_name_
      +000738    859587A3 886D8598 A48193A2 6DA3966D  F060606E C3C5D3C8 E5F0F0F3 40404040  |ength_equals_to_0--
>CELHV003    |
          +000758    40404040 7A979989 95A38640 40404040  40404040 40404040 40404040 40404040
|    :printf                     |
          +000778    40404040 404040F1                                                        |
1                        |

          +000780    Time 22.10.56.836605    Date 2005.05.01    Thread ID... 21DEC83000000000
          +000790    Member ID.... 03    Flags..... 000000    Entry Type..... 00000008

          +000798    40404040 40404040 40404040 40404040  7AF3F440 40404040 40404040 40404040  |
:34            |
          +0007B8    40404040 40404040 40404040 40404040  4060606E 40404040 40404040 40404040  |                --
>           |
          +0007D8    40404040 7A404040 40404040 40404040  40404040 40404040 40404040 40404040
|    :                           |
          +0007F8    40404040 404040F2                                                        |
2                        |

          +000800    Time 22.10.56.836671    Date 2005.05.01    Thread ID... 21DEC83000000000
          +000810    Member ID.... 01    Flags..... 000000    Entry Type..... 00001800
          +000818    0125D23C A04F07F0 2033E150 20C121B8  00000001 00000010 00000000 20C121B8
|..K..|.0...&.A...............A..|
          +000838    01000000 00000000 00000000 00000000  00000000 00000000 000000F2 00000000
|..........................2....|
          +000858    00000000 202D92B8 03000000 00000000  BCF2310D 2130666C 40404040 40404040
|......k..........2.....%        |
          +000878    40404040 40404040
|                                |

Additional Language Specific Information:

  errno information :
  Thread Id .... 21DEC83000000000 Errno ...... 0 Errnojr .... 00000000
```

Debugging examples of C/C++ routines

This section contains examples that demonstrate the debugging process for C/C++ routines. Important areas of the output are highlighted. Data unnecessary to the debugging examples has been replaced by ellipses.

Divide-by-zero error

Figure 69 on page 203 illustrates a C program that contains a divide-by-zero error. The code was compiled with RENT so static and external variables need to be calculated from the WSA field. The code was compiled with XREF, LIST and OFFSET to generate a listing, which is used to calculate addresses of functions and data. The code was processed by the binder with MAP to generate a binder map, which is used to calculate the addresses of static and external variables.

```
#include <stdio.h>
#include <stdlib.h>
#include <errno.h>
int statint = 73;
int fa;
void funcb(int *pp);

int main(void) {
  int aa, bb=1;
  aa = bb;
  funcb(&aa);
  return(99);
}

void funcb(int *pp) {
  int result;
  fa = *pp;
  result = fa/(statint-73);
  return;
}
```

Figure 69. C routine with a divide-by-zero error

To debug this routine, use the following steps:

1. Locate the Original Condition message in the Condition Information for Active Routines section of the dump. In this example, the message is CEE3209S. The system detected a fixed-point divide exception. This message indicates the error was caused by an attempt to divide by zero. For more information about CEE3209S, see Language Environment runtime messages in *z/OS Language Environment Runtime Messages*.

   The traceback section of the dump indicates that the exception occurred at offset X'76' within function funcb. This information is used along with the compiler-generated Pseudo Assembly Listing to determine where the problem occurred.

   If the TEST compiler option is specified, variable information is in the dump. If the GONUMBER compiler option is specified, statement number information is in the dump. Figure 70 on page 204 shows the generated traceback from the dump.

```
CEE3DMP V1 R12.0: Condition processing resulted in the unhandled condition.         05/24/10 6:20:36 PM                 Page:    1
ASID: 0049   Job ID: JOB23480   Job name: CDIVZERO   Step name: STEP1      UserID: HEALY

CEE3845I CEEDUMP Processing started.

Information for enclave main

  Information for thread 8000000000000000

  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     CEEHDSP     +00004030              CEEPLPKA             CEEHDSP                        D1908    Call
    2     funcb       +00000076  18          CDIVZERO                                                     Exception
    3     main        +00000064  12          CDIVZERO                                                     Call
    4     EDCZMINV    +000000C2              CEEEV003                                                     Call
    5     CEEBBEXT    +000001B6              CEEPLPKA             CEEBBEXT                       D1908    Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     20FCB358   209C4238   209C4238   +00004030  20061215   CEL
    2     20FCB2B0   20900960   20900960   +00000076  20070115   C/C++
    3     20FCB208   209008E0   209008E0   +00000064  20070115   C/C++
    4     20FCB0F0   20E699EE   20E699EE   +000000C2  20061215   LIBRARY
    5     20FCB030   20992208   20992208   +000001B6  20061215   CEL

Condition Information for Active Routines
      Condition Information for  (DSA address 20FCB2B0)
        CIB Address: 20FCBC78
        Current Condition:
          CEE0198S The termination of a thread was signaled due to an unhandled condition.
        Original Condition:
          CEE3209S The system detected a fixed-point divide exception (System Completion Code=0C9).
        Location:
          Program Unit:  Entry: funcb Statement: 18 Offset: +00000076
        Machine State:
          ILC..... 0002    Interruption Code..... 0009
          PSW..... 078D2400 A09009D8
          GPR0..... 00000000_20900A08  GPR1..... 00000000_00000000  GPR2..... 00000000_20FCB2A8  GPR3..... 00000000_2090099A
          GPR4..... 00000000_00000000  GPR5..... 00000000_00000001  GPR6..... 00000000_20900B24  GPR7..... 00000000_20900098
          GPR8..... 00000000_00000030  GPR9..... 00000000_80000000  GPR10.... 00000000_A0E699E2  GPR11.... 00000000_A0992208
          GPR12.... 00000000_209139B0  GPR13.... 00000000_20FCB2B0  GPR14.... 00000000_20914F50  GPR15.... 00000000_00000008
      Storage dump near condition, beginning at location: 209009C6
        +000000 209009C6  5811E000 504FE000 A71AFFB7 8E400020  1D4158F0 306A4110 D0985000 D0985050  |....&|..x.... .....0.....q&..q&&|
      GPREG STORAGE:
        Storage around GPR0 (20900A08)
          -0020 209009E8  0DEF18F5 58D0D004 58E0D00C 9825D01C  051E0707 00000000 00000008 209000B8  |...5........q...................|
          +0000 20900A08  D985A2A4 93A3407E 406C8415 00000000  1CCEA106 00000228 00000178 00000000  |Result = %d.....................|

⋮
```

Figure 70. Sections of the dump from example C/C++ routine (divide-by-zero error)

2. Locate the instruction with the divide-by-zero error in the Pseudo Assembly Listing in Figure 71 on page 205.

   The offset (within `funcb`) of the exception from the traceback (X'76') reveals the divide instruction: `DR r4,r1` at that location. Instructions X'66' through X'76' refer to the `result = fa/(statint-73);` line of the C/C++ routine.

```
OFFSET OBJECT CODE        LINE#  FILE#    P S E U D O   A S S E M B L Y
L I S T I N G
                          000015 |       *  int funcb(int *pp) {
000000                    000015 |        funcb    DS       0D
.
.
.
000046  50D0  E004        000015 |                 ST       r13,4(,r14)
00004A  18DE              000015 |                 LR       r13,r14
00004C                    End of Prolog

00004C  58E0  C1F4        000000 |                 L        r14,_CEECAA_(,r12,500)
                          000016 |       *    int result;
                          000017 |       *    fa = *pp;
000050  5820  1000        000017 |                 L        r2,pp(,r1,0)
000054  5810  3062        000018 |                 L        r1,=Q(statint)(,r3,98)
000058  58F0  3066        000017 |                 L        r15,=Q(fa)(,r3,102)
00005C  C000  0000  0026  000000 |                 LARL     r0,F'38'
000062  5840  2000        000017 |                 L        r4,(*)int(,r2,0)
                          000018 |       *    result = fa/(statint-73);
000066  5811  E000        000018 |                 L        r1,statint(r1,r14,0)
00006A  504F  E000        000017 |                 ST       r4,fa(r15,r14,0)
00006E  A71A  FFB7        000018 |                 AHI      r1,H'-73'
000072  8E40  0020        000018 |                 SRDA     r4,32
000076  1D41              000018 |                 DR       r4,r1
                          000019 |       *    printf("Result = %d\n",result);
000078  58F0  306A        000019 |                 L        r15,=V(printf)(,r3,106)
00007C  4110  D098        000019 |                 LA       r1,#MX_TEMP2(,r13,152)
000080  5000  D098        000019 |                 ST       r0,#MX_TEMP2(,r13,152)
000084  5050  D09C        000019 |                 ST       r5,#MX_TEMP2(,r13,156)
000088  0DEF              000019 |                 BASR     r14,r15
                          000020 |       *    return result;
00008A  18F5              000020 |                 LR       r15,r5
                          000021 |       *  }
00008C                    000021 |        @2L3     DS       0H

00008C                    Start of Epilog
00008C  58D0  D004        000021 |                 L        r13,4(,r13)
000090  58E0  D00C        000021 |                 L        r14,12(,r13)
000094  9825  D01C        000021 |                 LM       r2,r5,28(r13)
000098  051E              000021 |                 BALR     r1,r14
00009A  0707              000021 |                 NOPR     7

00009C                    Start of Literals
00009C  00000000                                            =Q(statint)
0000A0  00000000                                            =Q(fa)
0000A4  00000000                                            =V(printf)
0000A8                    End of Literals

                          ***   General purpose registers used: 1111110000001111
                          ***   Floating point  registers used: 1111111100000000
                          ***   Size of register spill area: 128(max) 0(used)
                          ***   Size of dynamic storage: 168
                          ***   Size of executable code: 156

                          Constant Area
000000  D985A2A4 93A3407E 406C8415 00          |Result = %d..   |

                          PPA1: Entry Point Constants
000000  1CCEA106                                            =F'483303686'      Flags
000004  00000228                                            =A(PPA2-main)
000008  00000178                                            =A(PPA3-main)
00000C  00000000                                            =F'0'              No EPD
000010  FE000000                                            =F'-33554432'      Register save mask
000014  00000000                                            =F'0'              Member flags
000018  90                                                  =AL1(144)          Flags
000019  000000                                              =AL3(0)            Callee's DSA use/8
00001C  0040                                                =H'64'             Flags
00001E  0012                                                =H'18'             Offset/2 to CDL
000020  00000000                                            =F'0'              Reserved
000024  5000003C                                            =F'1342177340'     CDL function length/2
000028  FFFFFEC8                                            =F'-312'           CDL function EP offset
00002C  38260000                                            =F'942014464'      CDL prolog
000030  40090033                                            =F'1074331699'     CDL epilog
000034  00000000                                            =F'0'              CDL end
000038  0004  ****                                          AL2(4),C'main'
                          PPA1 End
⋮
```

Figure 71. Pseudo assembly listing (C/C++ routine divide-by-zero error)

3. Verify the value of the divisor `statint`. The procedure specified below is to be used for determining the value of static variables only. If the divisor is an automatic variable, there is a different procedure for finding the value of the variable. For more information about finding automatic variables in a dump, see "Steps for finding automatic variables" on page 172.

   Because this routine was compiled with the RENT option, find the WSA address in the Enclave Control Blocks section of the dump. In this example, this address is X'20914F50'. Figure 72 on page 205 shows the WSA address.

```
  Enclave Control
Blocks:

⋮

    WSA
address.................20914F50

⋮
```

Figure 72. C/C++ CAA information in dump (C/C++ routine divide-by-zero error)

4. Routines compiled with the RENT option must also be processed by the binder. The binder produces the Writable Static Map. Find the offset of `statint` in the Writable Static Map in Figure 73 on page 206. In this example, the offset is X'0'.

```
⋮

---------------

CLASS  C_WSA              LENGTH =       AC  ATTRIBUTES = MRG, DEFER ,
RMODE=ANY
                          OFFSET =        0 IN SEGMENT 002       ALIGN =
DBLWORD
---------------



CLASS

           OFFSET  NAME                TYPE    LENGTH
SECTION
                0  statint          PART             4
statint
                8  fa               PART             4
fa
               10  environ          PART             4
environ
               18  errno            PART             4
errno
⋮
```

Figure 73. Writable static map (C/C++ routine divide-by-zero error)

5. Add the WSA address of X'20914F50' to the offset of `statint`. The result is X'20914F50'. This is the address of the variable `statint`, which is in the writable static area.

   The writable static area is shown in the Enclave Storage section of the dump. For a load module, the writable static area is storage allocated by the C/C++ runtime for the C/C++ user, so it is in the user heap. For a program object, the writable static area is storage allocated by the loader and is shown in the WSA for Program Object(s) section of the dump.

   For this example, the program was built as a program object. The writable static area is displayed in the Enclave Storage section of the dump, shown in Figure 74 on page 206.

6. To find the variable `statint` in the writable static area, locate the closest address listed that is before the address of `statint`. In this case, that address is X'20914F50'. Count across X'00' to location X'20914F50'. The value at that location is X'49' (that is, `statint` is 73), and hence the fixed point divide exception.

```
  Enclave Storage:
⋮
    WSA for Program Object(s)
    WSA: 20914F50
      +000000 20914F50  00000049 00000000 00000001 00000000  2090A880 00000000 00000000 00000000  |..................y.............|
      +000020 20914F70  20910260 2091026A 00000000 00000000  00000000 00000000 00000000 00000000  |.j.-.j..........................|
      +000040 20914F90  00000001 00000000 00000001 00000000  00000000 00000000 00000000 00000000  |................................|
      +000060 20914FB0  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000080 20914FD0  00000000 00000000 00000000 00000000  2090F6BC 00000000 2090F28C 00000000  |..................6.......2.....|
      +0000A0 20914FF0  2090F4A4 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |..4u............................|
⋮
```

Figure 74. Enclave storage section of dump (C/C++ routine divide-by-zero error)

Calling a nonexistent non-XPLINK function

Figure 75 on page 207 demonstrates the error of calling a nonexistent function. This routine was compiled with the compiler options LIST, OFFSET, and RENT and was run with the option TERMTHDACT(DUMP). The code was processed by the binder with MAP to generate a binder map, which is used to calculate the addresses of static and external variables. This routine was not compiled with the TEST(ALL) compiler option. As a result, arguments and variables do not appear in the dump.

```
#include <stdio.h>
#include <stdlib.h>
#include <errno.h>
#include <signal.h>
void funca(int* aa);
int (*func_ptr)(void)=0;
int main(void) {
  int aa;
  funca(&aa);
  printf("result of funca = %d\n",aa);
  return;
}
void funca(int* aa) {
  *aa = func_ptr();
  return;
}
```

Figure 75. C/C++example of calling a nonexistent subroutine

To debug this routine, use the following steps:

1. Locate the Original Condition message in the Condition Information for Active Routines section of the dump, shown in Figure 76 on page 208. In this example, the message is

   `CEE3201S The system detected an operation exception (System Completion Code=0C1).`

   It suggests that the error was caused by an attempt to branch to an unknown address. For more information about CEE3201S, see Language Environment runtime messages in *z/OS Language Environment Runtime Messages*.

   The Location section of the dump indicates that the exception occurred at offset X'-20900978' within function `funca` and that there may have been a bad branch from offset X'+0000005A' within function `funca`. The negative offset indicates that the offset cannot be used to locate the instruction that caused the error. Another indication of bad data is the value of X'80000002' in the instruction address of the PSW. This address indicates that an instruction in the routine branched outside the bounds of the routine.

```
CEE3DMP V1 R12.0: Condition processing resulted in the unhandled condition.         04/18/10 5:38:23 PM                 Page:    1
ASID: 0049   Job ID: JOB21060   Job name: EXIST      Step name: STEP1      UserID: HEALY

CEE3845I CEEDUMP Processing started.

Information for enclave main

  Information for thread 8000000000000000

  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     CEEHDSP     +00004030              CEEPLPKA             CEEHDSP                        D1908    Call
    2     funca       -20900978              EXIST                                                        Exception
    3     main        +0000005C              EXIST                                                        Call
    4     EDCZMINV    +000000C2              CEEEV003                                                     Call
    5     CEEBBEXT    +000001B6              CEEPLPKA             CEEBBEXT                       D1908    Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     20FCB350   209D2B08   209D2B08   +00004030  20061215   CEL
    2     20FCB2B0   20900978   20900978   -20900978  20070115   C/C++
    3     20FCB208   209008E0   209008E0   +0000005C  20070115   C/C++
    4     20FCB0F0   20E699EE   20E699EE   +000000C2  20061215   LIBRARY
    5     20FCB030   209A0AD8   209A0AD8   +000001B6  20061215   CEL

  Condition Information for Active Routines
    Condition Information for  (DSA address 20FCB2B0)
      CIB Address: 20FCBC70
      Current Condition:
        CEE0198S The termination of a thread was signaled due to an unhandled condition.
      Original Condition:
        CEE3201S The system detected an operation exception (System Completion Code=0C1).
      Location:
        Program Unit:  Entry: funca Statement:  Offset: -20900978
        Possible Bad Branch:  Statement:   Offset: +0000005A
      Machine State:
        ILC..... 0002    Interruption Code..... 0001
        PSW..... 078D1400 80000002
        GPR0..... 00000000_20FCB350  GPR1..... 00000000_20FCB2A0  GPR2..... 00000000_20FCB2A0  GPR3..... 00000000_209009B2
        GPR4..... 00000000_A09A0BBC  GPR5..... 00000000_20912648  GPR6..... 00000000_20900AA4  GPR7..... 00000000_20900098
        GPR8..... 00000000_00000030  GPR9..... 00000000_80000000  GPR10.... 00000000_A0E699E2  GPR11.... 00000000_A09A0AD8
        GPR12.... 00000000_209139B0  GPR13.... 00000000_20FCB2B0  GPR14.... 00000000_A09009D4  GPR15.... 00000000_00000000
    Storage dump near condition, beginning at location: 00000000
      +000000 00000000  Inaccessible storage.
    GPREG STORAGE:
      Storage around GPR0 (20FCB350)
     -0020 20FCB330  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
     +0000 20FCB350  0808CEE1 20FCB2B0 20FCE470 A09D6B3A  A09EFFD8 20FCB350 20FCB7A8 20912648  |..........U...,....Q...&...y.j..|
⋮
 Parameters, Registers, and Variables for Active Routines:
    CEEHDSP (DSA address 20FCB350):
      UPSTACK DSA
      Saved Registers:
        GPR0..... 20FCB350  GPR1..... 20FCB7A8  GPR2..... 20912648  GPR3..... 00000080
        GPR4..... 209D7734  GPR5..... A0915000  GPR6..... 2090C2A8  GPR7..... 20FCBC70
        GPR8..... A09D665A  GPR9..... 20FCD34E  GPR10.... 20FCC34F  GPR11.... 209D2B08
        GPR12.... 209139B0  GPR13.... 20FCB350  GPR14.... A09D6B3A  GPR15.... A09EFFD8
⋮
    funca (DSA address 20FCB2B0):
      UPSTACK DSA
      Saved Registers:
        GPR0..... 20FCB350  GPR1..... 20FCB2A0  GPR2..... 20FCB2A0  GPR3..... 209009B2
        GPR4..... A09A0BBC  GPR5..... 20912648  GPR6..... 20900AA4  GPR7..... 20900098
        GPR8..... 00000030  GPR9..... 80000000  GPR10.... A0E699E2  GPR11.... A09A0AD8
        GPR12.... 209139B0  GPR13.... 20FCB2B0  GPR14.... A09009D4  GPR15.... 00000000
⋮
```

Figure 76. Sections of the dump from example C routine (calling a nonexistent subroutine)

2. Find the branch instructions at offset X'+0000005A' of `funca` in the listing in Figure 77 on page 209. The instruction is BASR `r14,r15`. This branch is part of the source statement `*aa = func_ptr()`.

```
OFFSET OBJECT CODE        LINE#  FILE#    P S E U D O   A S S E M B L Y   L I S T I N G


                          000016 |       *  void funca(int* aa)
{
000000                    000016 |        funca    DS
0D
.

.

.
000046  50D0  E004        000016 |                 ST
r13,4(,r14)
00004A  18DE              000016 |                 LR
r13,r14
00004C                    End of
Prolog


00004C  58E0  C1F4        000000 |                 L
r14,_CEECAA_(,r12,500)
                          000017 |       *    *aa =
func_ptr();
000050  58F0  303A        000017 |                 L        r15,=Q(func_ptr)
(,r3,58)
000054  1821              000016 |                 LR
r2,r1
000056  58FF  E000        000017 |                 L
r15,func_ptr(r15,r14,0)
00005A  0DEF              000017 |                 BASR
r14,r15
00005C  5810  2000        000017 |                 L
r1,aa(,r2,0)
000060  50F0  1000        000017 |                 ST       r15,
(*)int(,r1,0)
                          000018 |       *
return;
                          000019 |
*  }
000064                    000019 |        @2L3     DS
0H


000064                    Start of
Epilog
000064  58D0  D004        000019 |                 L
r13,4(,r13)
000068  58E0  D00C        000019 |                 L
r14,12(,r13)
00006C  9824  D01C        000019 |                 LM
r2,r4,28(r13)
000070  051E              000019 |                 BALR
r1,r14
000072  0707              000019 |                 NOPR     7
```

Figure 77. Pseudo assembly listing (calling a nonexistent subroutine)

3. Find the offset of `func_ptr` in the Writable Static Map, shown in Figure 78 on page 210, as produced by the binder.

```
⋮

---------------
CLASS  C_WSA             LENGTH =       A4  ATTRIBUTES = MRG, DEFER ,
RMODE=ANY
                         OFFSET =        0 IN SEGMENT 002       ALIGN =
DBLWORD
---------------



CLASS
           OFFSET  NAME                TYPE    LENGTH
SECTION
                0  func_ptr         PART            4
func_ptr
                8  environ          PART            4
environ
               10  errno            PART            4
errno
               18  tzname           PART            8
tzname
⋮
```

Figure 78. Writable static map (calling a nonexistent subroutine)

4. Add the offset of FUNC@PTR (X'0') to the address of WSA (X'20914F58'). The result (X'20914F58') is the address of the function pointer `func_ptr` in the writable static storage area within the heap. This value is 0, indicating the variable is uninitialized. Figure 79 on page 210 shows the sections of the dump.

```
⋮
  Enclave Control Blocks:
⋮
    WSA address.................20914F58

  Enclave Storage:
⋮
    WSA for Program Object(s)
    WSA: 20914F58
      +000000 20914F58  00000000 00000000 2090A880 00000000  00000000 00000000 20910260 2091026A  |..........y.............j.-.j..|
      +000020 20914F78  00000000 00000000 00000000 00000000  00000000 00000000 00000001 00000000  |................................|
      +000040 20914F98  00000001 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000060 20914FB8  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000080 20914FD8  00000000 00000000 2090F6BC 00000000  2090F28C 00000000 2090F4A4 00000000  |..........6.......2.......4u....|
      +0000A0 20914FF8  00000000 00000000 A099FF10 A09C4A58  A09D0FD8 A09D7E98 A09D2B08 A09D9A78  |.........r.........Q..=q........|
⋮
```

Figure 79. Enclave control blocks and storage sections in dump (calling a nonexistent subroutine)

Calling a nonexistent XPLINK function

Figure 80 on page 211 demonstrates the error of calling a nonexistent function. This routine was compiled with the compiler options XPLINK, LIST and RENT and was run with the option TERMTHDACT(DUMP). This routine was not compiled with the TEST(ALL) compile option. As a result, arguments and variables do not appear in the dump.

```
#include <stdio.h>
#include <stdlib.h>
#include <errno.h>
#include <signal.h>
void funca(int* aa);
int (*func_ptr)(void)=0;
int main(void) {
  int aa;
  funca(&aa);
  printf("result of funca = %d\n",aa);
  return;
}
void funca(int* aa) {
  *aa = func_ptr();
  return;
}
```

Figure 80. C/C++example of calling a nonexistent XPLINK function

To debug this routine, use the following steps:

1. Locate the Original Condition message in the Condition Information for Active Routines section of the dump, shown in "Sections of the dump from example C routine (calling a nonexistent XPLINK function)" on page 212. In this example, the message is

   `CEE3201S The system detected an operation exception (System Completion Code=0C1).`

   It suggests that the error was caused by an attempt to branch to an unknown address. For additional information about CEE3201S, see Language Environment runtime messages in *z/OS Language Environment Runtime Messages*.

   The location section of the dump indicates that the exception occurred at offset X'-20900158' within function `funca` and that there may have been a bad branch from offset X'+0000001C'. The negative offset indicates that the offset cannot be used to locate the instruction that caused the error. Another indication of bad data is the value of X'80000004' in the instruction address of the PSW. This address indicates that an instruction in the routine branched outside the bounds of the routine.

2. Find the branch instruction at offset X'+0000001C' of `funca` in the listing in Figure 81 on page 211. This instruction is BASR `r7,r6`. This branch is part of the `source statement *aa = func_ptr()`.

```
                              00015 |       *  void funca(int* aa) {
 :
 000020                                      @2L0     DS    0D
 000020  00C300C5                                           =F'12779717'       XPLink entrypoint marker
 000024  00C500F1                                           =F'12910833'
 000028  FFFFFFE0                                           =F'-32'
 00002C  00000080                                           =F'128'
 000000                       00015 |        funca    DS    0D
 000000  9057  4784           00015 |                 STM   r5,r7,1924(r4)
 000004  A74A  FF80           00015 |                 AHI   r4,H'-128'
 000008                       End of Prolog

 000008  5010  48C0           00015 |                 ST    r1,aa(,r4,2240)
                              00016 |       *    *aa = func_ptr();
 00000C  5860  4804           00016 |                 L     r6,#Save_ADA_Ptr_2(,r4,2052)
 000010  5860  6018           00016 |                 L     r6,=A(func_ptr)(,r6,24)
 000014  5860  6000           00016 |                 L     r6,func_ptr(,r6,0)
 000018  9856  6010           00016 |                 LM    r5,r6,&ADA_&EPA(r6,16)
 00001C  0D76                 00016 |                 BASR  r7,r6
 00001E  4700  0004           00016 |                 NOP   4
 000022  1803                 00016 |                 LR    r0,r3
 000024  5860  48C0           00016 |                 L     r6,aa(,r4,2240)
 000028  5000  6000           00016 |                 ST    r0,(*)int(,r6,0)
                              00017 |       *    return;
                              00018 |       *  }
 00002C                       00018 |        @2L3     DS    0H

 00002C                       Start of Epilog
 00002C  5870  480C           00018 |                 L     r7,2060(,r4)
 000030  4140  4080           00018 |                 LA    r4,128(,r4)
 000034  07F7                 00018 |                 BR    r7
 :
```

Figure 81. Pseudo assembly listing (calling a nonexistent XPLINK function)

3. Find the offset of `func_ptr` in the Writable Static Map, shown in Figure 82 on page 212.

```
⋮
---------------
CLASS  C_WSA             LENGTH =       3C  ATTRIBUTES = MRG, DEFER , RMODE=ANY
                         OFFSET =        0 IN SEGMENT 002       ALIGN = DBLWORD
---------------

            CLASS
           OFFSET  NAME                TYPE    LENGTH   SECTION

                0  $PRIV000011      PART            10
               10  exist            PART            28  EXIST
               38  func_ptr         PART             4  func_ptr
⋮
```

Figure 82. Writable static map (calling a nonexistent XPLINK function)

4. Add the offset of `func_ptr` (X'38') to the address of WSA (X'20914FC0'). The result (X'20914FF8') is the address of the function pointer `func_ptr` in the writable static storage area within the heap. This value is 0, indicating the variable is uninitialized. Figure 83 on page 212 shows the sections of the dump.

```
  Enclave Control Blocks:
⋮
    DLL Information:
    WSA Addr  Module Addr  Thread ID         Use Count  Name
    20914FC0                                 00000001   main

    WSA address.................20914FC0

  Enclave Storage:
⋮
    WSA for Program Object(s)
    WSA: 20914FC0
      +000000 20914FC0  C36DE6E2 C1404040 40404040 40404040  9985A2A4 93A34096 864086A4 95838140  |C_WSA           result of funca |
      +000020 20914FE0  7E406C84 15000000 20914FF8 00000000  00000060 20F23280 00000000 00000000  |= %d.....j|8.......-.2..........|
⋮
```

Figure 83. Enclave control blocks and storage sections in dump (calling a nonexistent XPLINK function)

Sections of the dump from example C routine (calling a nonexistent XPLINK function)

```
CEE3DMP V1 R12.0: Condition processing resulted in the unhandled condition.        01/26/10 1:41:48 PM                 Page:    1
ASID: 0051   Job ID: JOB06606   Job name: XEXIST     Step name: STEP1      UserID: HEALY

CEE3845I CEEDUMP Processing started.

Information for enclave main

  Information for thread 8000000000000000

  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     CEEHDSP     +00004030              CEEPLPKA             CEEHDSP                        D1908    Call
    2     CEEHRNUH    +00000092              CEEPLPKA             CEEHRNUH                       D1908    Call
    3     funca       -20900158              XEXIST                                                       Exception
    4     main        +00000012              XEXIST                                                       Call
    5     CEEVROND    +000011FA              CEEPLPKA                                                     Call
    6     EDCZHINV    +000000B4              CELHV003             EDCZHINV                       D1908    Call
    7     CEEBBEXT    +000001B6              CEEPLPKA             CEEBBEXT                       D1908    Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     2110C500   209D2B08   209D2B08   +00004030  20061215   CEL
    2     2110C340   209E0B80   209E0B80   +00000092  20061215   CEL
    3     211B5620   20900158   20900158   -20900158  20000404   C/C++    XPLINK EBCDIC  HFP
    4     211B56A0   209000D0   209000D0   +00000012  20000404   C/C++    XPLINK EBCDIC  HFP
    5     211B5720   20ACA1E0   20ACA188   +00001252  20061215   CEL      XPLINK EBCDIC  HFP
    6     2110C0F0   20C36CE8   20C36CE8   +000000B4  20061214   LIBRARY
    7     2110C030   209A0AD8   209A0AD8   +000001B6  20061215   CEL

  Condition Information for Active Routines
    Condition Information for  (DSA address 211B5620)
      CIB Address: 2110CE20
      Current Condition:
        CEE0198S The termination of a thread was signaled due to an unhandled condition.
      Original Condition:
        CEE3201S The system detected an operation exception (System Completion Code=0C1).
      Location:
        Program Unit:  Entry: funca Statement:  Offset: -20900158
        Possible Bad Branch:  Statement:   Offset: +0000001C
      Machine State:
        ILC..... 0002    Interruption Code..... 0001
        PSW..... 078D2400 80000002
        GPR0..... 00000000_2110C500  GPR1..... 00000000_211B5F00  GPR2..... 00000000_2110C294  GPR3..... 00000000_2110C298
        GPR4..... 00000000_211B5620  GPR5..... 00000000_00FDD100  GPR6..... 00000000_00000000  GPR7..... 00000000_A0900176
        GPR8..... 00000000_A09000DA  GPR9..... 00000000_20ACB187  GPR10.... 00000000_2110C1A0  GPR11.... 00000000_A0ACA188
        GPR12.... 00000000_209139B0  GPR13.... 00000000_2110C1B8  GPR14.... 00000000_00000000  GPR15.... 00000000_00000000
```

```
    Storage dump near condition, beginning at location: 00000000
      +000000 00000000  Inaccessible storage.
    GPREG STORAGE:
     Storage around GPR0 (2110C500)
      -0020 2110C4E0  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +0000 2110C500  0808CEE1 2110C340 2110F620 A09D6B3A  A09EFFD8 2110C500 2110C958 20912648  |......C ..6...,....Q..E...I..j..|
      +0020 2110C520  00000080 209D7734 A0915000 2090C2A8  2110CE20 A09D665A 2110E4FE 2110D4FF  |.........j&...By.......!..U...M.|
⋮

  Parameters, Registers, and Variables for Active Routines:
    CEEHDSP (DSA address 2110C500):
      UPSTACK DSA
      Saved Registers:
        GPR0..... 2110C500  GPR1..... 2110C958  GPR2..... 20912648  GPR3..... 00000080
        GPR4..... 209D7734  GPR5..... A0915000  GPR6..... 2090C2A8  GPR7..... 2110CE20
        GPR8..... A09D665A  GPR9..... 2110E4FE  GPR10.... 2110D4FF  GPR11.... 209D2B08
        GPR12.... 209139B0  GPR13.... 2110C500  GPR14.... A09D6B3A  GPR15.... A09EFFD8
⋮
```

```
    CEEHRNUH (DSA address 2110C340):
      TRANSITION DSA
      Saved Registers:
        GPR0..... 2110C500  GPR1..... 00000000  GPR2..... 2090B3B0  GPR3..... 2090B458
        GPR4..... 209E0B80  GPR5..... 211B5620  GPR6..... 2110C340  GPR7..... 209E625C
        GPR8..... 940C1000  GPR9..... 00000000  GPR10.... 2090B430  GPR11.... 209E0B80
        GPR12.... 209139B0  GPR13.... 2110C340  GPR14.... A09E0C14  GPR15.... 209D2B08
⋮
    funca (DSA address 211B5620):
      DOWNSTACK DSA
      Saved Registers:
        GPR0..... 2110C500  GPR1..... 211B5F00  GPR2..... 2110C294  GPR3..... 2110C298
        GPR4..... 211B5620  GPR5..... 00FDD100  GPR6..... 00000000  GPR7..... A0900176
        GPR8..... A09000DA  GPR9..... 20ACB187  GPR10.... 2110C1A0  GPR11.... A0ACA188
        GPR12.... 209139B0  GPR13.... 2110C1B8  GPR14.... 00000000  GPR15.... 00000000
⋮
```

Handling dumps written to the z/OS UNIX file system

When a z/OS UNIX C/C++ application program is running in an address space created as a result of a call to `spawnp()`, `vfork()`, or one of the `exec` family of functions, the SYSMDUMP DD allocation information is not inherited. Even though the SYSMDUMP allocation is not inherited, a SYSMDUMP allocation must exist in the parent in order to obtain a storage dump.

Alternatively, you can specify the DYNDUMP runtime option to generate a system dump. For more information about DYNDUMP, see DYNDUMP in *z/OS Language Environment Programming Reference*.

If the program terminates abnormally while running in this new address space, the kernel causes an unformatted storage dump to be written to a file in the user's working directory. The file is placed in the current working directory or into `/tmp` if the current working directory is not defined. The file name has the following format; *directory* is the current working directory or `tmp`, and *pid* is the hexadecimal process ID (PID) for the process that terminated. For details on how to generate the system dump, see "Steps for generating a system dump in a z/OS UNIX shell" on page 83.

```
/directory/coredump.pid
```

To debug the dump, use the MVS Interactive Problem Control System (IPCS). If the dump was written to a file, you must allocate a data set that is large enough and has the correct attributes for receiving a copy of the file. For example, from the ISPF DATA SET UTILITY panel you can specify a volume serial and data set name to allocate. Doing so brings up the DATA SET INFORMATION panel for specifying characteristics of the data set to be allocated. The following filled-in panel shows the characteristics defined for the `URCOMP.JRUSL.COREDUMP` dump data set:

```
-------------------------  DATA SET INFORMATION  ---------------------
Command ===>

Data Set Name  . . . : URCOMP.JRUSL.COREDUMP

General Data                          Current Allocation
 Management class . . : STANDARD       Allocated cylinders : 30
 Storage class  . . . : OS390          Allocated extents . : 1
  Volume serial . . . : DPXDU1
  Device type . . . . : 3380
 Data class . . . . . :
  Organization  . . . : PS            Current Utilization
  Record format . . . : FB             Used cylinders. . . : 0
  Record length . . . : 4160           Used extents  . . . : 0
  Block size  . . . . : 4160
  1st extent cylinders: 30
  Secondary cylinders : 10
  Data set name type  :

  Creation date . . . : 2001/08/30
  Expiration date . . : ***None***

F1=Help     F2=Split     F3=End       F4=Return    F5=Rfind     F6=Rchange
F7=Up       F8=Down      F9=Swap     F10=Left     F11=Right    F12=Cancel
```

Figure 84. IPCS panel for entering data set information

Fill in the information for your data set as shown, and estimate the number of cylinders required for the dump file you are going to copy.

Use the TSO/E OGET or OCOPY command with the BINARY keyword to copy the file into the data set. For example, to copy the storage dump file `coredump.00060007` into the data set `URCOMP.JRUSL.COREDUMP` just allocated, a user with the user ID URCOMP enters the following command:

```
OGET '/u/urcomp/coredump.00060007' 'urcomp.jrusl.coredump' BINARY
```

After you have copied the storage dump file to the data set, you can use IPCS to analyze the dump. See "Formatting and analyzing system dumps" on page 84 for information about formatting Language Environment control blocks.

Multithreading consideration

Certain control blocks are locked while a dump is in progress. For example, a `csnap()` of the file control block would prevent another thread from using or dumping the same information. An attempt to do so causes the second thread to wait until the first one completes before it can continue.

Understanding C/C++ heap information in storage reports

Storage reports that contain specific C/C++ heap information can be generated in two ways; details on how to request and interpret the reports are provided in the following sections.

- By setting the Language Environment RPTSTG(ON) runtime option for Language Environment created heaps
- By issuing a stand-alone call to the C function `__uheapreport()` for user–created heaps.

Language Environment storage report with heap pools statistics

To request a Language Environment storage report set RPTSTG(ON). If the C/C++ application specified the HEAPPOOLS(ON) runtime option, then the storage report displays heap pools statistics. Figure 4 on page 14 is a sample storage report that shows heap pools statistics for a multithreaded C/C++ application. The following sections describe the C/C++ specific heap pools information.

HEAPPOOLS storage statistics

The HEAPPOOLS runtime option controls usage of the heap pools storage algorithm at the enclave level. The heap pools algorithm allows for the definition of one to twelve heap pools, each consisting of a number of storage cells of a specified length.

Note: The use of an alternative Vendor Heap Manager (VHM) overrides the use of the HEAPPOOLS runtime option.

HEAPPOOLS statistics

- Pool *p* size: *ssss* Get requests: *gggg*

  p
  : the number of the pool. When there are multiple pools for a cell size, the pools are numbered using the format *aa.bbb*.

    aa
    : the number for the cell size.

    bbb
    : the number for the pool within the cell size.

  ssss
  : the cell size specified for the pool.

  gggg
  : the number of storage requests that were satisfied from this pool.

- Successful Get Heap requests: *xxxx-yyyy n*

  xxxx
  : the low side of the 8 byte range

  yyyy
  : the high side of the 8 byte range

  n
  : the number of requests in the 8 byte range.

- Requests greater than the largest cell size — the number of storage requests that are not satisfied by heap pools.

Note: Values displayed in the HEAPPOOLS statistics report are not serialized when collected; therefore, the values are not necessarily exact.

HEAPPOOLS summary

The HEAPPOOLS summary displays a report of the HEAPPOOLS statistics and provides suggested percentages for current cell sizes as well as suggested cell sizes.

- Specified Cell Size — the size of the cell specified in the HEAPPOOLS runtime option
- Element Size — the size of the cell plus any additional storage needed for control information or to maintain alignment
- Extent Percent — the cell pool percent specified by the HEAPPOOLS runtime option
- Cells Per Extent — the number of cells per extent. This number is calculated using the following formula, with a minimum of four cells:

  ```
  Initial Heap Size * (Extent Percent/100))/(Element Size)
  ```

  Note: Having a small number of cells per extent is not recommended since the pool could allocate many extents, which would cause the HEAPPOOLS algorithm to perform inefficiently.

- Extents Allocated — the number of times that each pool allocated an extent.

  To optimize storage usage, the extents allocated should be either one or two. If the number of extents allocated is too high, then increase the percentage for the pool.

- Maximum Cells Used — the maximum number of cells used for each pool.
- Cells In Use — the number of cells that were never freed.

  A large number in this field could indicate a storage leak.

- Suggested Percentages for current Cell Sizes — percentages calculated to find the optimal size of the cell pool extent. The calculation is based on the following formula:

```
(Maximum Cells Used * (Element Size) * 100) / Initial Heap Size
With a minimum of 1% and a maximum of 90%
```

  Make sure that your cell pool extents are neither too large nor too small. If your percentages are too large then additional, unreferenced virtual storage will be allocated, thereby causing the program to exhaust the region size. If the percentages are too small then the HEAPPOOLS algorithm will run inefficiently.

- Suggested Cell Sizes — sizes that are calculated to optimally use storage (assuming that the application will __malloc/__free with the same frequency).

  The suggested cell sizes are given with no percentages because the usage of each new cell pool size is not known. If there are less than 12 cell sizes calculated and the last calculated cell size is smaller than the largest cell size currently in effect, the largest cell size currently in effect will be used for the last suggested cell size.

For more information about stack and heap storage, see Stack and heap storage in *z/OS Language Environment Programming Guide*.

C function __uheapreport() storage report

To generate a user-created heap storage report use the C function, *__uheapreport()*. Use the information in the report to assist with tuning your application's use of the user-created heap.

Figure 85 on page 216 shows a sample storage report generated by *__uheapreport()*. For more information about the *__uheapreport()* function, see __uheapreport() — Produce a storage report for a user-created heap in *z/OS XL C/C++ Runtime Library Reference*. For tuning tips, see Tuning heap storage in *z/OS Language Environment Programming Guide*.

```
Storage Report for Enclave  12/26/09 11:42:23 AM
Language Environment V01 R12.00

    HeapPools Statistics:
      Pool 1 size:    32
        Successful Get Heap requests:     1-   32          11250
      Pool 2 size:   128
        Successful Get Heap requests:    97-  128           3306
      Pool 3 size:   512
        Successful Get Heap requests:   481-  512            864
      Pool 4 size:  2048
        Successful Get Heap requests:  2017- 2048            216
      Pool 5 size:  8192
        Successful Get Heap requests:  8161- 8192             54
      Pool 6 size: 16384
        Successful Get Heap requests: 16353-16384             27
      Requests greater than the largest cell size:             0
    HeapPools Summary:
      Cell  Extent   Cells Per  Extents    Maximum     Cells In
      Size  Percent  Extent     Allocated  Cells Used  Use
      ----------------------------------------------------------
         32   15        3750          1       3750          0
        128   15        1102          1       1102          0
        512   15         288          1        288          0
       2048   15          72          1         72          0
       8192   15          18          1         18          0
      16384   15           9          1          9          0
      ----------------------------------------------------------
      Suggested Percentages for current Cell Sizes:
        32,15,128,15,512,15,2048,15,8192,15,16384,15
      Suggested Cell Sizes:
        32,,128,,512,,2048,,8192,,16384,
End of Storage Report
```

Figure 85. Storage report generated by __uheapreport()

User-created HeapPools statistics

- Pool *p* size: *ssss*

  p
  : the number of the pool

ssss
: the cell size specified for the pool.

- Successful Get Heap requests: *xxxx-yyyy n*

  xxxx
  : the low side of the range

  yyyy
  : the high side of the range

  n
  : the number of requests in the range.

- Requests greater than the largest cell size — the number of storage requests that are not satisfied by heap pools.

Note: Values displayed in the HeapPools statistics report are not serialized when collected; therefore, the values are not necessarily exact.

HeapPools summary

The HeapPools summary displays a report of the HeapPool statistics and provides suggested percentages for current cell sizes as well as suggested cell sizes.

- Cell Size — the size of the cell specified on the __ucreate() call
- Extent Percent — the cell pool percent specified on the __ucreate() call
- Cells Per Extent — the number of cells per extent. This number is calculated using the following formula:

  ```
  Initial Heap Size * (Extent Percent/100))/(8 + Cell Size)
  ```

  with a minimum of four cells.
- Extents Allocated — the number of times that each pool allocated an extent.
- Maximum Cells Used — the maximum number of cells used for each pool.
- Cells In Use — the number of cells that were never freed.

  Note: A large number in this field could indicate a storage leak.
- Suggested Percentages for current Cell Sizes — percentages calculated to find the optimal size of the cell pool extent. The calculation is based on the following formula:

  ```
  (Maximum Cells Used * (Cell Size + 8) * 100) / Initial Heap Size
  With a minimum of 1% and a maximum of 90%
  ```

  Make sure that your cell pool extents are neither too large nor too small. If your percentages are too large then additional, unreferenced virtual storage will be allocated, thereby causing the program to exhaust the region size. If the percentages are too small then the HeapPools algorithm will run inefficiently.
- Suggested Cell Sizes — sizes that are calculated to optimally use storage (assuming that the application will __umalloc/__ufree with the same frequency).

  Note: The suggested cell sizes are given with no percentages because the usage of each new cell pool size is not known. If there are less than 12 cell sizes calculated and the last calculated cell size is smaller than the largest cell size currently in effect, the largest cell size currently in effect will be used for the last suggested cell size.

For more information about stack and heap storage, see Stack and heap storage in *z/OS Language Environment Programming Guide*.

MEMCHECK VHM memory leak analysis tool

The MEMCHECK VHM memory leak analysis tool is an alternative vendor heap manager used to diagnose memory problems. MEMCHECK VHM performs the following functions and displays the results in two reports:

- Check for heap storage leaks, double free, and overlays.
- Trace user heap storage allocation and deallocation requests.

The trace is limited to 1024 entries and will wrap.

Restrictions:

- MEMCHECK VHM works with C/C++ and Enterprise PL/I applications, but is not enabled for COBOL or Fortran.
- MEMCHECK VHM and HEAPPOOLS are mutually exclusive. HEAPPOOLS will be ignored when MEMCHEKC VHM is active.
- MEMCHECK VHM should not be used in PIPI, PICI, CICS, and SPC environments.

Invoking MEMCHECK VHM

As with any alternate vendor heap manager, you must specify the dllname with the environment variable _CEE_HEAP_MANAGER to indicate that MEMCHECK VHM will be used to manage the user heap. Since CEE_HEAP_MANAGER must be set before any user code gains control, use the ENVAR runtime option to set the variable or set it inside the file specified by environment variables _CEE_ENVFILE or _CEE_ENVFILE_S. The format follows:

```
_CEE_HEAP_MANAGER=dllname
```

The following two DLLs are associated with MEMCHECK VHM and use the following events.

- CEL4MCHK: 31-bit base and XPLINK
- CELQMCHK: 64-bit

_VHM_INIT
: replaces C-RTL malloc(), calloc(), realloc(), and free() with the corresponding MEMCHECK VHM functions. This event is only at Language Environment Initialization and only called by Language Environment.

_VHM_TERM
: terminates Vendor Heap Manager to free the memcheck storage functions. This event is called only by Language Environment at Language Environment Termination.

_VHM_REPORT
: generates the Heap Leak Report and the optional Trace Report. This new event will be called by Language Environment at Language Environment Termination and will write the Heap Leak Report (and the optional Trace Report if the _CEE_MEMCHECK_TRACE environment variable is active) in the output file name specified in _CEE_MEMCHECK_OUTFILENAME. This event can also be called dynamically by the __vhm_event() API.

MEMCHECK VHM environment variables

The MEMCHECK VHM environment variables control the tool, the call levels of the Heap Leak Report and Trace Report, the Overlay Analysis, the pad length added in the user heap allocation for overlay analysis, and the output file name for the reports. They should be activated through the ENVAR runtime option, the file specified by the _CEE_ENVFILE (or _CEE_ENVFILE_S) environment variable, or using the export command from the z/OS UNIX shell before any user code gets control (prior to the HLL user exit, static constructors, or main getting control). Setting these environment variables after the user code has begun execution will not activate them and the default values will be used.

_CEE_MEMCHECK_DEPTH

Description: Controls the number of call-levels to be generated on the Heap Leak Report.

Valid settings: integer value : the minimum is 1 and the maximum is 100. If the value specified is not valid, the default will be used.

Default: 10.

_CEE_MEMCHECK_OVERLAY

Description: Activates the storage overlays analysis beyond the end of the malloc'd storage.

Valid settings: ON to activate the analysis, OFF to deactivate. If an invalid value is specified, the default value will be used.

Default: OFF

_CEE_MEMCHECK_OVERLAYLEN

Description: Sets the pad length added in the user heap allocation for overlay analysis. This environment variable will be used only if _CEE_MEMCHECK_OVERLAY is active.

Valid settings: integer value, multiple of 8: the minimum is 8 and the maximum is 80. Non-multiples of 8 will be rounded up to the next multiple.

Default: 8

_CEE_MEMCHECK_TRACE

Description: Enables tracing of all heap storage allocation and deallocation and a Trace Report will be generated at Language Environment Termination.

Valid settings: ON to activate the analysis, OFF to deactivate. If an invalid value is specified, the default value will be used.

Default: OFF

_CEE_MEMTRACE_DEPTH

Description: Controls the number of call-levels to be generated in the Trace Report, on each call to a library function that deals with heap. This environment variable will be used only if _CEE_MEMCHECK_TRACE is active.

Valid settings: integer value: the minimum is 1 and the maximum is 100. If the value specified is not valid, the default value will be used.

Default: 10

_CEE_MEMCHECK_OUTFILENAME

Description: Sets the name of the fully qualified path name of the file in which the Heap Leak Report and Trace Report should be directed. The report name could be any valid name used in C-RTL fopen() function, then it could also generates the reports in a Data Set.

Valid settings: string value. If an invalid value is specified, the default value will be used.

Default: standard error output

MEMCHECK VHM report sample scenario

In this example, the MEMCHECK VHM tool is used by specifying the environment variables from the z/OS UNIX shell. The user specifies a depth of 8 call levels in the Heap Leak Report and 8 call levels in the Trace Report for 31-bit.

1. Specifies the depth to trace on storage requests (written to the Heap Leak Report):

   ```
   Export _CEE_MEMCHECK_DEPTH=8
   ```

2. Activates the Trace Report option:

   ```
   Export _CEE_MEMCHECK_TRACE=ON
   ```

3. Specifies the depth to trace on storage requests (written to the Trace Report):

```
Export _CEE_MEMTRACE_DEPTH=8
```

4. Activates the Overlay analysis option:

```
Export _CEE_MEMCHECK_OVERLAY=ON
```

5. Activates the tool with the 31-bit DLL (automatically generating the Heap Leak Report):

```
Export _CEE_HEAP_MANAGER=CEL4MCHK
```

MEMCHECK VHM report examples

Both reports are written at Language Environment termination (_VHM_TERM event). They are written in the output file name specified in _CEE_MEMCHECK_OUTFILENAME and are consistent with the format of other Language Environment reports.

The following trace report will be generated at Language Environment termination (_VHM_TERM event) if the _CEE_MEMCHECK_TRACE environment variable is active. The report generates the traceback information of all heap storage allocations and deallocations.

```
MEMCHECK
Language Environment V1 R7
TRACE REPORT for enclave main, termination report

DEALLOCATE of storage at 0x25a2ea30
      - sequence 12
      Called from: 25a43c78  +00000120  MemFree
      Called from: 05cd9918  +0000005c  CEEPGTFN
      Called from: 257f6888  +000002b0  _cterm
      Called from: 05d46788  +0000040c  (unknown)
DEALLOCATE of storage at 0x25a2e0c8
      - sequence 11
      Called from: 25a43c78  +00000120  MemFree
      Called from: 05cd9918  +0000005c  CEEPGTFN
      Called from: 257f6888  +000001bc  _cterm
      Called from: 05d46788  +0000040c  (unknown)
DEALLOCATE of storage at 0x25a2ecf8
      - sequence 10
      Called from: 25a43c78  +00000120  MemFree
      Called from: 05cd9918  +0000005c  CEEPGTFN
      Called from: 25601ae8  +000000b2  function3
      Called from: 25601bb8  +0000008c  function2
      Called from: 25601c68  +000000ca  function1
      Called from: 25601a60  +00000062  main
ALLOCATE of storage at 0x25a2ecf8 for 5 bytes
      - sequence 9
      Called from: 25a44330  +000000fc  MemAlloc
      Called from: 05cd9918  +0000005c  CEEPGTFN
      Called from: 25601ae8  +00000084  function3
      Called from: 25601bb8  +0000008c  function2
      Called from: 25601c68  +000000ca  function1
      Called from: 25601a60  +00000062  main
ALLOCATE of storage at 0x25a2ecd8 for 8 bytes
      - sequence 8
      Called from: 25a44330  +000000fc  MemAlloc
      Called from: 05cd9918  +0000005c  CEEPGTFN
      Called from: 25601bb8  +0000007e  function2
      Called from: 25601c68  +000000ca  function1
      Called from: 25601a60  +00000062  main
DEALLOCATE of storage at 0x25a2ecd8
      - sequence 7
      Called from: 25a43c78  +00000120  MemFree
      Called from: 05cd9918  +0000005c  CEEPGTFN
      Called from: 25601c68  +000000bc  function1
      Called from: 25601a60  +00000062  main
DEALLOCATE of storage at 0x25a2ecd8
      - sequence 6
      Called from: 25a43c78  +00000120  MemFree
      Called from: 05cd9918  +0000005c  CEEPGTFN
      Called from: 25601c68  +0000009e  function1
      Called from: 25601a60  +00000062  main
```

```
ALLOCATE of storage at 0x25a2ecd8 for 4 bytes
      - sequence 5
```

```
      Called from: 25a44330  +000000fc  MemAlloc
      Called from: 05cd9918  +0000005c  CEEPGTFN
      Called from: 25601c68  +0000007e  function1
      Called from: 25601a60  +00000062  main
ALLOCATE of storage at 0x25a2ec90 for 48 bytes
      - sequence 4
      Called from: 25a44330  +000000fc  MemAlloc
      Called from: 05cd9918  +0000005c  CEEPGTFN
      Called from: 25725c08  +000000a0  dllinit
      Called from: 05d49c88  +000007dc  (unknown)
ALLOCATE of storage at 0x25a2ea30 for 584 bytes
      - sequence 3
      Called from: 25a44330  +000000fc  MemAlloc
      Called from: 05cd9918  +0000005c  CEEPGTFN
      Called from: 258c6d70  +00000186  setlocale
      Called from: 25862540  +0000059e  tzset
      Called from: 257f8d30  +00002df2  _cinit
      Called from: 05d4abb0  +00000cb4  (unknown)
ALLOCATE of storage at 0x25a2e1f8 for 2074 bytes
      - sequence 2
      Called from: 25a44330  +000000fc  MemAlloc
      Called from: 05cd9918  +0000005c  CEEPGTFN
      Called from: 258c6958  +00000070  realloc_name_buffer
      Called from: 258c6d70  +00000132  setlocale
      Called from: 25862540  +0000059e  tzset
      Called from: 257f8d30  +00002df2  _cinit
      Called from: 05d4abb0  +00000cb4  (unknown)
ALLOCATE of storage at 0x25a2e0c8 for 280 bytes
      - sequence 1
      Called from: 25a44330  +000000fc  MemAlloc
      Called from: 05cd9918  +0000005c  CEEPGTFN
      Called from: 258c6d70  +000000f6  setlocale
      Called from: 25862540  +0000059e  tzset
      Called from: 257f8d30  +00002df2  _cinit
      Called from: 05d4abb0  +00000cb4  (unknown)
```

The Heap Leak Report (Figure 86 on page 222) will be generated with any remaining entries in the memory leak control block. The allocated entries will be reported as storage leaks, while the deallocated entries will be reported as duplicated deallocations and the overlay entries as overlay damage.

```
MEMCHECK
Language Environment V1 R7
HEAP LEAK REPORT for enclave main, termination report

     Total number of ALLOCATE calls = 7
     Total number of DEALLOCATE calls = 5


     Current number of bytes allocated = 288928
     Maximum number of bytes allocated = 289824


     Total number of unmatched ALLOCATE calls = 3
  Unmatched ALLOCATE of 8 bytes at address 0x25a2ecd8
      - sequence 8
      Called from: 25a44330  +000000d2  MemAlloc
      Called from: 05cd9918  +0000005c  CEEPGTFN
      Called from: 25601bb8  +0000007e  function2
      Called from: 25601c68  +000000ca  function1
      Called from: 25601a60  +00000062  main
  Unmatched ALLOCATE of 48 bytes at address 0x25a2ec90
      - sequence 4
      Called from: 25a44330  +000000d2  MemAlloc
      Called from: 05cd9918  +0000005c  CEEPGTFN
      Called from: 25725c08  +000000a0  dllinit
      Called from: 05d49c88  +000007dc  (unknown)
  Unmatched ALLOCATE of 2074 bytes at address 0x25a2e1f8
      - sequence 2
      Called from: 25a44330  +000000d2  MemAlloc
      Called from: 05cd9918  +0000005c  CEEPGTFN
      Called from: 258c6958  +00000070  realloc_name_buffer
      Called from: 258c6d70  +00000132  setlocale
      Called from: 25862540  +0000059e  tzset
      Called from: 257f8d30  +00002df2  _cinit
      Called from: 05d4abb0  +00000cb4  (unknown)

     Total number of unmatched DEALLOCATE calls = 1
  Unmatched DEALLOCATE at address 0x25a2ecd8
      - sequence 7
      Called from: 25a43c78  +000000f2  MemFree
      Called from: 05cd9918  +0000005c  CEEPGTFN
      Called from: 25601c68  +000000bc  function1
      Called from: 25601a60  +00000062  main

     Total number of OVERLAY calls = 1
  OVERLAY damage using more than 5 bytes requested at address 0x25a2ecf8
      Called from: 25a44330  +000000d2  MemAlloc
      Called from: 05cd9918  +0000005c  CEEPGTFN
      Called from: 25601ae8  +00000084  function3
      Called from: 25601bb8  +0000008c  function2
      Called from: 25601c68  +000000ca  function1
      Called from: 25601a60  +00000062  main
```

Figure 86. Heap Leak Report generated by MEMCHECK VHM

The following names are used within MEMCHECK to denote special cases and may be displayed in any of the reports:

(unknown)
: Name of the routine is not known.

(noname)
: Routine does not have a name in the PPA section. (For example, module compiled with `compress` option).

(nospace)
: Internal memory space reserved by MEMCHECK is full, so name was not saved for the traceback information. No action is needed from the user.

Chapter 5. Debugging COBOL programs

This section provides information for debugging applications that contain one or more COBOL programs. It includes information about:

- Determining the source of error
- Generating COBOL listings and the Language Environment dump
- Finding COBOL information in a dump
- Debugging example COBOL programs

Determining the source of error

The following sections describe how you can determine the source of error in your COBOL program. They explain how to simplify the process of debugging COBOL programs by using features such as the DISPLAY statement, declaratives, and file status keys. The following methods for determining errors are covered:

- Tracing program logic
- Finding and handling input/output errors
- Validating data
- Assessing switch problems
- Generating information about procedures

After you have located and fixed any problems in your program, you should delete all debugging aids and recompile it before running it in production. Doing so helps the program run more efficiently and use less storage.

For detailed information about any of the topics and techniques discussed in the following sections, refer to the appropriate COBOL documentation in the Enterprise COBOL for z/OS library (www.ibm.com/support/docview.wss?uid=swg27036733).

Tracing program logic

You can add DISPLAY statements to help you trace through the logic of the program in a non-CICS environment. If, for example, you determine that the problem appears in an EVALUATE statement or in a set of nested IF statements, DISPLAY statements in each path tell you how the logic flows. You can also use DISPLAY statements to show you the value of interim results. Scope terminators can also help you trace the logic of your program because they clearly indicate the end of a statement.

For example, to check logic flow, you might insert the following statement to determine if you started and finished a particular procedure:

```
DISPLAY "ENTER CHECK PROCEDURE".
       .
       .  (checking procedure routine)
       .
DISPLAY "FINISHED CHECK PROCEDURE".
```

After you are sure that the program works correctly, comment out the DISPLAY statement lines by putting asterisks in position 7 of the appropriate lines.

Finding input/output errors

VSAM file status keys can help you determine whether routine errors are due to the logic of your routine or are I/O errors occurring on the storage media. To use file status keys as a debugging aid, include a test after each I/O statement to check for a value other than 0 in the file status key. If the value is other than 0, you can expect to receive an error message. You can use a nonzero value to indicate how the I/O procedures in the routine were coded. You can also include procedures to correct the error based on the file status key value.

Handling input/output errors

If you have determined that the problem lies in one of the I/O procedures in your program, you can include the USE EXCEPTION/ERROR declarative to help debug the problem. If the file does not open, the appropriate USE EXCEPTION/ERROR declarative is activated. You can specify the appropriate declarative for the file or for the different open attributes: INPUT, OUTPUT, I/O, or EXTEND. Code each USE AFTER STANDARD ERROR statement in a separate section immediately after the Declarative Section keyword of the Procedure Division.

Validating data (class test)

If you suspect that your program is trying to perform arithmetic on nonnumeric data or is somehow receiving the wrong type of data on an input record, you can use the class test to validate the type of data.

Assessing switch problems

Using INITIALIZE or SET statements to initialize a table or data item is useful when you suspect that a problem is caused by residual data left in those fields. If your problem occurs intermittently and not always with the same data, the problem could be that a switch is not initialized, but is generally set to the right value (0 or 1). By including a SET statement to ensure that the switch is initialized, you can determine if the uninitialized switch is the cause of the problem.

Generating information about procedures

You can use the USE FOR DEBUGGING declarative to include COBOL statements in a COBOL program and specify when they should run. Use these statements to generate information about your program and how it is running. Code each USE FOR DEBUGGING declarative in a separate section in the DECLARATIVES SECTION of the PROCEDURE DIVISION.

For example, to check how many times a procedure is run, include a special procedure for debugging (in the USE FOR DEBUGGING declarative) that adds 1 to a counter each time control passes to that procedure. The adding-to-a-counter technique can be used as a check for:

- How many times a PERFORM ran. This shows you whether the control flow you are using is correct.
- How many times a loop routine actually runs. This tells you whether the loop is running and whether the number you have used for the loop is accurate.

You can use debugging lines, debugging statements, or both in your program. Debugging lines are placed in your program, and are identified by a `D` in position 7. Debugging statements are coded in the DECLARATIVES SECTION of the PROCEDURE DIVISION.

- The USE FOR DEBUGGING declaratives must:
  - Be only in the DECLARATIVES SECTION
  - Follow a DECLARATIVES header USE FOR DEBUGGING

  With USE FOR DEBUGGING, the TEST compiler option must have the NONE hook-location suboption specified or the NOTEST compiler option must be specified. The TEST compiler option and the DEBUG runtime option are mutually exclusive, with DEBUG taking precedence.
- Debugging lines must have a `D` in position 7 to identify them.

To use debugging lines and statements in your declarative procedures, you must include both:

- WITH DEBUGGING MODE in the SOURCE-COMPUTER paragraph in the ENVIRONMENT DIVISION
- The DEBUG runtime option

Figure 87 on page 225 shows how to use the DISPLAY statement and the USE FOR DEBUGGING declarative to debug a program.

```
Environment Division
Source Computer . . . With Debugging Mode.
   ⋮
Data Division.
   ⋮
  File Section.

  Working-Storage Section.

 *(among other entries you would need:)

  01  Trace-Msg    PIC X(30)
                   Value "  Trace for Procedure-Name : ".
  01  Total        PIC 99  Value Zeros.

 *(balance of Working-Storage Section)

Procedure Division.
Declaratives.
Debug-Declar Section.
    Use For Debugging On 501-Some-Routine.
Debug-Declar-Paragraph.
    Display Trace-Msg, Debug-Name, Total.
Debug-Declar-End.
    Exit.

End Declaratives.

Begin-Program Section.
⋮
    Perform 501-Some-Routine.

   *(within the module where you want to test, place:)

    Add 1 To Total

  * (whether you put a period at the end depends on
  * where you put this statement.)
```

Figure 87. Example of using the WITH DEBUGGING MODE clause

In the example in Figure 87 on page 225, portions of a program are shown to illustrate the kind of statements needed to use the USE FOR DEBUGGING declarative. The DISPLAY statement specified in the DECLARATIVES SECTION issues the following message every time the PERFORM 501-SOME-ROUTINE runs. The total shown, *nn*, is the value accumulated in the data item named TOTAL:

```
Trace For Procedure-Name : 501-Some-Routine nn
```

Another use for the DISPLAY statement technique shown above is to show the flow through your program. You do this by changing the USE FOR DEBUGGING declarative in the DECLARATIVES SECTION to the following value and dropping the word TOTAL from the DISPLAY statement.

```
USE FOR DEBUGGING ON ALL PROCEDURES.
```

Using COBOL listings

When you are debugging, you can use one or more of the listings shown in Table 40 on page 226. The following sections give an overview of each of these listings and the compiler option you use to obtain each listing.

Table 40. Compiler-generated COBOL listings and their contents

Name	Contents	Compiler Option
Sorted Cross-Reference Listings	Provides sorted cross-reference listings of DATA DIVISION, PROCEDURE DIVISION, and program names. The listings provide the location of all references to this information.	XREF
Data Map listing	Provides information about the locations of all DATA DIVISION items and all implicitly declared variables. This option also supplies a nested program map, which indicates where the programs are defined and provides program attribute information.	MAP
Verb Cross-Reference listing	Produces an alphabetic listing of all the verbs in your program and indicates where each is referenced.	VBREF
Procedure Division listings	Tells the COBOL compiler to generate a listing of the PROCEDURE DIVISION along with the assembler coding produced by the compiler. The list output includes the assembler source code, a map of the task global table (TGT), information about the location and size of WORKING-STORAGE and control blocks, and information about the location of literals and code for dynamic storage usage.	LIST
Procedure Division listings	Instead of the full PROCEDURE DIVISION listing with assembler expansion information, you can use the OFFSET compiler option to get a condensed listing that provides information about the program verb usage, global tables, WORKING-STORAGE, and literals. The OFFSET option takes precedence over the LIST option. That is, OFFSET and LIST are mutually exclusive; if you specify both, only OFFSET takes effect.	OFFSET

Generating a Language Environment dump of a COBOL program

The sample programs shown in Figure 88 on page 226 and Figure 89 on page 227 generate Language Environment dumps with COBOL-specific information.

COBOL program that calls another COBOL program

In Figure 88 on page 226, program COBDUMP1 calls COBDUMP2, which in turn calls the Language Environment dump service CEE3DMP.

```
CBL  TEST(STMT,SYM),RENT
     IDENTIFICATION DIVISION.
       PROGRAM-ID.   COBDUMP1.
       AUTHOR. USER NAME

     ENVIRONMENT DIVISION.

     DATA DIVISION.

     WORKING-STORAGE SECTION.
     01 SOME-WORKINGSTG.
        05 SUB-LEVEL PIC X(80).

     01   SALARY-RECORDA.
      02    NAMEA   PIC X(10).
      02    DEPTA   PIC 9(4).
      02    SALARYA PIC 9(6).

     PROCEDURE DIVISION.
     START-SEC.
         DISPLAY "STARTING TEST COBDUMP1".
         MOVE "THIS IS IN WORKING STORAGE" TO SUB-LEVEL.
         CALL "COBDUMP2" USING SALARY-RECORDA.
         DISPLAY "END OF TEST COBDUMP1"
         STOP RUN.
     END PROGRAM COBDUMP1.
```

Figure 88. COBOL program COBDUMP1 calling COBDUMP2

COBOL program that calls the Language Environment CEE3DMP callable service

In the example in Figure 89 on page 227, program COBDUMP2 calls the Language Environment dump service CEE3DMP.

```
CBL  TEST(STMT,SYM),RENT
     IDENTIFICATION DIVISION.
       PROGRAM-ID.   COBDUMP2.
       AUTHOR. USER NAME

     ENVIRONMENT DIVISION.
     INPUT-OUTPUT SECTION.
     FILE-CONTROL.
         SELECT OPTIONAL IOFSS1 ASSIGN AS-ESDS1DD
             ORGANIZATION SEQUENTIAL ACCESS SEQUENTIAL.

     DATA DIVISION.
     FILE SECTION.
     FD  IOFSS1 GLOBAL.
       1 IOFSS1R PIC X(40).

     WORKING-STORAGE SECTION.
       01  TEMP4.
           05  A-1 OCCURS 2 TIMES.
               10  A-2 OCCURS 2 TIMES.
                   15 A-3V PIC X(3).
                   15 A-6  PIC X(3).
     77   DMPTITLE   PIC X(80).
     77   OPTIONS    PIC X(255).
     77   FC         PIC X(12).

     LINKAGE SECTION.
     01   SALARY-RECORD.
      02    NAME   PIC X(10).
      02    DEPT   PIC 9(4).
      02    SALARY PIC 9(6).

     PROCEDURE DIVISION USING SALARY-RECORD.
     START-SEC.
         DISPLAY "STARTING TEST COBDUMP2"
         MOVE "COBOL DUMP" TO DMPTITLE.
         MOVE "XXX" TO A-6(1, 1).
         MOVE "YYY" TO A-6(1, 2).
         MOVE "ZZZ" TO A-6(2, 1).
         MOVE " BLOCKS STORAGE PAGE(55) FILES" TO OPTIONS.
         CALL "CEE3DMP" USING DMPTITLE, OPTIONS, FC.
         DISPLAY "END OF TEST COBDUMP2"
         GOBACK.
     END PROGRAM COBDUMP2.
```

Figure 89. COBOL program COBDUMP2 calling the Language Environment dump service CEE3DMP

Sample Language Environment dump with COBOL-specific information

The call in program COBDUMP2 to CEE3DMP generates a Language Environment dump, shown below. The dump includes a traceback section, which shows the names of both programs, a section on register usage at the time the dump was generated, and a variables section, which shows the storage and data items for each program. Note that the high half of register 14 at entry to CEE3DMP is not available and is shown in the dump as ********. Character fields in the dump are indicated by single quotes. For an explanation of these sections of the dump, see "Finding COBOL information in a dump" on page 228.

```
CEE3DMP V1 R12.0: COBOL DUMP                                                07/10/10 2:59:23 PM                  Page:    1
ASID: 0099   Job ID: J0005740   Job name: COBDUMP1   Step name: GO         UserID: BARBARA

CEE3845I CEEDUMP Processing started.
CEE3DMP called by program unit COBDUMP2 at statement 40 (offset +00000496).

Registers on Entry to CEE3DMP:

  PM....... 0000
  GPR0..... 00000000_11480BDC  GPR1..... 00000000_114842C0  GPR2..... 00000000_114A4340  GPR3..... 00000000_11202BBC
  GPR4..... 00000000_11202818  GPR5..... 00000000_11480100  GPR6..... 00000000_00000000  GPR7..... 00000000_00FDD100
  GPR8..... 00000000_114A41D8  GPR9..... 00000000_11480AA0  GPR10.... 00000000_11202908  GPR11.... 00000000_11202AD4
  GPR12.... 00000000_112129C0  GPR13.... 00000000_114841D0  GPR14.... ********_91202C78  GPR15.... 00000000_12EF898
  FPR0..... 00000000  00000000            FPR2..... 00000000  00000000
  FPR4..... 00000000  00000000            FPR6..... 00000000  00000000
  VR0...... 00000000 00000000 00000000 00000000        VR1...... 00000000 00000000 00000000 00000000
  VR2...... 00000000 00000000 00000000 00000000        VR3...... 00000000 00000000 00000000 00000000
  VR4...... 00000000 00000000 00000000 00000000        VR5...... 00000000 00000000 00000000 00000000
  VR6...... 00000000 00000000 00000000 00000000        VR7...... 00000000 00000000 00000000 00000000
  VR8...... 00000000 00000000 00000000 00000000        VR9...... 00000000 00000000 00000000 00000000
  VR10..... 00000000 00000000 00000000 00000000        VR11..... 00000000 00000000 00000000 00000000
  VR12..... 00000000 00000000 00000000 00000000        VR13..... 00000000 00000000 00000000 00000000
  VR14..... 00000000 00000000 00000000 00000000        VR15..... 00000000 00000000 00000000 00000000
  VR16..... 00000000 00000000 00000000 00000000        VR17..... 00000000 00000000 00000000 00000000
  VR18..... 00000000 00000000 00000000 00000000        VR19..... 00000000 00000000 00000000 00000000
  VR20..... 00000000 00000000 00000000 00000000        VR21..... 00000000 00000000 00000000 00000000
  VR22..... 00000000 00000000 00000000 00000000        VR23..... 00000000 00000000 00000000 00000000
  VR24..... 00000000 00000000 00000000 00000000        VR25..... 00000000 00000000 00000000 00000000
  VR26..... 00000000 00000000 00000000 00000000        VR27..... 00000000 00000000 00000000 00000000
  VR28..... 00000000 00000000 00000000 00000000        VR29..... 00000000 00000000 00000000 00000000
  VR30..... 00000000 00000000 00000000 00000000        VR31..... 00000000 00000000 00000000 00000000
    GPREG STORAGE:
      Storage around GPR0 (11480BDC)
        -0020 11480BBC  00000000 00000000 00000000 114A4158  114A41D8 00000000 114A4120 0001E038  |...................Q............|
        +0000 11480BDC  00000000 00000000 11202D2C 07FE07FE  00000000 00000000 00001FFF 07FE0000  |................................|
        +0020 11480BFC  00000000 00000000 00000000 11480C50  40000000 00000000 00000000 11480D68  |...............& ...............|
⋮
Information for enclave COBDUMP1

  Information for thread 8000000000000000

  Registers on Entry to CEE3DMP:
```

```
    PM....... 0000

    GPR0..... 00000000_11480BDC  GPR1..... 00000000_114842C0  GPR2..... 00000000_114A4340  GPR3..... 00000000_11202BBC
    GPR4..... 00000000_11202818  GPR5..... 00000000_11480100  GPR6..... 00000000_00000000  GPR7..... 00000000_00FDD100
    GPR8..... 00000000_114A41D8  GPR9..... 00000000_11480AA0  GPR10.... 00000000_11202908  GPR11.... 00000000_11202AD4
    GPR12.... 00000000_112129C0  GPR13.... 00000000_114841D0  GPR14.... ********_91202C78  GPR15.... 00000000_912EF898
    FPR0..... 00000000  00000000            FPR2..... 00000000  00000000
    FPR4..... 00000000  00000000            FPR6..... 00000000  00000000
    VR0...... 00000000 00000000 00000000 00000000        VR1...... 00000000 00000000 00000000 00000000
    VR2...... 00000000 00000000 00000000 00000000        VR3...... 00000000 00000000 00000000 00000000
    VR4...... 00000000 00000000 00000000 00000000        VR5...... 00000000 00000000 00000000 00000000
    VR6...... 00000000 00000000 00000000 00000000        VR7...... 00000000 00000000 00000000 00000000
    VR8...... 00000000 00000000 00000000 00000000        VR9...... 00000000 00000000 00000000 00000000
    VR10..... 00000000 00000000 00000000 00000000        VR11..... 00000000 00000000 00000000 00000000
    VR12..... 00000000 00000000 00000000 00000000        VR13..... 00000000 00000000 00000000 00000000
    VR14..... 00000000 00000000 00000000 00000000        VR15..... 00000000 00000000 00000000 00000000
    VR16..... 00000000 00000000 00000000 00000000        VR17..... 00000000 00000000 00000000 00000000
    VR18..... 00000000 00000000 00000000 00000000        VR19..... 00000000 00000000 00000000 00000000
    VR20..... 00000000 00000000 00000000 00000000        VR21..... 00000000 00000000 00000000 00000000
    VR22..... 00000000 00000000 00000000 00000000        VR23..... 00000000 00000000 00000000 00000000
    VR24..... 00000000 00000000 00000000 00000000        VR25..... 00000000 00000000 00000000 00000000
    VR26..... 00000000 00000000 00000000 00000000        VR27..... 00000000 00000000 00000000 00000000
    VR28..... 00000000 00000000 00000000 00000000        VR29..... 00000000 00000000 00000000 00000000
    VR30..... 00000000 00000000 00000000 00000000        VR31..... 00000000 00000000 00000000 00000000
    GPREG STORAGE:
      Storage around GPR0 (11480BDC)
        -0020 11480BBC  00000000 00000000 00000000 114A4158  114A41D8 00000000 114A4120 0001E038  |..................Q...........|
        +0000 11480BDC  00000000 00000000 11202D2C 07FE07FE  00000000 00000000 00001FFF 07FE0000  |................................|
        +0020 11480BFC  00000000 00000000 00000000 11480C50  40000000 00000000 00000000 11480D68  |...............& ..............|
⋮

  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     COBDUMP2    +00000496  40          GO                   COBDUMP2                                Call
    2     COBDUMP1    +000003A4  23          GO                   COBDUMP1                                Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     114841D0   112027E0   112027E0   +00000496  20070214   COBOL
    2     11484030   11200398   11200398   +000003A4  20070214   COBOL

  Parameters, Registers, and Variables for Active Routines:
    COBDUMP2 (DSA address 114841D0):
      UPSTACK DSA
      Saved Registers:
        GPR0..... 11480BDC  GPR1..... 114842C0  GPR2..... 114A4340  GPR3..... 11202BBC
        GPR4..... 11202818  GPR5..... 11480100  GPR6..... 00000000  GPR7..... 00FDD100
        GPR8..... 114A41D8  GPR9..... 11480AA0  GPR10.... 11202908  GPR11.... 11202AD4
        GPR12.... 112129C0  GPR13.... 114841D0  GPR14.... 91202C78  GPR15.... 912EF898
    GPREG STORAGE:
      Storage around GPR0 (11480BDC)
        -0020 11480BBC  00000000 00000000 00000000 114A4158  114A41D8 00000000 114A4120 0001E038  |..................Q...........|
        +0000 11480BDC  00000000 00000000 11202D2C 07FE07FE  00000000 00000000 00001FFF 07FE0000  |................................|
        +0020 11480BFC  00000000 00000000 00000000 11480C50  40000000 00000000 00000000 11480D68  |...............& ..............|
⋮

      Local Variables:
            13 IOFSS1                          FILE SPECIFIED AS: OPTIONAL, ORGANIZATION=VSAM SEQUENTIAL,
                                              ACCESS MODE=SEQUENTIAL, RECFM=FIXED.  CURRENT STATUS OF
                                              FILE IS: NOT OPEN, FILE STATUS CODE=00, VSAM FEEDBACK=000,
                                              VSAM RET CODE=000, VSAM FUNCTION CODE=000.
            14 01 IOFSS1R          X(40) DISP       '                                        '
            17 01 TEMP4            AN-GR
            18  02 A-1              AN-GR OCCURS 2
            19   03 A-2              AN-GR OCCURS 2
```

```
            20    04 A-3V             XXX
                     SUB(1,1)         DISP             '   '
                    SUB(1,2) to SUB(2,2) elements same as above.
            21    04 A-6              XXX
                     SUB(1,1)         DISP             'XXX'
                     SUB(1,2)                          'YYY'
                     SUB(2,1)                          'ZZZ'
                     SUB(2,2)                          '   '
            22 77 DMPTITLE         X(80) DISP       'COBOL DUMP
                                                                       '
            23 77 OPTIONS          X(255) DISP      ' BLOCKS STORAGE PAGE(55) FILES

                                                                  '
            24 77 FC               X(12) DISP       '            '
            27 01 SALARY-RECORD    AN-GR
            28  02 NAME             X(10) DISP       '          '
            29  02 DEPT             9999 DISP
            30  02 SALARY           9(6) DISP
    COBDUMP1 (DSA address 11484030):
      UPSTACK DSA
      Saved Registers:
        GPR0..... 1148057C  GPR1..... 11484120  GPR2..... 114A4120  GPR3..... 112006C4
        GPR4..... 112003D0  GPR5..... 11211778  GPR6..... 00000000  GPR7..... 00000000
        GPR8..... 114A40D0  GPR9..... 11480448  GPR10.... 112004C0  GPR11.... 112005E8
        GPR12.... 112129C0  GPR13.... 11484030  GPR14.... 9120073E  GPR15.... 112027E0
    GPREG STORAGE:
      Storage around GPR0 (1148057C)
        -0020 1148055C  114A40D0 00000000 00000000 00000000  00000000 114A4050 114A40D0 00000000  |.. .................. &.. .....|
        +0000 1148057C  11480A48 00000000 11200824 07FE07FE  00000000 00000000 00001FFF 07FE0000  |................................|
        +0020 1148059C  00000000 00000000 00000000 40000000  00000000 00000000 00000000 00000001  |............ ...................|
⋮
      Local Variables:
            10 01 SOME-WORKINGSTG  AN-GR
            11  02 SUB-LEVEL        X(80) DISP       'THIS IS IN WORKING STORAGE
                                                                       '
            13 01 SALARY-RECORDA   AN-GR
            14  02 NAMEA            X(10) DISP       '          '
            15  02 DEPTA            9999 DISP
            16  02 SALARYA          9(6) DISP
⋮
```

Finding COBOL information in a dump

Like the standard Language Environment dump format, dumps generated from COBOL programs contain:

- Control block information for active programs
- Storage for each active program

- Enclave-level data
- Process-level data

Control block information for active routines

The Control Blocks for Active Routines section of the dump, shown in Figure 90 on page 230, displays the following information for each active COBOL program:

- DSA
- Program name and date/time of compile
- COBOL compiler Version, Release, Modification, and User Level
- COBOL compile Options
- COBOL control blocks TGT and CLLE. The layout of the TGT can be found by looking at the compiler listing of the COBOL program. For Enterprise COBOL V5.1 and later releases, the TGT is replaced by COBDSACB. The CLLE is a COBOL control block that is allocated by the COBOL runtime for each program. The CLLE is dumped for IBM service personnel use.

```
⋮
  Control Blocks for Active Routines:
    DSA for COBDUMP2: 114841D0
      +000000  FLAGS.... 0010      member... 4001      BKC...... 11484030  FWC...... 11484370  R14......
91202C78
      +000010  R15...... 912EF898  R0....... 11480BDC  R1....... 114842C0  R2....... 114A4340  R3.......
11202BBC
      +000024  R4....... 11202818  R5....... 11480100  R6....... 00000000  R7....... 00FDD100  R8.......
114A41D8
      +000038  R9....... 11480AA0  R10...... 11202908  R11...... 11202AD4  R12...... 112129C0  reserved.
00000000
      +00004C  NAB...... 11484370  PNAB..... 00000000  reserved. 00000000
11480AA0
      +000064  reserved. 11200398  reserved. 114803F0  MODE..... 00016108  reserved.
00000000
      +000078  reserved. 11205F98  reserved.
00000000


    Program COBDUMP2 was compiled 02/14/07 2:59:20 PM
    COBOL Version = 03 Release = 04 Modification = 01     User Level = '    '

    COBOL compile
options


    Compile Options for COBDUMP2:
      ADV, ARITH(COMPAT), NOAWO, CODEPAGE(01140), DATA(31), NODATEPROC,
DBCS,
      NODLL, NODYNAM, NOEXPORTALL, NOFASTSRT, INTDATE(ANSI),
NUMPROC(NOPFD),
      NOOPTIMIZE, OUTDD(SYSOUT), PGMNAME(COMPAT), RENT, RMODE(ANY),
NOSSRANGE,
      TEST(STMT,SYM,NOSEPARATE), NOTHREAD, TRUNC(STD), YEARWINDOW(1900),
ZWB
    TGT for COBDUMP2: 11480AA0
      +000000 11480AA0  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
      +000020 11480AC0 - +00003F 11480ADF             same as
above
      +000040 11480AE0  00000000 00000000 F3E3C7E3 00000000  06000000 42430260 11480100 000167FC
|........3TGT..........-........|
      +000060 11480B00  11480C20 00000001 00000174 00000000  00000000 114A4148 00000000 00000000
|................................|
      +000080 11480B20  112129C0 00000180 00000000 00000000  00000000 00000001 E2E8E2D6 E4E34040
|........................SYSOUT  |
      +0000A0 11480B40  C9C7E9E2 D9E3C3C4 00000000 00000000  00000000 00000000 00000000 00000000  |
IGZSRTCD........................|
      +0000C0 11480B60  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
      +0000E0 11480B80  00000000 00000000 112028DC 00000000  11480C0C 11480A48 1120298B 11480BE0
|................................|
      +000100 11480BA0  112027E0 11202910 11480C08 11202904  11480C08 114A41D8 00000000 00000000
|.......................Q........|
      +000120 11480BC0  00000000 00000000 114A4158 114A41D8  00000000 114A4120 0001E038 00000000
|...............Q................|
      +000140 11480BE0  00000000 11202D2C 07FE07FE 00000000  00000000 00001FFF 07FE0000 00000000
|................................|
      +000160 11480C00  00000000 00000000 11480C50 40000000  00000000 00000000 11480D68 00000001
|...........& ...................|

    CLLE for COBDUMP2: 11480A48
      +000000 11480A48  C3D6C2C4 E4D4D7F2 00004100 00000000  84810000 112027E0 11480AA0 00000000  |
COBDUMP2........da..............|
      +000020 11480A68  00000000 114808E4 114809F0 114803F0  00000001 00000000 00000000 00000000
|.......U...0...0................|
⋮
```

Figure 90. Control block information for active COBOL routines

Storage for each active routine

The Storage for Active Routines section of the dump, shown in "Storage for active COBOL programs" on page 231, displays the following information for each COBOL program:

- Program name
- Contents of the base locators for files, WORKING-STORAGE, LINKAGE SECTION, LOCAL-STORAGE SECTION, variably-located areas, and EXTERNAL data.
- File record contents.
- WORKING-STORAGE, including the base locator for WORKING-STORAGE (BLW) and program class storage.

Storage for active COBOL programs

```
⋮
  Storage for Active Routines:
    COBDUMP2:
      Contents of base locators for files are:
           0-0001E038

      Contents of base locators for WORKING-STORAGE are:
           0-114A41D8

      Contents of base locators for the LINKAGE SECTION are:
           0-00000000        1-114A4120

      No indexes were used in this program.

      No variably-located areas were used in this program.

      No EXTERNAL data was used in this program.

      No OBJECT instance data were used in this program.

      No LOCAL-STORAGE was used in this program.

      No DSA indexes were used in this program.

      No FACTORY data was used in this program.

      No XML data was used in this program.

    File record contents for COBDUMP2
    ESDS1DD  (BLF-0): 0001E038
      +000000 0001E038  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000020 0001E058 - +00003F 0001E077             same as above

    WORKING-STORAGE for COBDUMP2
    BLW-0: 114A41D8
      +000000 114A41D8  000000E7 E7E70000 00E8E8E8 000000E9  E9E90000 00000000 C3D6C2D6 D340C4E4  |...XXX...YYY...ZZZ......COBOL DU|
      +000020 114A41F8  D4D74040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |MP                              |
      +000040 114A4218  40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
      +000060 114A4238  40404040 40404040 40C2D3D6 C3D2E240  E2E3D6D9 C1C7C540 D7C1C7C5 4DF5F55D  |         BLOCKS STORAGE PAGE(55)|
      +000080 114A4258  40C6C9D3 C5E24040 40404040 40404040  40404040 40404040 40404040 40404040  | FILES                          |
      +0000A0 114A4278  40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
      +0000C0 114A4298 - +00015F 114A4337             same as above
      +000160 114A4338  40404040 40404000 00000000 00000000  00000000 00000000 00000000 00000000  |       .........................|

    LINKAGE SECTION for COBDUMP2
    BLL-1: 114A4120
      +000000 114A4120  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000020 114A4140  114A4018 00000218 00000210 00000000  00000000 11480C40 00000000 00000000  |.. .................... ........|
      +000040 114A4160  00000000 00000000 00000000 00000000  C9C7E9E2 D9E3C3C4 00000000 00000000  |................IGZSRTCD........|
      +000060 114A4180  00000000 00000000 00000000 00000000  E2E8E2D6 E4E34040 00000000 00000000  |................SYSOUT  ........|
      +000080 114A41A0  0E000000 00000000 0F000000 00000000  00000000 00000000 40404040 40404040  |........................        |
      +0000A0 114A41C0  40404040 40404040 40404040 40404040  40404040 40400000 000000E7 E7E70000  |                      .....XXX..|
      +0000C0 114A41E0  00E8E8E8 000000E9 E9E90000 00000000  C3D6C2D6 D340C4E4 D4D74040 40404040  |.YYY...ZZZ......COBOL DUMP      |
      +0000E0 114A4200  40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
      +000100 114A4220 - +00011F 114A423F             same as above
      +000120 114A4240  40C2D3D6 C3D2E240 E2E3D6D9 C1C7C540  D7C1C7C5 4DF5F55D 40C6C9D3 C5E24040  | BLOCKS STORAGE PAGE(55) FILES  |
      +000140 114A4260  40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
      +000160 114A4280 - +0001FF 114A431F             same as above
      +000200 114A4320  40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404000  |                               .|
      +000220 114A4340  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000240 114A4360 - +000FFF 114A511F             same as above

    Program class storage: 114A4148
      +000000 114A4148  00000210 00000000 00000000 11480C40  00000000 00000000 00000000 00000000  |............... ................|
      +000020 114A4168  00000000 00000000 C9C7E9E2 D9E3C3C4  00000000 00000000 00000000 00000000  |........IGZSRTCD................|
      +000040 114A4188  00000000 00000000 E2E8E2D6 E4E34040  00000000 00000000 0E000000 00000000  |........SYSOUT  ................|
      +000060 114A41A8  0F000000 00000000 00000000 00000000  40404040 40404040 40404040 40404040  |................                |
      +000080 114A41C8  40404040 40404040 40404040 40400000  000000E7 E7E70000 00E8E8E8 000000E9  |              .....XXX...YYY...Z|
      +0000A0 114A41E8  E9E90000 00000000 C3D6C2D6 D340C4E4  D4D74040 40404040 40404040 40404040  |ZZ......COBOL DUMP              |
      +0000C0 114A4208  40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
      +0000E0 114A4228  40404040 40404040 40404040 40404040  40404040 40404040 40C2D3D6 C3D2E240  |                         BLOCKS |
      +000100 114A4248  E2E3D6D9 C1C7C540 D7C1C7C5 4DF5F55D  40C6C9D3 C5E24040 40404040 40404040  |STORAGE PAGE(55) FILES          |
      +000120 114A4268  40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
      +000140 114A4288 - +0001DF 114A4327             same as above
      +0001E0 114A4328  40404040 40404040 40404040 40404040  40404040 40404000 00000000 00000000  |                       .........|
```

```
      +000200 114A4348  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
    Program class storage: 11480C40
      +000000 11480C40  000001D2 00000000 114A4148 0001E028  C6C3C200 01020000 FFFFFFFF FFFFFFFF  |...K............FCB.............|
      +000020 11480C60  FFFFFFFF FFFFFFFF FFFFFFFF FFFFFFFF  FFFFFFFF 00000000 00000000 00000000  |................................|
      +000040 11480C80  00000000 00000000 00000000 800082C8  800082C8 800082C8 914754F8 800082C8  |............bH..bH..bHj..8..bH|
      +000060 11480CA0  800082C8 800082C8 914754F8 00000000  00000000 00000000 00000000 00000000  |..bH..bHj..8....................|
      +000080 11480CC0  00000000 00000000 00000000 00000000  00000000 00000000 C3D6C2C4 E4D4D7F2  |........................COBDUMP2|
      +0000A0 11480CE0  C5E2C4E2 F1C4C440 00000000 00000000  00000000 11202A34 00000000 00000000  |ESDS1DD ........................|
      +0000C0 11480D00  00000000 00000000 00000000 00000000  00000000 00000000 00008800 00000000  |..........................h.....|
      +0000E0 11480D20  00000000 00000000 00000028 00000000  00000000 00000000 00000000 00000000  |................................|
      +000100 11480D40  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000120 11480D60 - +0001BF 11480DFF             same as above
      +0001C0 11480E00  00000000 00000000 00000000 00000000  00000000 00000000 11480000 00000E20  |................................|
    Program class storage: 0001E028
      +000000 0001E028  0000003F 00000000 11480C40 00000000  00000000 00000000 00000000 00000000  |........... ....................|
      +000020 0001E048  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
⋮
```

Enclave-level data

The Enclave Control Blocks section of the dump, shown in Figure 91 on page 232, displays the following information:

- RUNCOM control block. The RUNCOM is a control block that is allocated by the COBOL runtime to anchor enclave level resources. The RUNCOM is dumped for IBM service personnel use.

  Note: In Enterprise COBOL V5.1 and later releases, the RUNCOM control block is replaced by the COBEDB control block.
- Storage for all run units
- COBOL control blocks FCB, FIB, and GMAREA. The FCB, FIB, and GMAREA are control blocks used for COBOL file processing. These control blocks are dumped for IBM service personnel use.

```
  Enclave Control Blocks:
⋮
    RUNCOM: 11480100
      +000000 11480100  C3F3D9E4 D5C3D6D4 000002D8 04C60000  11211658 00000002 00006F50 00000000  |C3RUNCOM...Q.F............?&....|
      +000020 11480120  00000000 11200398 114803F0 00000000  11211778 00000000 00000000 00000000  |.......q...0....................|
      +000040 11480140  00016A80 000161BC 00000000 000167FC  00000000 00000000 112129C0 00000000  |....../.........................|
      +000060 11480160  00000000 00000000 00000000 00000000  00000000 F0F0F0F0 F0F0F0F0 114809F0  |....................00000000...0|
⋮
  Enclave Storage:
    Initial (User) Heap                                      : 114A4018
      +000000 114A4018  C8C1D5C3 0001E000 11211B38 00000000  914A4018 114A4358 00008000 00007CC0  |HANC............j. ...........@.|
      +000020 114A4038  114A4018 00000108 00000100 00000000  00000000 00000000 00000000 00000000  |.. .............................|
      +000040 114A4058  00000000 00000000 00000000 00000000  C9C7E9E2 D9E3C3C4 00000000 00000000  |................IGZSRTCD........|
      +000060 114A4078  00000000 00000000 00000000 00000000  E2E8E2D6 E4E34040 00000000 00000000  |................SYSOUT  ........|
      +000080 114A4098  0E000000 00000000 0F000000 00000000  00000000 00000000 40404040 40404040  |........................        |
      +0000A0 114A40B8  40404040 40404040 40404040 40404040  40404040 40400000 E3C8C9E2 40C9E240  |                      ..THIS IS |
      +0000C0 114A40D8  C9D540E6 D6D9D2C9 D5C740E2 E3D6D9C1  C7C54040 40404040 40404040 40404040  |IN WORKING STORAGE              |
      +0000E0 114A40F8  40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
      +000100 114A4118  40404040 40404040 00000000 00000000  00000000 00000000 00000000 00000000  |        ........................|
      +000120 114A4138  00000000 00000000 114A4018 00000218  00000210 00000000 00000000 11480C40  |.......... .................... |
      +000140 114A4158  00000000 00000000 00000000 00000000  00000000 00000000 C9C7E9E2 D9E3C3C4  |........................IGZSRTCD|
      +000160 114A4178  00000000 00000000 00000000 00000000  00000000 00000000 E2E8E2D6 E4E34040  |........................SYSOUT  |
      +000180 114A4198  00000000 00000000 0E000000 00000000  0F000000 00000000 00000000 00000000  |................................|
      +0001A0 114A41B8  40404040 40404040 40404040 40404040  40404040 40404040 40404040 40400000  |                              ..|
      +0001C0 114A41D8  000000E7 E7E70000 00E8E8E8 000000E9  E9E90000 00000000 C3D6C2D6 D340C4E4  |...XXX...YYY...ZZZ......COBOL DU|
      +0001E0 114A41F8  D4D74040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |MP                              |
      +000200 114A4218  40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
      +000220 114A4238  40404040 40404040 40C2D3D6 C3D2E240  E2E3D6D9 C1C7C540 D7C1C7C5 4DF5F55D  |         BLOCKS STORAGE PAGE(55)|
      +000240 114A4258  40C6C9D3 C5E24040 40404040 40404040  40404040 40404040 40404040 40404040  | FILES                          |
      +000260 114A4278  40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
      +000280 114A4298 - +00031F 114A4337             same as above
      +000320 114A4338  40404040 40404000 00000000 00000000  00000000 00000000 00000000 00000000  |       .........................|
      +000340 114A4358  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000360 114A4378 - +007FFF 114AC017             same as above
⋮
    LE/370 Anywhere Heap                                     : 11480000
⋮
      +0003E0 114803E0  00000050 00000000 00000000 00000000  C3D6C2C4 E4D4D7F1 00004100 00000000  |...&............COBDUMP1........|
      +000400 11480400  94810000 91200398 11480448 00000000  00000000 114808E0 114809F0 00000000  |ma..j..q...................0....|
      +000420 11480420  00000001 00000000 00000000 00000000  11480000 000001A0 00000194 00000000  |...........................m....|
      +000440 11480440  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000460 11480460 - +00047F 1148047F             same as above
      +000480 11480480  00000000 00000000 00000000 00000000  F3E3C7E3 00000000 06000000 60430260  |................3TGT........-..-|
      +0004A0 114804A0  11480100 000167FC 114805C0 00000000  00000064 00000000 00000000 00000000  |................................|
⋮
      +000A40 11480A40  00000000 00000000 C3D6C2C4 E4D4D7F2  00004100 00000000 84810000 112027E0  |........COBDUMP2........da......|
      +000A60 11480A60  11480AA0 00000000 00000000 114808E4  114809F0 114803F0 00000001 00000000  |...............U...0...0........|
      +000A80 11480A80  00000000 00000000 11480000 000001B0  000001A8 00000000 00000000 00000000  |...................y............|
      +000AA0 11480AA0  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000AC0 11480AC0 - +000ADF 11480ADF             same as above
      +000AE0 11480AE0  00000000 00000000 F3E3C7E3 00000000  06000000 42430260 11480100 000167FC  |........3TGT...........-........|
      +000B00 11480B00  11480C20 00000001 00000174 00000000  00000000 00000000 00000000 00000000  |................................|
⋮
  File Control Blocks:
    FCB for file ESDS1DD  in program COBDUMP2: 11480C50
      +000000 11480C50  C6C3C200 01020000 FFFFFFFF FFFFFFFF  FFFFFFFF FFFFFFFF FFFFFFFF FFFFFFFF  |FCB.............................|
      +000020 11480C70  FFFFFFFF 00000000 00000000 00000000  00000000 00000000 00000000 800082C8  |..............................bH|
      +000040 11480C90  800082C8 800082C8 914754F8 800082C8  800082C8 800082C8 914754F8 00000000  |..bH..bHj..8..bH..bH..bHj..8....|
      +000060 11480CB0  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000080 11480CD0  00000000 00000000 C3D6C2C4 E4D4D7F2  C5E2C4E2 F1C4C440 00000000 00000000  |........COBDUMP2ESDS1DD ........|
      +0000A0 11480CF0  00000000 11202A34 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +0000C0 11480D10  00000000 00000000 00008800 00000000  00000000 00000000 00000028 00000000  |.........h......................|
      +0000E0 11480D30  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000100 11480D50 - +00011F 11480D6F             same as above
    FIB for file ESDS1DD  in program COBDUMP2: 11202A34
      +000000 11202A34  C6C9C200 0103C5E2 C4E2F1C4 C4400088  8080A000 00008000 00000000 00000028  |FIB...ESDS1DD .h................|
      +000020 11202A54  00010000 00000000 00000000 00000000  00000000 00000000 11202A2D 00000000  |................................|
      +000040 11202A74  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000060 11202A94 - +00007F 11202AB3             same as above
      +000080 11202AB4  0000C9D6 C6E2E2F1 40404040 40404040  40404040 40404040 40404040 40404040  |..IOFSS1                        |
    GMAREA for file ESDS1DD  in program COBDUMP2: 00000000
      +000000 00000000  Inaccessible storage.
```

Figure 91. Enclave-level data for COBOL programs

Process-level data

The Process Control Block section of the dump, shown in Figure 92 on page 233, displays COBOL process-level control blocks THDCOM, COBCOM, COBVEC, and ITBLK. For Enterprise COBOL V5.1 and later releases, the process-level control blocks are COBPCB (corresponds to THDCOM), COBRCB (corresponds to COBCOM) and LIBVEC (corresponds to COBVEC). The control blocks are dumped for IBM service personnel use. In a non-CICS environment, the ITBLK control block only appears when a VS COBOL II program is active. In a CICS environment, the ITBLK control block always appears.

```
Process Control
Blocks:
⋮

  THDCOM:
00016A80
    +000000 00016A80  C3F3E3C8 C4C3D6D4 000001E8 81000000  00000100 00000000 00016108 000161BC  |
C3THDCOM...Ya............/.../.|
    +000020 00016AA0  11480100 00000000 C3D6C2C4 E4D4D7F1  00000000 00000000 00000000 00000000
|........COBDUMP1................|
    +000040 00016AC0  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
    +000060 00016AE0 - +00007F 00016AFF             same as
above
⋮

  COBCOM:
00016108
    +000000 00016108  C3F3C3D6 C2C3D6D4 00000978 00000000  00000000 00000000 00000000 00000000  |
C3COBCOM........................|
    +000020 00016128  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
    +000040 00016148  00000000 00000000 00000000 00000000  00000000 1140AE68 906000D6 000161BC
|..................... ...-.O../.|
    +000060 00016168  000167FC 00000100 00820000 00000000  00008000 08000000 00016A80 00000000
|.........b......................|
⋮

  COBVEC:
000161BC
    +000000 000161BC  0001643C 00016442 00016448 0001644E  00016454 0001645A 00016460 00016466
|..............+.......!...-....|
    +000020 000161DC  0001646C 00016472 00016478 0001647E  00016484 0001648A 00016490 00016496
|...%..........=...d..........o|
    +000040 000161FC  0001649C 000164A2 000164A8 000164AE  000164B4 000164BA 000164C0 000164C6
|.......s...y..................F|
    +000060 0001621C  000164CC 000164D2 000164D8 000164DE  000164E4 000164EA 000164F0 000164F6
|.......K...Q.......U.......0...6|
⋮
```

Figure 92. Process-level control blocks for COBOL programs

Debugging example COBOL programs

The following examples help demonstrate techniques for debugging COBOL programs. Important areas of the dump output are highlighted. Data unnecessary to debugging has been replaced by vertical ellipses.

Subscript range error

Figure 93 on page 233 illustrates the error of using a subscript value outside the range of an array. This program was compiled with LIST, TEST, and SSRANGE. The SSRANGE compiler option causes the compiler to generate code that checks (during run time) for data that has been stored or referenced outside of its defined area because of incorrect indexing and subscripting. The SSRANGE option takes effect during run time. For COBOL V4R2 and prior releases, you can disable the check by specifying the CHECK(OFF) runtime option. For Enterprise COBOL V5.1 and later releases, the CHECK runtime option is ignored.

The program was run with TERMTHDACT(TRACE) to generate the traceback information shown in “Sections of Language Environment dump for COBOLX” on page 234.

```
CBL  LIST,SSRANGE,TEST
     ID DIVISION.
     PROGRAM-ID. COBOLX.
     ENVIRONMENT DIVISION.
     DATA DIVISION.
     WORKING-STORAGE SECTION.
     77  J     PIC 9(4) USAGE COMP.
     01  TABLE-X.
      02  SLOT PIC 9(4) USAGE COMP OCCURS 8 TIMES.
     PROCEDURE DIVISION.
         MOVE 9 TO J.
         MOVE 1 TO SLOT (J).
         GOBACK.
```

Figure 93. COBOL example of moving a value outside an array range

To understand the traceback information and debug this program, use the following steps:

1. Locate the current error message in the Condition Information for Active Routines section of the Language Environment traceback, shown in "Sections of Language Environment dump for COBOLX" on page 234. The message is as follows:

   ```
   IGZ0006S The reference to table SLOT by verb number 01 on line 000011 addressed an area
   outside the region of the table.
   ```

   It indicates that line 11 was the current COBOL statement when the error occurred. For more information about this message, see COBOL runtime messages in *z/OS Language Environment Runtime Messages*.
2. Statement 11 in the traceback section of the dump occurred in program COBOLX.
3. Find the statement on line 11 in the listing for program COBOLX, shown in Figure 94 on page 234. This statement moves the 1 value to the array SLOT (J).

```
PP 5655-G53 IBM Enterprise COBOL for z/OS  3.4.1              COBOLX    Date 02/14/2007  Time 14:58:58   Page
3
  LineID  PL SL  ----+-*A-1-B--+----2----+----3----+----4----+----5----+----6----+----7-|--+----8 Map and Cross
Reference
/*
COBOLX

  000001                ID
DIVISION.
  000002                PROGRAM-ID.
COBOLX.
  000003                ENVIRONMENT
DIVISION.
  000004                DATA
DIVISION.
  000005                WORKING-STORAGE
SECTION.
  000006                77  J     PIC 9(4) USAGE
COMP.
  000007                01  TABLE-
X.
  000008                 02  SLOT PIC 9(4) USAGE COMP OCCURS 8
TIMES.
  000009                PROCEDURE
DIVISION.
  000010                    MOVE 9 TO J.
6
  000011                    MOVE 1 TO SLOT (J).                                       8
6
  000012
GOBACK.
*/ COBOLX
```

Figure 94. COBOL listing for COBOLX

4. Find the values of the local variables in the Parameters, Registers, and Variables for Active Routines section of the traceback, shown in "Sections of Language Environment dump for COBOLX" on page 234. J, which is of type PIC 9(4) with usage COMP, has a 9 value. J is the index to the array SLOT.

   The array SLOT contains eight positions. When the program tries to move a value into the J or 9th element of the 8-element array named SLOT, the error of moving a value outside the area of the array occurs.

Sections of Language Environment dump for COBOLX

```
CEE3DMP V1 R9.0: Condition processing resulted in the unhandled condition.        02/14/07 2:59:00 PM                 Page:    1
ASID: 0099   Job ID: J0005735   Job name: COBOLX     Step name: GO         UserID: BARBARA

CEE3845I CEEDUMP Processing started.

Information for enclave COBOLX

  Information for thread 8000000000000000

  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     CEEHDSP     +000049D6              CEEPLPKA             CEEHDSP                        D1908    Call
    2     CEEHSGLT    +0000005C              CEEPLPKA             CEEHSGLT                       D1908    Exception
    3     IGZCMSG     +000003C2              IGZCPAC              IGZCMSG                                 Call
    4     COBOLX      +000002BC  11          GO                   COBOLX                                  Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset   Comp Date   Compile Attributes
    1     1147E880   112BD238   112BD238   +000049D6   20061215    CEL
    2     1147E6E8   112CF960   112CF960   +0000005C   20061215    CEL
    3     1147E1D0   11455AA0   11455AA0   +000003C2   20061213    LIBRARY
    4     1147E030   00008398   00008398   +000002BC   20070214    COBOL
```

```
Condition Information for Active Routines
  Condition Information for CEEHSGLT (DSA address 1147E6E8)
    CIB Address: 1147F1A0
    Current Condition:
      IGZ0006S The reference to table SLOT by verb number 01 on line 000011 addressed an area outside the region of the table.
    Location:
      Program Unit: CEEHSGLT Entry: CEEHSGLT Statement:  Offset: +0000005C

  Storage dump near condition, beginning at location: 112CF9AC
    +000000 112CF9AC  F010D20B D0801000 58A0C2B8 58F0A01C  05EFD20B D098B108 41A0D098 50A0D08C  |0.K.......B..0....K..q.....q&...|

Parameters, Registers, and Variables for Active Routines:
  CEEHDSP (DSA address 1147E880):
    UPSTACK DSA
    Saved Registers:
      GPR0..... 00008550  GPR1..... 1147ECD8  GPR2..... 1147F1A0  GPR3..... 1120BD60
      GPR4..... 112C1E64  GPR5..... 9120E770  GPR6..... 00000000  GPR7..... 112092A8
      GPR8..... 912C1988  GPR9..... 1148087E  GPR10.... 1147F87F  GPR11.... 912BD238
      GPR12.... 1120C9C0  GPR13.... 1147E880  GPR14.... 912C1C10  GPR15.... 912E9898
  GPREG STORAGE:
    Storage around GPR0 (00008550)
      -0020 00008530  08000004 00224000 00000006 C0000140  00040800 00040028 02400002 08000004  |...... ........ ......... ......|
      +0000 00008550  001F03C0 00060800 0004001C 40000000  0040C000 01400006 08000004 002202C0  |............ .... ... ..........|
      +0020 00008570  00060800 00040022 183F4100 11A05500  C00C05F0 47D0F00C 58F0C300 05EF181F  |..................0..0..0C.....|
⋮
  IGZCMSG  (DSA address 1147E1D0):
    UPSTACK DSA
    Saved Registers:
      GPR0..... 00008550  GPR1..... 1147E3A8  GPR2..... 1147E3A8  GPR3..... 00000000
      GPR4..... 9120E770  GPR5..... 9120E770  GPR6..... 1147E3EA  GPR7..... 00000005
      GPR8..... 00019A80  GPR9..... 0000A1A8  GPR10.... 1147A100  GPR11.... 91455AA0
      GPR12.... 1120C9C0  GPR13.... 1147E1D0  GPR14.... 91455E64  GPR15.... 912CF960
  GPREG STORAGE:
    Storage around GPR0 (00008550)
      -0020 00008530  08000004 00224000 00000006 C0000140  00040800 00040028 02400002 08000004  |...... ........ ......... ......|
      +0000 00008550  001F03C0 00060800 0004001C 40000000  0040C000 01400006 08000004 002202C0  |............ .... ... ..........|
      +0020 00008570  00060800 00040022 183F4100 11A05500  C00C05F0 47D0F00C 58F0C300 05EF181F  |..................0..0..0C.....|
⋮
  COBOLX (DSA address 1147E030):
    UPSTACK DSA
    Saved Registers:
      GPR0..... 1147E1D0  GPR1..... 00008536  GPR2..... 00000010  GPR3..... 000197FC
      GPR4..... 000083D0  GPR5..... 1120B778  GPR6..... 00000000  GPR7..... 00000000
      GPR8..... 0000A398  GPR9..... 0000A1A8  GPR10.... 000084A0  GPR11.... 000085E4
      GPR12.... 00008494  GPR13.... 1147E030  GPR14.... 80008656  GPR15.... 91455AA0
  GPREG STORAGE:
    Storage around GPR0 (1147E1D0)
      -0020 1147E1B0  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +0000 1147E1D0  00101001 1147E030 1147E6E8 91455E64  912CF960 00008550 1147E3A8 1147E3A8  |.........WYj.;.j.9-..e&..Ty..Ty|
      +0020 1147E1F0  00000000 9120E770 9120E770 1147E3EA  00000005 00019A80 0000A1A8 1147A100  |....j.X.j.X...T............y....|
⋮
```

```
    Local Variables:
             6 77 J                9999 COMP        00009
             7 01 TABLE-X          AN-GR
             8  02 SLOT             9999  OCCURS 8
                   SUB(1)           COMP             00000
                  SUB(2) to SUB(8) elements same as above.
⋮
```

Calling a nonexistent subroutine

Figure 95 on page 235 demonstrates the error of calling a nonexistent subroutine in a COBOL program. In this example, the program COBOLY was compiled with the compiler options LIST, MAP and XREF. The TEST option was also specified with the suboptions NONE and SYM. Figure 95 on page 235 shows the program.

```
CBL  LIST,MAP,XREF,TEST(NONE,SYM)
     ID DIVISION.
     PROGRAM-ID. COBOLY.
     ENVIRONMENT DIVISION.
     DATA DIVISION.
     WORKING-STORAGE SECTION.
     77  SUBNAME PIC X(8) USAGE DISPLAY VALUE 'UNKNOWN'.
     PROCEDURE DIVISION.
         CALL SUBNAME.
         GOBACK.
```

Figure 95. COBOL example of calling a nonexistent subroutine

To understand the traceback information and debug this program, use the following steps:

1. Locate the error message for the original condition under the Condition Information for Active Routines section of the dump, shown in Figure 96 on page 237. The message is

   `CEE3501S The module UNKNOWN was not found.`

For more information about this message, see Language Environment runtime messages in *z/OS Language Environment Runtime Messages*.

2. Note the sequence of calls in the Traceback section of the dump. COBOLY called IGZCFCC; IGZCFCC (a COBOL library subroutine used for dynamic calls) called IGZCLDL; then IGZCLDL (a COBOL library subroutine used to load library routines) called CEESGLT, a Language Environment condition handling routine.

   This sequence indicates that the exception occurred in IGZCLDL when COBOLY was attempting to make a dynamic call. The call statement in COBOLY is located at offset +0000036E.

   Note: If COBOLY is compiled with Enterprise COBOL V5.1 or later releases, the traceback section of Language Environment dump is shown in Figure 97 on page 238. The only difference is that IGZCFCC and IGZCLDL are combined and replaced by IGZXFCA1. (IGZXFCA1 attempts to load a non-existent routine.)

```
CEE3DMP V1 R9.0: Condition processing resulted in the unhandled condition.        02/14/07 2:59:09 PM
Page:    1
ASID: 0099   Job ID: J0005737   Job name: COBOLY     Step name: GO         UserID:
BARBARA


CEE3845I CEEDUMP Processing
started.


Information for enclave
COBOLY


  Information for thread
8000000000000000



Traceback:

    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service
Status
    1     CEEHDSP     +00004030              CEEPLPKA             CEEHDSP                        D1908
Call
    2     CEEHSGLT    +0000005C              CEEPLPKA             CEEHSGLT                       D1908
Exception
    3     IGZCLDL     +0000012A              IGZCPAC              IGZCLDL
Call
    4     IGZCFCC     +000003EE              IGZCPAC              IGZCFCC
Call
    5     COBOLY      +0000036E  8           GO                   COBOLY
Call


    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile
Attributes
    1     1147E6F0   112BD238   112BD238   +00004030  20061215
CEL
    2     1147E558   112CF960   112CF960   +0000005C  20061215
CEL
    3     1147E3B0   11453680   11453680   +0000012A  20061213
LIBRARY
    4     1147E1D0   1140A5F8   1140A5F8   +000003EE  20061213
LIBRARY
    5     1147E030   000083F0   000083F0   +0000036E  20070214
COBOL


  Condition Information for Active
Routines
    Condition Information for CEEHSGLT (DSA address
1147E558)
      CIB Address:
1147F010
      Current
Condition:
        CEE0198S The termination of a thread was signaled due to an unhandled
condition.
      Original
Condition:
        CEE3501S The module UNKNOWN  was not
found.

Location:
        Program Unit: CEEHSGLT Entry: CEEHSGLT Statement:  Offset:
+0000005C


    Storage dump near condition, beginning at location:
112CF9AC
      +000000 112CF9AC  F010D20B D0801000 58A0C2B8 58F0A01C  05EFD20B D098B108 41A0D098 50A0D08C  |
0.K.......B..0....K..q.....q&...|
⋮
```

Figure 96. Sections of Language Environment dump for COBOLY

```
 .
 .
 .
   Traceback:
     DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
     1     CEEHDSP     +00004220              CEEPLPKA             CEEHDSP                        HLE7780  Call
     2     CEEHSGLT    +00000060              CEEPLPKA             CEEHSGLT                       HLE7780  Exception
     3     IGZXFCA1    +00000930              IGZXLPKA             IGZXFCA1                                Call
     4     COBOLY      +000001CA  8           COBOLY               COBOLY                                  Call

     DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
     1     2605E628   25DE6E68   25DE6E68   +00004220  20110318   CEL
     2     2605E490   25DF9578   25DF9578   +00000060  20110318   CEL
     3     2605E240   25F648C0   25F648C0   +00000930  20130605   LIBRARY
     4     2605E030   25D00000   25D00000   +000001CA  20130607   COBOLV5+ EBCDIC  HFP

 .
 .
 .
```

Figure 97. Portion of traceback of Language Environment dump for COBOLY (when compiled with Enterprise COBOL V5.1 or later)

3. Use the offset of X'36E' from the COBOL listing, shown below, to locate the statement that caused the exception in the COBOLY program. At offset X'36E' is an instruction for statement 8. Statement 8 is a call with the identifier SUBNAME specified.

```
PP 5655-G53 IBM Enterprise COBOL for z/OS  3.4.1              COBOLY    Date 02/14/2007  Time 14:59:07   Page    11
   0002B0                START    EQU   *                       COBOLY
   0002B0  183F                   LR    3,15
   0002B2  4100 11A0              LA    0,416(0,1)
   0002B6  5500 C00C              CL    0,12(0,12)
   0002BA  05F0                   BALR  15,0
   0002BC  47D0 F00C              BC    13,12(0,15)
   0002C0  58F0 C300              L     15,768(0,12)
   0002C4  05EF                   BALR  14,15
   0002C6  181F                   LR    1,15
   0002C8  50D0 1004              ST    13,4(0,1)
   0002CC  5000 104C              ST    0,76(0,1)
   0002D0  D203 1000 3058         MVC   0(4,1),88(3)
   0002D6  D703 1084 1084         XC    132(4,1),132(1)
   0002DC  5090 105C              ST    9,92(0,1)
   0002E0  18D1                   LR    13,1
   0002E2  58C0 90E8              L     12,232(0,9)             TGTFIXD+232
   0002E6  1812                   LR    1,2
   0002E8  50D0 D058              ST    13,88(0,13)
   0002EC  58A0 C004              L     10,4(0,12)              CBL=1
   0002F0  5880 912C              L     8,300(0,9)              BLW=0
   0002F4  D203 D088 A010         MVC   136(4,13),16(10)        DSAFIXD+136                        PGMLIT AT +8
   0002FA  4120 D100              LA    2,256(0,13)             CALLname+0
   0002FE  5020 D08C              ST    2,140(0,13)             DSAFIXD+140
   000302  BF2F 916C              ICM   2,15,364(9)             IPCB=1+16
   000306  58B0 C008              L     11,8(0,12)              PBL=1
   00030A  4780 B000              BC    8,0(0,11)               GN=7(00031C)
   00030E  5830 905C              L     3,92(0,9)               TGTFIXD+92
   000312  58F0 30F4              L     15,244(0,3)             V(IGZCMSG )
   000316  4110 A188              LA    1,392(0,10)             PGMLIT AT +384
   00031A  05EF                   BALR  14,15
   00031C                GN=7     EQU   *
   00031C  5A20 C000              A     2,0(0,12)               SYSLIT AT +0
   000320  5020 916C              ST    2,364(0,9)              IPCB=1+16
   000324  9140 9057              TM    87(9),X'40'             TGTFIXD+87
   000328  4710 B024              BC    1,36(0,11)              GN=8(000340)
   00032C  9120 9054              TM    84(9),X'20'             TGTFIXD+84
   000330  47E0 B01C              BC    14,28(0,11)             GN=9(000338)
   000334  9620 D084              OI    132(13),X'20'           DSAFIXD+132
   000338                GN=9     EQU   *
   000338  9640 9057              OI    87(9),X'40'             TGTFIXD+87
   00033C  47F0 B024              BC    15,36(0,11)             GN=10(000340)
   000340                GN=8     EQU   *
   000340                GN=10    EQU   *
   000340  9640 915C              OI    348(9),X'40'            IPCB=1
   000344  9601 D084              OI    132(13),X'01'           DSAFIXD+132
000008  *
000008  CALL
   000348                GN=13    EQU   *
   000348  D207 D0F0 8000         MVC   240(8,13),0(8)          TS2=0                              SUBNAME
   00034E  DC07 D0F0 A01A         TR    240(8,13),26(10)        TS2=0                              PGMLIT AT +18
   000354  D203 D0F8 A162         MVC   248(4,13),354(10)       TS2=8                              PGMLIT AT +346
   00035A  4120 D0F0              LA    2,240(0,13)             TS2=0
   00035E  5020 D0FC              ST    2,252(0,13)             TS2=12
   000362  4110 D0F8              LA    1,248(0,13)             TS2=8
   000366  5820 905C              L     2,92(0,9)               TGTFIXD+92
   00036A  58F0 2100              L     15,256(0,2)             V(IGZCFCC )
   00036E  05EF                   BALR  14,15
   000370  5830 9128              L     3,296(0,9)              BL=1
PP 5655-G53 IBM Enterprise COBOL for z/OS  3.4.1              COBOLY    Date 02/14/2007  Time 14:59:07   Page    12
   000374  40F0 3008              STH   15,8(0,3)               RETURN-CODE
000009  GOBACK
   000378                GN=14    EQU   *
   000378  58B0 C008              L     11,8(0,12)              PBL=1
   00037C  47F0 B07C              BC    15,124(0,11)            GN=2(000398)
   000380  0700                   BCR   0,0
   000382  9120 D084              TM    132(13),X'20'           DSAFIXD+132
   000386  47E0 B07C              BC    14,124(0,11)            GN=2(000398)
   00038A  5820 905C              L     2,92(0,9)               TGTFIXD+92
   00038E  58F0 20F4              L     15,244(0,2)             V(IGZCMSG )
   000392  4110 A176              LA    1,374(0,10)             PGMLIT AT +366
   000396  05EF                   BALR  14,15
   000398                GN=2     EQU   *
   000398  5820 916C              L     2,364(0,9)              IPCB=1+16
   00039C  5B20 C000              S     2,0(0,12)               SYSLIT AT +0
   0003A0  5020 916C              ST    2,364(0,9)              IPCB=1+16
   0003A4  9140 9055              TM    85(9),X'40'             TGTFIXD+85
```

```
   0003A8  47E0 B09E              BC    14,158(0,11)            GN=11(0003BA)
   0003AC  4110 0008              LA    1,8(0,0)
```

```
   0003B0  5820 905C               L     2,92(0,9)              TGTFIXD+92
   0003B4  58F0 2020               L     15,32(0,2)             V(IGZCCTL )
   0003B8  05EF                    BALR  14,15
   0003BA                 GN=11    EQU   *
   0003BA  9128 9054               TM    84(9),X'28'            TGTFIXD+84
   0003BE  4770 B0BC               BC    7,188(0,11)            GN=12(0003D8)
   0003C2  5820 9128               L     2,296(0,9)             BL=1
   0003C6  48F0 2008               LH    15,8(0,2)              RETURN-CODE
   0003CA  58D0 D004               L     13,4(0,13)
   0003CE  58E0 D00C               L     14,12(0,13)
   0003D2  980C D014               LM    0,12,20(13)
   0003D6  07FE                    BCR   15,14
   0003D8                 GN=12    EQU   *
   0003D8  D20B D0F0 A156          MVC   240(12,13),342(10)     TS2=0                              PGMLIT AT +334
   0003DE  5830 9128               L     3,296(0,9)             BL=1
   0003E2  4820 3008               LH    2,8(0,3)               RETURN-CODE
   0003E6  5020 D0FC               ST    2,252(0,13)            TS2=12
   0003EA  4110 D0F0               LA    1,240(0,13)            TS2=0
   0003EE  5820 905C               L     2,92(0,9)              TGTFIXD+92
   0003F2  58F0 2224               L     15,548(0,2)            V(IGZETRM )
   0003F6  05EF                    BALR  14,15
 ⋮
```

4. Find the value of the local variables in the Parameters, Registers, and Variables for Active Routines section of the dump, shown in Figure 98 on page 239. Notice that the value of SUBNAME with usage DISP, has a value of 'UNKNOWN'.

   Correct the problem by either changing the subroutine name to one that is defined, or by ensuring that the subroutine is available at compile time.

```
⋮

  Parameters, Registers, and Variables for Active
Routines:
⋮

    COBOLY (DSA address
1147E030):
      UPSTACK
DSA
      Saved
Registers:
        GPR0..... 1147E1D0  GPR1..... 1147E128  GPR2..... 000197FC  GPR3.....
000083F0
        GPR4..... 00008428  GPR5..... 1120B778  GPR6..... 00000000  GPR7.....
00000000
        GPR8..... 0000A3A8  GPR9..... 0000A1B8  GPR10.... 000084F8  GPR11....
0000870C
        GPR12.... 000084EC  GPR13.... 1147E030  GPR14.... 80008760  GPR15....
9140A5F8
    GPREG
STORAGE:
      Storage around GPR0
(1147E1D0)
        -0020 1147E1B0  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
|................................|
        +0000 1147E1D0  00102001 1147E030 00000000 9140A9E8  91453680 1147E3B0 1147E368 000197FC  |...........j
zYj.....T...T...p.|
        +0020 1147E1F0  000083F0 1147E128 000197FC 00000000  1147E358 00019A80 0000A1B8 1147A100
|..c0......p.......T............|
⋮

      Local
Variables:
               6 77 SUBNAME          X(8) DISP        'UNKNOWN
'
⋮
```

Figure 98. Parameters, registers, and variables for active routines section of dump for COBOLY

Divide-by-zero error

The following example demonstrates the error of calling an assembler routine that tries to divide by zero. Both programs were compiled with TEST(STMT,SYM) and run with the TERMTHDACT(TRACE) runtime option. Figure 99 on page 240 shows the main COBOL program (COBOLZ1), the COBOL subroutine (COBOLZ2), and the assembler routine.

```
 [Main Program]

  CBL  TEST(STMT,SYM),DYN,XREF(FULL),MAP
       ID DIVISION.
       PROGRAM-ID. COBOLZ1.
       ENVIRONMENT DIVISION.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       77  D-VAL PIC 9(4) USAGE COMP VALUE 0.
       PROCEDURE DIVISION.
           CALL "COBOLZ2" USING D-VAL.
           GOBACK.


 [Subroutine]

  CBL  TEST(STMT,SYM),DYN,XREF(FULL),MAP
       ID DIVISION.
       PROGRAM-ID. COBOLZ2.
       ENVIRONMENT DIVISION.
       DATA DIVISION.
       WORKING-STORAGE SECTION.
       77  DV-VAL PIC 9(4) USAGE COMP.
       LINKAGE SECTION.
       77  D-VAL PIC 9(4) USAGE COMP.
       PROCEDURE DIVISION USING D-VAL.
           MOVE D-VAL TO DV-VAL.
           CALL "ASSEMZ3" USING DV-VAL.
           GOBACK.


[Assembler Routine]

           PRINT NOGEN
ASSEMZ3  CEEENTRY MAIN=NO,PPA=MAINPPA
         LA    5,2348             Low order part of quotient
         SR    4,4                Hi order part of quitient
         L     6,0(1)             Get pointer to divisor
         LA    6,0(6)             Clear hi bit
         D     4,0(6)             Do division
         CEETERM  RC=0            Terminate with return code zero
*
MAINPPA  CEEPPA                   Constants describing the code block
         CEEDSA                   Mapping of the Dynamic Save Area
         CEECAA                   Mapping of the Common Anchor Area
         END   ASSEMZ3
```

Figure 99. Main COBOL program, COBOL subroutine, and assembler routine

To debug this application, use the following steps:

1. Locate the error message for the current condition in the Condition Information section of the dump, shown in "Sections of Language Environment dump for program COBOLZ1" on page 243. The message is

   `CEE3209S The system detected a fixed-point divide exception (System Completion Code=0C9).`

   For more information about this message, see Language Environment runtime messages in *z/OS Language Environment Runtime Messages*.

2. Note the sequence of calls in the call chain. COBOLZ1 called IGZCFCC, which is a COBOL library subroutine used for dynamic calls; IGZCFCC called COBOLZ2; COBOLZ2 then called IGZCFCC; and IGZCFCC called ASSEMZ3. The exception occurred at this point, resulting in a call to CEEHDSP, a Language Environment condition handling routine.

   The call to ASSEMZ3 occurred at statement 11 of COBOLZ2. The exception occurred at offset +64 in ASSEMZ3.

3. Locate statement 11 in the COBOL listing for the COBOLZ2 program, shown in Figure 100 on page 241. This is a call to the assembler routine ASSEMZ3.

```
PP 5655-G53 IBM Enterprise COBOL for z/OS  3.4.1               COBOLZ2   Date 02/14/2007  Time 14:59:15   Page
3
  LineID  PL SL  ----+-*A-1-B--+----2----+----3----+----4----+----5----+----6----+----7-|--+----8 Map and Cross
Reference
/*
COBOLZ2

  000001               ID
DIVISION.
  000002               PROGRAM-ID.
COBOLZ2.
  000003               ENVIRONMENT
DIVISION.
  000004               DATA
DIVISION.
  000005               WORKING-STORAGE
SECTION.
  000006               77  DV-VAL PIC 9(4) USAGE COMP.                                       BLW=00000+000
2C
  000007               LINKAGE
SECTION.
  000008               77  D-VAL PIC 9(4) USAGE COMP.                                        BLL=00001+000
2C
  000009               PROCEDURE DIVISION USING D-VAL.
8
  000010                   MOVE D-VAL TO DV-VAL.                                             8
6
  000011                   CALL "ASSEMZ3" USING DV-VAL.                                      EXT 6
  000012
GOBACK.
*/ COBOLZ2
```

Figure 100. COBOL listing for COBOLZ2

4. Check offset +64 in the listing for the assembler routine ASSEMZ3, shown in Figure 101 on page 242.

   This shows an instruction to divide the contents of register 4 by the variable pointed to by register 6. You can see the two instructions preceding the divide instruction load register 6 from the first word pointed to by register 1 and prepare register 6 for the divide. Because of linkage conventions, you can infer that register 1 contains a pointer to a parameter list that passed to ASSEMZ3. Register 6 points to a 0 value because that was the value passed to ASSEMZ3 when it was called by a higher level routine.

```
                                    High Level Assembler Option Summary                (PTF UK21335)   Page
1
                                                                                    HLASM R5.0  2007/02/14
14.59
  No Overriding ASMAOPT
Parameters
  Overriding Parameters-
NODECK,LIST
  No Process
Statements
  Options for this Assembly

⋮
                                         External Symbol Dictionary                                    Page
2
Symbol   Type   Id     Address  Length   Owner Id Flags Alias-of                    HLASM R5.0  2007/02/14
14.59
ASSEMZ3   SD 00000001 00000000 000000CC
07
CEESTART  ER
00000002
                                                                                                       Page
3
  Active Usings:
None
  Loc  Object Code    Addr1 Addr2  Stmt   Source Statement                          HLASM R5.0  2007/02/14
14.59
                                     1          PRINT
NOGEN
000000 47F0 F014          00014     2 ASSEMZ3  CEEENTRY
MAIN=NO,PPA=MAINPPA
000056 4150 092C          0092C    38          LA    5,2348             Low order part of
quotient
00005A 1B44                        39          SR    4,4                Hi order part of
quitient
00005C 5861 0000          00000    40          L     6,0(1)             Get pointer to
divisor
000060 4166 0000          00000    41          LA    6,0(6)             Clear hi
bit
000064 5D46 0000          00000    42          D     4,0(6)             Do division
000068 58F0 B0C8          000C8    43          CEETERM  RC=0            Terminate with return code
zero
                                   50
*
000080 10                          51 MAINPPA  CEEPPA                   Constants describing the code
block
                                  123+*,Time Stamp = 2007/02/14 14:59:00                               01-
CEEPP
                                  124+*,Version 1 Release 1 Modification 0                             01-
CEEPP
                                  135          CEEDSA                   Mapping of the Dynamic Save
Area
                                  228          CEECAA                   Mapping of the Common Anchor
Area
000000                            551          END
ASSEMZ3
0000C8 00000000                   552                =A(0)
```

Figure 101. Listing for ASSEMZ3

5. Check local variables for COBOLZ2 in the Local Variables section of the dump shown in Figure 102 on page 242. From the dump and listings, you know that COBOLZ2 called ASSEMZ3 and passed a parameter in the variable DV-VAL. The two variables DV-VAL and D-VAL have 0 values.

```
⋮
Local Variables:
        6 77 DV-VAL            9999 COMP        00000
        8 77 D-VAL             9999 COMP        00000
⋮
```

Figure 102. Variables section of Language Environment dump for COBOLZ2

6. In the COBOLZ2 subroutine, the variable D-VAL is moved to DV-VAL, the parameter passed to the assembler routine. D-VAL appears in the Linkage section of the COBOLZ2 listing, shown in Figure 103 on page 243, indicating that the value did pass from COBOLZ1 to COBOLZ2.

```
PP 5655-G53 IBM Enterprise COBOL for z/OS  3.4.1              COBOLZ2   Date 02/14/2007  Time 14:59:15   Page
3
  LineID  PL SL  ----+-*A-1-B--+----2----+----3----+----4----+----5----+----6----+----7-|--+----8 Map and Cross
Reference
/*
COBOLZ2

  000001                ID
DIVISION.
  000002                PROGRAM-ID.
COBOLZ2.
  000003                ENVIRONMENT
DIVISION.
  000004                DATA
DIVISION.
  000005                WORKING-STORAGE
SECTION.
  000006                77  DV-VAL PIC 9(4) USAGE COMP.                                         BLW=00000+000
2C
  000007                LINKAGE SECTION.
  000008                77  D-VAL PIC 9(4) USAGE COMP.                                          BLL=00001+000
2C
  000009                PROCEDURE DIVISION USING D-VAL.
8
  000010                    MOVE D-VAL TO DV-VAL.                                               8 6
  000011                    CALL "ASSEMZ3" USING DV-VAL.                                        EXT 6
  000012
GOBACK.
*/ COBOLZ2
```

Figure 103. Listing for COBOLZ2

7. In the Local Variables section of the dump for program COBOLZ1, shown in Figure 104 on page 243, D-VAL has a 0 value. This indicates that the error causing a fixed-point divide exception in ASSEMZ3 was actually caused by the value of D-VAL in COBOLZ1.

```
         ⋮
           Local Variables:
                6 77 D-VAL            9999 COMP        00000
         ⋮
```

Figure 104. Variables section of Language Environment dump for COBOLZ1

Sections of Language Environment dump for program COBOLZ1

```
CEE3DMP V1 R12.0: Condition processing resulted in the unhandled condition.        01/26/10 2:59:19 PM                Page:    1
ASID: 0099   Job ID: J0005739   Job name: COBOLZ1N   Step name: GO        UserID: BARBARA

CEE3845I CEEDUMP Processing started.

Information for enclave COBOLZ1

  Information for thread 8000000000000000

  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     CEEHDSP     +000049D6              CEEPLPKA             CEEHDSP                        D1908    Call
    2     ASSEMZ3     +00000064              ASSEMZ3              ASSEMZ3                                 Exception
    3     IGZCFCC     +000002CA              IGZCPAC              IGZCFCC                                 Call
    4     COBOLZ2     +000002A4  11          COBOLZ2              COBOLZ2                                 Call
    5     IGZCFCC     +000002CA              IGZCPAC              IGZCFCC                                 Call
    6     COBOLZ1     +0000028E  8           GO                   COBOLZ1                                 Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     1147E7D0   112BD238   112BD238   +000049D6  20061215   CEL
    2     1147E750   1120E448   1120E448   +00000064  20070214   ASM
    3     1147E570   1140A5F8   1140A5F8   +000002CA  20061213   LIBRARY
    4     1147E3C0   0001F320   0001F320   +000002A4  20070214   COBOL
    5     1147E1E0   1140A5F8   1140A5F8   +000002CA  20061213   LIBRARY
    6     1147E030   000083D0   000083D0   +0000028E  20070214   COBOL

  Condition Information for Active Routines
    Condition Information for ASSEMZ3 (DSA address 1147E750)
      CIB Address: 1147F0F0
      Current Condition:
        CEE3209S The system detected a fixed-point divide exception (System Completion Code=0C9).
      Location:
        Program Unit: ASSEMZ3 Entry: ASSEMZ3 Statement:  Offset: +00000064
      Machine State:
        ILC..... 0004    Interruption Code..... 0009
        PSW..... 078D0000 9120E4B0
        GPR0..... 00000000_1147E7D0  GPR1..... 00000000_1147E4B8  GPR2..... 00000000_1147AE54  GPR3..... 00000000_000212E8
        GPR4..... 00000000_00000000  GPR5..... 00000000_0000092C  GPR6..... 00000000_000213A8  GPR7..... 00000000_1147E4B8
        GPR8..... 00000000_00000002  GPR9..... 00000000_000211B0  GPR10.... 00000000_1147A100  GPR11.... 00000000_9120E448
        GPR12.... 00000000_1120C9C0  GPR13.... 00000000_1147E750  GPR14.... 00000000_9140A8C4  GPR15.... 00000000_9120E448
    Storage dump near condition, beginning at location: 1120E49C
      +000000 1120E49C  10184150 092C1B44 58610000 41660000  5D460000 58F0B0C8 5800B0C8 58DD0004  |...&...../......)....0.H...H....|
    GPREG STORAGE:
```

```
      Storage around GPR0 (1147E7D0)
        -0020 1147E7B0  1120C9C0 00000000 00000000 00000000  00008408 00000000 00000100 1147E958  |..I..............d...........Z.|
        +0000 1147E7D0  0808CEE1 1147E750 114818F0 912C1C10  912E9898 1147E7D0 1147EC28 1147F0F0  |......X&...0j...j.qq..X.......00|
        +0020 1147E7F0  1120BD60 112C1E64 9120E770 00000000  112092A8 912C1988 114807CE 1147F7CF  |...-....j.X.......kyj..h......7.|
⋮
  Parameters, Registers, and Variables for Active Routines:
⋮
    COBOLZ2 (DSA address 1147E3C0):
      UPSTACK DSA
      Saved Registers:
        GPR0..... 1147E570  GPR1..... 1147E4C0  GPR2..... 000197FC  GPR3..... 000212E8
        GPR4..... 1147E4B8  GPR5..... 000191BC  GPR6..... 1147AFD0  GPR7..... 00FDD100
        GPR8..... 000213A8  GPR9..... 000211B0  GPR10.... 0001F428  GPR11.... 0001F54C
        GPR12.... 0001F41C  GPR13.... 1147E3C0  GPR14.... 8001F5C6  GPR15.... 9140A5F8
    GPREG STORAGE:
      Storage around GPR0 (1147E570)
        -0020 1147E550  1147E30C 1147E44C 1120B658 00000000  1147E470 00000000 00000011 00000005  |..T...U<..........U.............|
        +0000 1147E570  00102401 1147E3C0 1147E750 9140A8C4  9120E448 1147E750 1147E4B8 1147AE54  |......T...X&j yDj.U...X&..U.....|
        +0020 1147E590  000212E8 1147E4C0 000212E8 1147B028  1147E4B8 00000002 000211B0 1147A100  |...Y..U....Y......U.............|
⋮                                             o
      Local Variables:
               6 77 DV-VAL           9999 COMP        00000
               8 77 D-VAL            9999 COMP        00000
⋮
```

```
    COBOLZ1 (DSA address 1147E030):
      UPSTACK DSA
      Saved Registers:
        GPR0..... 1147E1E0  GPR1..... 1147E130  GPR2..... 000197FC  GPR3..... 0000A2E4
        GPR4..... 1147E128  GPR5..... 1120B778  GPR6..... 00000000  GPR7..... 00000000
        GPR8..... 0000A3A8  GPR9..... 0000A1B0  GPR10.... 000084D8  GPR11.... 000085F4
        GPR12.... 000084CC  GPR13.... 1147E030  GPR14.... 80008660  GPR15.... 9140A5F8
    GPREG STORAGE:
      Storage around GPR0 (1147E1E0)
        -0020 1147E1C0  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
        +0000 1147E1E0  00102401 1147E030 1147E3C0 9140A8C4  0001F320 1147E3C0 1147E128 000197FC  |..........T.j yD..3...T.......p.|
        +0020 1147E200  0000A2E4 1147E130 0000A2E4 1147AFD0  1147E128 00000002 0000A1B0 1147A100  |..sU......sU....................|
⋮
      Local Variables:
               6 77 D-VAL            9999 COMP        00000
⋮
```

Chapter 6. Debugging Fortran routines

You can debug applications that contain one or more Fortran routines.

Determining the source of errors in Fortran routines

Most errors in Fortran routines can be identified by the information provided in Fortran runtime messages, which begin with the prefix "FOR". The Fortran compiler cannot identify all possible errors. The following list identifies several errors not detected by the compiler that could potentially result in problems:

- Failing to assign values to variables and arrays before using them in your program.
- Specifying subscript values that are not within the bounds of an array. If you assign data outside the array bounds, you can inadvertently destroy data and instructions.
- Moving data into an item that is too small for it, resulting in truncation.
- Making invalid data references to EQUIVALENCE items of differing types (for example, integer or real).
- Transferring control into the range of a DO loop from outside the range of the loop. The compiler issues a warning message for all such branches if you specify OPT(2), OPT(3), or VECTOR.
- Using arithmetic variables and constants that are too small to give the precision you need in the result. For example, to obtain more than 6 decimal digits in floating-point results, you must use double precision.
- Concatenating character strings in such a way that overlap can occur.
- Trying to access services that are not available in the operating system or hardware.
- Failing to resolve name conflicts between Fortran and C library routines using the procedures described in Resolving library module name conflicts between Fortran and C in *z/OS Language Environment Programming Guide*.

Identifying runtime errors

Fortran has several features that help you find runtime errors. Fortran runtime messages are discussed in Fortran runtime messages in *z/OS Language Environment Runtime Messages*. Other debugging aids include the optional traceback map, program interruption messages, abnormal termination dumps, and operator messages.

- The optional traceback map helps you identify where errors occurred while running your application. The TERMTHDACT(TRACE) runtime option, which is set by default under Language Environment, generates a dump containing the traceback map.

  You can also get a traceback map at any point in your routine by invoking the ERRTRA subroutine.
- Program interruption messages are generated whenever the program is interrupted during execution. Program interruption messages are written to the Language Environment message file.

  The program interruption message indicates the exception that caused the termination; the completion code from the system indicates the specification or operation exception resulting in termination.
- Program interruptions causing an abnormal termination produce a dump, which displays the completion code and the contents of registers and system control fields.

  To display the contents of main storage as well, you must request an abnormal termination (ABEND) dump by including a SYSUDUMP DD statement in the appropriate job step. The following example shows how the statement can be specified for IBM-supplied cataloged procedures:

  ```
  //GO.SYSUDUMP DD SYSOUT=A
  ```

- You can request various dumps by invoking any of several dump service routines while your program runs. These dump service routines are discussed in "Generating a Language Environment dump of a Fortran routine" on page 247.
- Operator messages are displayed when your program issues a PAUSE or STOP *n* statement. These messages help you understand how far execution has progressed before reaching the PAUSE or STOP statement.

  The operator message can take the following forms:

  n
  : String of 1–5 decimal digits you specified in the PAUSE or STOP statement. For the STOP statement, this number is placed in R15.

  'message'
  : Character constant you specified in the PAUSE or STOP statement.

  0
  : Printed when a PAUSE statement containing no characters is executed (not printed for a STOP statement).

  A PAUSE message causes the program to stop running pending an operator response. The format of the operator's response to the message depends on the system being used.
- Under Language Environment, error messages produced by Language Environment and Fortran are written to a common message file. Its ddname is specified in the MSGFILE runtime option. The default ddname is SYSOUT.

  Fortran information directed to the message file includes:

  – Error messages resulting from unhandled conditions
  – Printed output from any of the dump services (SDUMP, DUMP/PDUMP, CDUMP/CPDUMP)
  – Output produced by a WRITE statement with a unit identifier having the same value as the Fortran error message unit
  – Output produced by a WRITE statement with * given as the unit identifier (assuming the Fortran error message unit and standard print unit are the same unit)
  – Output produced by the PRINT statement (assuming the Fortran error message unit and the standard print unit are the same unit)

  For more information about handling message output using the Language Environment MSGFILE runtime option, see MSGFILE in *z/OS Language Environment Programming Reference*.

Using Fortran compiler listings

Fortran listings provide you with:

- The date of compilation including information about the compiler
- A listing of your source program
- Diagnostic messages telling you of errors in the source program
- Informative messages telling you the status of the compilation

Table 41 on page 246lists of the contents of the various compiler-generated listings that you might find helpful when you use information in dumps to debug Fortran programs.

Table 41. Compiler-generated Fortran listings and their contents

Name	Contents	Compiler Option
Diagnostic message listing	Error messages detected during compilation.	FLAG
Source program	Source program statements.	SOURCE

Table 41. Compiler-generated Fortran listings and their contents (continued)

Name	Contents	Compiler Option
Source program	Source program statements and error messages.	SRCFLG
Storage map and cross reference	Variable use, statement function, subprogram, or intrinsic function within a program.	MAP and XREF
Cross reference	Cross reference of names with attributes.	XREF
Source program map	Offsets of automatic and static internal variables (from their defining base).	MAP
Object code	Contents of the program control section in hexadecimal notation and translated into a pseudo-assembler format. To limit the size of the object code listing, specify the statement or range of statements to be listed; for example, LIST(20) or LIST(10,30).	LIST
Variable map, object code, static storage	Same as MAP and LIST options above, plus contents of static internal and static external control sections in hexadecimal notation with comments.	MAP and LIST
Symbolic dump	Internal statement numbers, sequence numbers, and symbol (variable) information.	SDUMP

Generating a Language Environment dump of a Fortran routine

To generate a dump containing Fortran information, call either DUMP/PDUMP, CDUMP/CPDUMP, or SDUMP. DUMP/PDUMP and CDUMP/CPDUMP produce output that is unchanged from the output generated under Fortran. Under Language Environment, however, the output is directed to the message file.

When SDUMP is invoked, the output is also directed to the Language Environment message file. The dump format differs from other Fortran dumps, however, reflecting a common format shared by the various HLLs under Language Environment.

You cannot make a direct call to CEE3DMP from a Fortran program. It is possible to call CEE3DMP through an assembler routine called by your Fortran program. Fortran programs are currently restricted from directly invoking Language Environment callable services.

DUMP/PDUMP
: Provides a dump of a specified area of storage.

CDUMP/CPDUMP
: Provides a dump of a specified area of storage in character format.

SDUMP
: Provides a dump of all variables in a program unit.

DUMP/PDUMP subroutines

The DUMP/PDUMP subroutine dynamically dumps a specified area of storage to the system output data set. When you use DUMP, the processing stops after the dump; when you use PDUMP, the processing continues after the dump.

Syntax

CALL {DUMP | PDUMP} (a_1, b_1,k_1, a_2,b_2, k_2,...)

a* and *b
: Variables in the program unit. Each indicates an area of storage to be dumped. Either *a* or *b* can represent the upper or lower limit of the storage area.

k
: The dump format to be used. The values that can be specified for *k*, and the resulting dump formats, are:

Value
: **Format Requested**

0
: Hexadecimal

1
: LOGICAL*1

2
: LOGICAL*4

3
: INTEGER*2

4
: INTEGER*4

5
: REAL*4

6
: REAL*8

7
: COMPLEX*8

8
: COMPLEX*16

9
: CHARACTER

10
: REAL*16

11
: COMPLEX*32

12
: UNSIGNED*1

13
: INTEGER*1

14
: LOGICAL*2

15
: INTEGER*8

16
: LOGICAL*8

Usage considerations for DUMP/PDUMP

A load module or phase can occupy a different area of storage each time it is executed. To ensure that the appropriate areas of storage are dumped, the following conventions should be observed.

If an array and a variable are to be dumped at the same time, a separate set of arguments should be used for the array and for the variable. The specification of limits for the array should be from the first element in the array to the last element. For example, assume that A is a variable in common, B is a real number, and TABLE is an array of 20 elements. The following call to the storage dump routine could be used to dump TABLE and B in hexadecimal format, and stop the program after the dump is taken.

```
CALL DUMP(TABLE(1),TABLE(20),0,B,B,0)
```

If an area of storage in common is to be dumped at the same time as an area of storage not in common, the arguments for the area in common should be given separately. For example, the following call to the storage dump routine could be used to dump the variables A and B in REAL*8 format without stopping the program.

```
CALL PDUMP(A,A,6,B,B,6)
```

If variables not in common are to be dumped, each variable must be listed separately in the argument list. For example, if R, P, and Q are defined implicitly in the program, the following statement should be used to dump the three variables in REAL*4 format.

```
CALL PDUMP(R,R,5,P,P,5,Q,Q,5)
```

If the following statement is used, all main storage between R and Q is dumped, which might or might not include P, and could include other variables.

```
CALL PDUMP(R,Q,5)
```

CDUMP/CPDUMP subroutines

The CDUMP/CPDUMP subroutine dynamically dumps a specified area of storage containing character data. When you use CDUMP, the processing stops after the dump; when you use CPDUMP, the processing continues after the dump.

Syntax

CALL {CDUMP | CPDUMP} (a_1, b_1, a_2, b_2,...)

a* and *b
: Variables in the program unit. Each indicates an area of storage to be dumped. Either *a* or *b* can represent the upper or lower limit of each storage area.

The dump is always produced in character format. A dump format type (unlike for DUMP/PDUMP) must not be specified.

Usage considerations for CDUMP/CPDUMP

A load module can occupy a different area of storage each time it is executed. To ensure that the appropriate areas of storage are dumped, the following conventions should be observed.

If an array and a variable are to be dumped at the same time, a separate set of arguments should be used for the array and for the variable. The specification of limits for the array should be from the first element in the array to the last element. For example, assume that B is a character variable and TABLE is a character array of 20 elements. The following call to the storage dump routine could be used to dump TABLE and B in character format, and stop the program after the dump is taken.

```
CALL CDUMP(TABLE(1), TABLE(20), B, B)
```

SDUMP subroutine

The SDUMP subroutine provides a symbolic dump that is displayed in a format dictated by variable type as coded or defaulted in your source. Data is dumped to the error message unit. The symbolic dump is created by program request, on a program unit basis, using CALL SDUMP. Variables can be dumped automatically after abnormal termination using the compiler option SDUMP. For more information on the SDUMP compiler option, see *VS FORTRAN Version 2 Programming Guide for CMS and MVS.*

Items displayed are:

- All referenced, local, named, and saved variables in their Fortran-defined data representation
- All variables contained in a static common area (blank or named) in their Fortran-defined data representation

- All variables contained in a dynamic common area in their Fortran-defined data representation
- Nonzero or nonblank character array elements only
- Array elements with their correct indexes

The amount of output produced can be very large, especially if your program has large arrays, or large arrays in common blocks. For such programs, you might want to avoid calling SDUMP.

Syntax

CALL SDUMP [(*rtn*$_1$,*rtn*$_2$,...)]

***rtn*$_1$,*rtn*$_2$,...**
: Names of other program units from which data will be dumped. These names must be listed in an EXTERNAL statement.

Usage considerations for SDUMP

- To obtain symbolic dump information and location of error information, compilation must be done either with the SDUMP option or with the TEST option.
- Calling SDUMP and specifying program units that have not been entered gives unpredictable results.
- Calling SDUMP with no parameters produces the symbolic dump for the current program unit.
- An EXTERNAL statement must be used to identify the names being passed to SDUMP as external routine names.
- At higher levels of optimization (1, 2, or 3), the symbolic dump could show incorrect values for some variables because of compiler optimization techniques.
- Values for uninitialized variables are unpredictable. Arguments in uncalled subprograms or in subprograms with argument lists shorter than the maximum can cause the SDUMP subroutine to fail.
- The display of data can also be invoked automatically. If the runtime option TERMTHDACT(DUMP) is in effect and your program abends in a program unit compiled with the SDUMP option or with the TEST option, all data in that program unit is automatically dumped. All data in any program unit in the save area traceback chain compiled with the SDUMP option or with the TEST option is also dumped. Data occurring in a common block is dumped at each occurrence, because the data definition in each program unit could be different.

Examples of calling SDUMP from the main program and from a subprogram follow. Figure 105 on page 251 shows a sample program calling SDUMP and Figure 107 on page 252 shows the resulting output that is generated. In the main program, the following statement

```
EXTERNAL PGM1,PGM2,PGM3
```

makes the address of subprograms PGM1, PGM2, and PGM3 available for a call to SDUMP, as follows:

```
CALL SDUMP (PGM1,PGM2,PGM3)
```

This causes variables in PGM1, PGM2, and PGM3 to be printed.

In the subprogram PGM1, the following statement makes PGM2 and PGM3 available. (PGM1 is missing because the call is in PGM1.)

```
EXTERNAL PGM2,PGM3
```

The following statements dump the variables PGM1, PGM2, and PGM3.

```
CALL SDUMP
CALL SDUMP (PGM2,PGM3)
```

```
OPTIONS IN EFFECT: LIST NOMAP NOXREF NOGOSTMT NODECK SOURCE TERM OBJECT FIXED TRMFLG SRCFLG NODDIM NORENT SDUMP(ISN)
                   NOSXM NOVECTOR IL(DIM) NOTEST SC(*) NODC NOEC NOEMODE NOICA NODIRECTIVE NODBCS NOSAA NOPARALLEL NODYNAMIC
NOSYM
                   NOREORDER NOPC
                   OPT(0) LANGLVL(77) NOFIPS FLAG(I) HALT(S) AUTODBL(NONE) PTRSIZE(8) LINECOUNT(60) CHARLEN(500) NAME(MAIN#)
 IF DO   ISN   *....*...1.........2.........3.........4.........5.........6.........7.*.......8
           1         PROGRAM FORTMAIN
           2         EXTERNAL PGM1,PGM2,PGM3
           3         INTEGER*4 ANY_INT
           4         INTEGER*4 INT_ARR(3)
           5         CHARACTER*20 CHAR_VAR
           6         ANY_INT = 555
           7         INT_ARR(1) = 1111
           8         INT_ARR(2) = 2222
           9         INT_ARR(3) = 2222
          10         CHAR_VAR = 'SAMPLE CONSTANT '
          11         CALL PGM1(ANY_INT,CHAR_VAR)
          12         CALL SDUMP(PGM1,PGM2,PGM3)
          13         STOP
          14         END
OPTIONS IN EFFECT: LIST NOMAP NOXREF NOGOSTMT NODECK SOURCE TERM OBJECT FIXED TRMFLG SRCFLG NODDIM NORENT SDUMP(ISN)
                   NOSXM NOVECTOR IL(DIM) NOTEST SC(*) NODC NOEC NOEMODE NOICA NODIRECTIVE NODBCS NOSAA NOPARALLEL NODYNAMIC
NOSYM
                   NOREORDER NOPC
                   OPT(0) LANGLVL(77) NOFIPS FLAG(I) HALT(S) AUTODBL(NONE) PTRSIZE(8) LINECOUNT(60) CHARLEN(500) NAME(MAIN#)
 IF DO   ISN   *....*...1.........2.........3.........4.........5.........6.........7.*.......8
           1         SUBROUTINE PGM1(ARG1,ARG2)
           2         EXTERNAL PGM2,PGM3
           3         INTEGER*4 ARG1
           4         CHARACTER*20 ARG2
           5         ARG1 = 1
           6         ARG2 = 'ARGUMENT'
           7         CALL PGM2
           8         CALL SDUMP
           9         CALL SDUMP(PGM2,PGM3)
          10         RETURN
          11         END
```

Figure 105. Example program that calls SDUMP

```
OPTIONS IN EFFECT: LIST NOMAP NOXREF NOGOSTMT NODECK SOURCE TERM OBJECT FIXED TRMFLG SRCFLG NODDIM NORENT SDUMP(ISN)
                   NOSXM NOVECTOR IL(DIM) NOTEST SC(*) NODC NOEC NOEMODE NOICA NODIRECTIVE NODBCS NOSAA NOPARALLEL NODYNAMIC
NOSYM
                   NOREORDER NOPC
                   OPT(0) LANGLVL(77) NOFIPS FLAG(I) HALT(S) AUTODBL(NONE) PTRSIZE(8) LINECOUNT(60) CHARLEN(500) NAME(MAIN#)
 IF DO   ISN   *....*...1.........2.........3.........4.........5.........6.........7.*.......8
           1         SUBROUTINE PGM2
           2         INTEGER*4 PGM2VAR
           3         PGM2VAR = 555
           4         CALL PGM3
           5         RETURN
           6         END
OPTIONS IN EFFECT: LIST NOMAP NOXREF NOGOSTMT NODECK SOURCE TERM OBJECT FIXED TRMFLG SRCFLG NODDIM NORENT SDUMP(ISN)
                   NOSXM NOVECTOR IL(DIM) NOTEST SC(*) NODC NOEC NOEMODE NOICA NODIRECTIVE NODBCS NOSAA NOPARALLEL NODYNAMIC
NOSYM
                   NOREORDER NOPC
                   OPT(0) LANGLVL(77) NOFIPS FLAG(I) HALT(S) AUTODBL(NONE) PTRSIZE(8) LINECOUNT(60) CHARLEN(500) NAME(MAIN#)
 IF DO   ISN   *....*...1.........2.........3.........4.........5.........6.........7.*.......8
           1         SUBROUTINE PGM3
           2         CHARACTER*20 PGM3VAR
           3         PGM3VAR = 'PGM3 VAR'
           4         RETURN
           5         END
```

Figure 106. Example program that calls SDUMP (continued)

Figure 107 on page 252 shows the resulting output generated by the example in Figure 105 on page 251.

```
Parameters, Registers, and Variables for Active Routines:
PGM1      (DSA address 06D004C8):
Parameters:
  ARG2             CHARACTER*20     ARGUMENT

  ARG1             INTEGER*4                  1
Local Variables:
Parameters, Registers, and Variables for Active Routines:
PGM2      (DSA address 000930FC):
Parameters:
Local Variables:
  PGM2VAR          INTEGER*4                555
Parameters, Registers, and Variables for Active Routines:
PGM3      (DSA address 000930FC):
Parameters:
Local Variables:
  PGM3VAR          CHARACTER*20     PGM3 VAR

Parameters, Registers, and Variables for Active Routines:
PGM1      (DSA address 000930FC):
Parameters:
  ARG2             CHARACTER*20     ARGUMENT

  ARG1             INTEGER*4                  1
Local Variables:
Parameters, Registers, and Variables for Active Routines:
PGM2      (DSA address 000930FC):
Parameters:
Local Variables:
  PGM2VAR          INTEGER*4                555
Parameters, Registers, and Variables for Active Routines:
PGM3      (DSA address 000930FC):
Parameters:
Local Variables:
  PGM3VAR          CHARACTER*20     PGM3 VAR
```

Figure 107. Language Environment dump generated using SDUMP

Finding Fortran information in a Language Environment dump

To locate Fortran-specific information in a Language Environment dump, you must understand how to use the traceback section and the section in the symbol table dump showing parameters and variables. Figure 108 on page 253 shows an example of a Fortran dump; Table 42 on page 253 provides additional information about each section within the dump.

```
CEE3DMP V1 R3.0: Condition processing resulted in the unhandled condition.        08/30/01 10:32:56 AM
Page:    1

Information for enclave SAMPLE

  Information for thread 8000000000000000
[1]
  Traceback:
    DSA Addr  Program Unit  PU Addr   PU Offset  Entry         E Addr    E  Offset   Statement  Load Mod  Service  Status
    0002D018  CEEHDSP       05936760  +0000277C  CEEHDSP       05936760  +0000277C              CEEPLPKA           Call
    0002F018  AFHCSGLE      059DF718  +000001A8  AFHCSGLE      059DF718  +000001A8              AFHPRNAG           Exception
    05A44060  AFHOOPNR      05A11638  +00001EDE  AFHOOPNR      05A11638  +00001EDE              AFHPRNAG           Call
    05900A90  SAMPLE        059009A8  +0000021C  SAMPLE        059009A8  +0000021C       6_ISN  GO                 Call

[2]
  Condition Information for Active Routines
    Condition Information for AFHCSGLE (DSA address 0002F018)
      CIB Address: 0002D468
      Current Condition:
        FOR1916S The OPEN statement for unit 999 failed. The unit number was either less than 0 or greater than 99, the highest
unit number allowed at your installation.
      Location:
        Program Unit: AFHCSGLE Entry: AFHCSGLE Statement:  Offset: +000001A8
    Storage dump near condition, beginning at location: 059DF8B0
      +000000 059DF8B0  5060D198 5880C2B8 58F0801C 4110D190  05EFD502 D3019751 4770A1F0 4820D2FE  |&-
Jq..B..0....J...N.L.p....0..K.|

  Parameters, Registers, and Variables for Active Routines:
    CEEHDSP (DSA address 0002D018):
      Saved Registers:
        GPR0..... 000003E7  GPR1..... 0002D3B4  GPR2..... 0002DFD7  GPR3..... 0002E027
        GPR4..... 0002DF94  GPR5..... 00000000  GPR6..... 00000004  GPR7..... 00000000
        GPR8..... 0002E017  GPR9..... 0593875E  GPR10.... 0593775F  GPR11.... 85936760
        GPR12.... 00014770  GPR13.... 0002D018  GPR14.... 800250DE  GPR15.... 85949C70

  GPREG STORAGE:
    Storage around GPR0 (000003E7)
      -000020 000003C7  Inaccessible storage.
      +000000 000003E7  Inaccessible storage.
      +000020 00000407  Inaccessible storage.
    Storage around GPR1 (0002D3B4)
      -000020 0002D394  00000006 00000000 0002E017 0593875E  0593775F 85936760 00014770 00000000
|............lg;.l.¬el.-........|
      +000000 0002D3B4  0002DFD7 0002E027 0002DF94 0002DF94  0002DDF4 0002DEC4 0002E158 0002D018
|...P.......m...m...4...D........|
      +000020 0002D3D4  0002D468 00000000 00000000 00000007  859D67E0 00000000 00000000 05914848
|..M.............e............j..|
   ⋮
[3]
      Local Variables:
          ABC              CHARACTER*3      123
          J                INTEGER*4                444

[4]
  File Status and Attributes:
    The total number of units defined is 100.
    The default unit for the PUNCH statement is 7.
    The default unit for the Fortran error messages is 6.
    The default unit for formatted sequential output is 6.
    The default unit for formatted sequential input is 5.
```

Figure 108. Sections of the Language Environment dump

Table 42 on page 253 describes the sections shown in the sample dump in Figure 108 on page 253 .

Table 42. Understanding the Language Environment traceback table

Section	Contents
[1]	The traceback section of the dump contains condition information about your routine and information about the statement number and address where the exception occurred. The traceback section helps you locate where an error occurred in your program. The information in this section begins with the most recent program unit and ends with the first program unit.
[2]	The condition information section contains information for the active routines. It indicates the program message, program unit name, the statement number, and the offset within the program unit where the error occurred.
[3]	The local variable section contains information on all variables and arrays in each program unit in the save area chain, including the program that caused the dump to be invoked. The output shows variable items (one line only) and array (more than one line) items. Use the local variable section of the dump to identify the variable name, type, and value at the time the dump was called. Variable and array items can contain either character or noncharacter data, but not both.

Section	Contents
[4]	The file status and attribute section of the dump displays the total number of units defined, the default units for error messages, and the default unit numbers for formatted input or formatted output.

Examples of debugging Fortran routines

This section contains examples of Fortran routines and instructions for using information in the Language Environment dump to debug them.

Calling a nonexistent routine

Figure 109 on page 254 illustrates an error caused by calling a nonexistent routine. The options in effect at compile time appear at the top of the listing.

```
OPTIONS IN EFFECT: LIST NOMAP NOXREF NOGOSTMT NODECK SOURCE TERM OBJECT FIXED TRMFLG SRCFLG NODDIM NORENT SDUMP(ISN)
                   NOSXM NOVECTOR IL(DIM) NOTEST SC(*) NODC NOEC NOEMODE NOICA NODIRECTIVE NODBCS NOSAA NOPARALLEL NODYNAMIC
NOSYM
                   NOREORDER NOPC
                   OPT(0) LANGLVL(77) NOFIPS FLAG(I) HALT(S) AUTODBL(NONE) PTRSIZE(8) LINECOUNT(60) CHARLEN(500) NAME(MAIN#)
           1         PROGRAM CALLNON
           2         INTEGER*4 ARRAY_END
               C
           3         CALL SUBNAM
           4         STOP
           5         END
```

Figure 109. Example of calling a nonexistent routine

Figure 110 on page 255 shows sections of the dump generated by a call to SDUMP.

```
CEE3DMP V1 R3.0: Condition processing resulted in the unhandled condition.        08/30/01 10:33:01 AM
Page:    1

Information for enclave CALLNON

  Information for thread 8000000000000000

  Traceback:
    DSA Addr  Program Unit  PU Addr   PU Offset  Entry         E Addr    E  Offset   Statement  Load Mod  Service  Status
    0002D018  CEEHDSP       05936760  +0000277C  CEEHDSP       05936760  +0000277C              CEEPLPKA           Call
    05900C10  CALLNON       05900B28  -05900B26  CALLNON       05900B28  -05900B26       3_ISN  GO                 Exception

  Condition Information for Active Routines
    Condition Information for CALLNON   (DSA address 05900C10)
      CIB Address: 0002D468
      Current Condition:
        CEE3201S The system detected an operation exception.
      Location:
        Program Unit: CALLNON
        Entry:        CALLNON
        Statement:    3_ISN Offset: -05900B26
      Machine State:
        ILC..... 0002    Interruption Code..... 0001
        PSW..... 078D3D00 80000004
        GPR0..... FD000008  GPR1..... 00000000  GPR2..... 05900D04  GPR3..... 05900C10
        GPR4..... 007F6930  GPR5..... 007FD238  GPR6..... 007BFFF8  GPR7..... FD000000
        GPR8..... 007FD968  GPR9..... 807FD4F8  GPR10.... 00000000  GPR11.... 007FD238
        GPR12.... 00E21ED2  GPR13.... 05900C10  GPR14.... 85900CE8  GPR15.... 00000000
    Storage dump near condition, beginning at location: 00000000
      +000000 00000000  Inaccessible storage.

  Parameters, Registers, and Variables for Active Routines:
    CEEHDSP (DSA address 0002D018):
      Saved Registers:
        GPR0..... 00000000  GPR1..... 0002D3B4  GPR2..... 0002DFD7  GPR3..... 0002E027
        GPR4..... 0002DF94  GPR5..... 00000000  GPR6..... 00000004  GPR7..... 00000000
        GPR8..... 0002E017  GPR9..... 0593875E  GPR10.... 0593775F  GPR11.... 05936760
        GPR12.... 00014770  GPR13.... 0002D018  GPR14.... 800250DE  GPR15.... 85949C70

  GPREG STORAGE:
    Storage around GPR0 (00000000)
      +000000 00000000  Inaccessible storage.
      +000020 00000020  Inaccessible storage.
      +000040 00000040  Inaccessible storage.
    Storage around GPR1 (0002D3B4)
     -000020 0002D394  00000006 00000000 0002E017 0593875E  0593775F 05936760 00014770 00000000
|............lg;.l.¬.l.-........|
     +000000 0002D3B4  0002DFD7 0002E027 0002DF94 0002DF94  0002DDF4 0002DEC4 0002E158 00000000
|...P.......m...m...4...D........|
     +000020 0002D3D4  0002D468 00000000 00000000 00000007  859D67E0 00000000 00000000 05914848
|..M.............e............j..|
       :
CEE3DMP V1 R3.0: Condition processing resulted in the unhandled condition.        08/30/01 10:33:01 AM
Page:    4

  File Status and Attributes:
    The total number of units defined is 100.
    The default unit for the PUNCH statement is 7.
    The default unit for the Fortran error messages is 6.
    The default unit for formatted sequential output is 6.
    The default unit for formatted sequential input is 5.
```

Figure 110. Sections of the Language Environment dump resulting from a call to a nonexistent routine

To understand the traceback section, and debug this example routine, do the following:

1. Find the Current Condition information in the Condition Information for Active Routines section of the dump. The message is CEE3201S. The system detected an operation exception at statement 3. For more information about this message, see *z/OS Language Environment Runtime Messages*. This section of the dump also provides such information as the name of the active routine and the current statement number at the time of the dump.
2. Locate statement 3 in the routine shown in Figure 109 on page 254. This statement calls subroutine SUBNAM. The message CEE3201S in the Condition Information section of the dump indicates that the operation exception was generated because of an unresolved external reference.
3. Check the linkage editor output for error messages.

Divide-by-zero error

Figure 111 on page 256 demonstrates a divide-by-zero error. In this example, the main Fortran program passed 0 to subroutine DIVZEROSUB, and the error occurred when DIVZEROSUB attempted to use this data as a divisor.

```
OPTIONS IN EFFECT: LIST NOMAP NOXREF NOGOSTMT NODECK SOURCE TERM OBJECT FIXED TRMFLG SRCFLG NODDIM NORENT SDUMP(ISN)
                   NOSXM NOVECTOR IL(DIM) NOTEST SC(*) NODC NOEC NOEMODE NOICA NODIRECTIVE NODBCS NOSAA NOPARALLEL NODYNAMIC
NOSYM
                   NOREORDER NOPC
                   OPT(0) LANGLVL(77) NOFIPS FLAG(I) HALT(S) AUTODBL(NONE) PTRSIZE(8) LINECOUNT(60) CHARLEN(500) NAME(MAIN#)
           1         PROGRAM DIVZERO
           2         INTEGER*4 ANY_NUMBER
           3         INTEGER*4 ANY_ARRAY(3)
           4         PRINT *,'EXAMPLE STARTING'
           5         ANY_NUMBER = 0
           6         DO I = 1,3
     1     7         ANY_ARRAY(I) = I
     1     8         END DO
           9         CALL DIVZEROSUB(ANY_NUMBER, ANY_ARRAY)
          10         PRINT *,'EXAMPLE ENDING'
          11         STOP
          12         END
OPTIONS IN EFFECT: LIST NOMAP NOXREF NOGOSTMT NODECK SOURCE TERM OBJECT FIXED TRMFLG SRCFLG NODDIM NORENT SDUMP(ISN)
                   NOSXM NOVECTOR IL(DIM) NOTEST SC(*) NODC NOEC NOEMODE NOICA NODIRECTIVE NODBCS NOSAA NOPARALLEL NODYNAMIC
NOSYM
                   NOREORDER NOPC
                   OPT(0) LANGLVL(77) NOFIPS FLAG(I) HALT(S) AUTODBL(NONE) PTRSIZE(8) LINECOUNT(60) CHARLEN(500) NAME(MAIN#)
           1         SUBROUTINE DIVZEROSUB(DIVISOR, DIVIDEND)
           2         INTEGER*4 DIVISOR
           3         INTEGER*4 DIVIDEND(3)
           4         PRINT *,'IN SUBROUTINE DIVZEROSUB'
           5         DIVIDEND(1) = DIVIDEND(3) / DIVISOR
           6         PRINT *,'END OF SUBROUTINE DIVZEROSUB'
           7         RETURN
           8         END
```

Figure 111. Fortran routine with a divide-by-zero error

Figure 112 on page 257 shows the Language Environment dump for routine DIVZERO.

```
CEE3DMP V1 R3.0: Condition processing resulted in the unhandled condition.        08/30/01 10:33:01 AM
Page:    1

Information for enclave DIVZERO

  Information for thread 8000000000000000

  Traceback:
    DSA Addr  Program Unit  PU Addr   PU Offset  Entry         E Addr    E  Offset   Statement  Load Mod  Service  Status
    0002D018  CEEHDSP       05936760  +0000277C  CEEHDSP       05936760  +0000277C              CEEPLPKA           Call
    05900640  DIVZSUB       05900558  +00000258  DIVZSUB       05900558  +00000258       5_ISN  GO                 Exception
    0002F018  AFHLCLNR      0001B150  +00000000  AFHLCLNR      0001B150  +00000000              AFHPRNBG           Call
    059002E8  DIVZERO       05900200  +00000298  DIVZERO       05900200  +00000298       9_ISN  GO                 Call

  Condition Information for Active Routines
    Condition Information for DIVZSUB   (DSA address 05900640)
      CIB Address: 0002D468
      Current Condition:
        CEE3209S The system detected a fixed-point divide exception.
      Location:
        Program Unit: DIVZSUB
        Entry:        DIVZSUB
        Statement:    5_ISN Offset: +00000258
      Machine State:
        ILC..... 0004    Interruption Code..... 0009
        PSW..... 078D2A00 859007B4
        GPR0..... 00000000  GPR1..... 00000003  GPR2..... 059003FC  GPR3..... 05900400
        GPR4..... 007F6930  GPR5..... 05900468  GPR6..... 0000000C  GPR7..... 059003E0
        GPR8..... 85900400  GPR9..... 807FD4F8  GPR10.... 00000000  GPR11.... 007FD238
        GPR12.... 00E21ED2  GPR13.... 05900640  GPR14.... 8590079C  GPR15.... 05900BA0
    Storage dump near condition, beginning at location: 059007A0
      +000000 059007A0  5870D118 5800700C 5870D120 8E000020  5D007000 5870D118 50107004 58F0D128
|..J.......J.....).....J.&....0J.|

  Parameters, Registers, and Variables for Active Routines:
    CEEHDSP (DSA address 0002D018):
      Saved Registers:
        GPR0..... 00000000  GPR1..... 0002D3B4  GPR2..... 0002DFD7  GPR3..... 0002E027
        GPR4..... 0002DF94  GPR5..... 00000000  GPR6..... 00000004  GPR7..... 00000000
        GPR8..... 0002E017  GPR9..... 0593875E  GPR10.... 0593775F  GPR11.... 05936760
        GPR12.... 00014770  GPR13.... 0002D018  GPR14.... 800250DE  GPR15.... 85949C70

  GPREG STORAGE:
    Storage around GPR0 (00000000)
      +000000 00000000  Inaccessible storage.
      +000020 00000020  Inaccessible storage.
      +000040 00000040  Inaccessible storage.
    Storage around GPR1 (0002D3B4)
      -000020 0002D394  00000006 00000000 0002E017 0593875E  0593775F 05936760 00014770 00000000
|............lg;.l.¬.l.-........|
      +000000 0002D3B4  0002DFD7 0002E027 0002DF94 0002DF94  0002DDF4 0002DEC4 0002E158 00000000
|...P.......m...m...4...D........|
      +000020 0002D3D4  0002D468 00000000 00000000 00000007  859D67E0 00000000 00000000 05914848
|..M.............e............j..|
   ⋮
      Local Variables:
          I               INTEGER*4                 4

          ANY_ARRAY(3)    INTEGER*4
          ANY_ARRAY(1)                              1           2           3

          ANY_NUMBER      INTEGER*4                 0

  File Status and Attributes:
    The total number of units defined is 100.
    The default unit for the PUNCH statement is 7.
    The default unit for the Fortran error messages is 6.
    The default unit for formatted sequential output is 6.
    The default unit for formatted sequential input is 5.
```

Figure 112. Language Environment dump from divide-by-zero Fortran example

To debug this application, do the following:

1. Locate the error message, CEE3209S, for the current condition in the Condition Information section of the dump, shown in Figure 112 on page 257. The system detected a fixed-point divide exception. For more information about this message, see Language Environment runtime messages in *z/OS Language Environment Runtime Messages*.
2. Note the sequence of the calls in the call chain:
   a. DIVZERO called AFHLCLNR, which is a Fortran library subroutine.
   b. AFHLCLNR called DIVZEROSUB.

      Note: When a program-unit name is longer than 7 characters, the name as it appears in the dump consists of the first 4 and last 3 characters concatenated together.
   c. DIVZEROSUB attempted a divide-by-zero operation at statement 5.

d. This resulted in a call to CEEHDSP, a Language Environment condition handling routine.

3. Locate statement 5 in the Fortran listing for the DIVZEROSUB subroutine in Figure 112 on page 257. This is an instruction to divide the contents of DIVIDEND(3) by DIVISOR.
4. Since DIVISOR is a parameter of subroutine DIVZEROSUB, go to the Parameters section of the dump shown in Figure 112 on page 257. The parameter DIVISOR shows a value of 0.
5. Since DIVISOR contains the value passed to DIVZEROSUB, check its value. ANY_NUMBER is the actual argument passed to DIVZEROSUB, and the dump and listing of DIVZERO indicate that ANY_NUMBER had value 0 when passed to DIVZEROSUB, leading to the divide-by-zero exception.

Chapter 7. Debugging PL/I for MVS & VM routines

This section contains information that can help you debug applications that contain one or more PL/I for MVS & VM routines. Following a discussion about potential errors in PL/I for MVS & VM routines, the first topic discusses how to use compiler-generated listings to obtain information about PL/I for MVS & VM routines, and how to use PLIDUMP to generate a Language Environment dump of a PL/I for MVS & VM routine. The last part of this section provides examples of PL/I for MVS & VM routines and explains how to debug them using information contained in the traceback information provided in the dump.

Determining the source of errors in PL/I for MVS & VM routines

Most errors in PL/I for PL/I for MVS & VM routines can be identified by the information provided in PL/I runtime messages, which begin with the prefix IBM. For a list of these messages, see PL/I runtime messages in *z/OS Language Environment Runtime Messages*.

A malfunction in running a PL/I for MVS & VM routine can be caused by:

- Logic errors in the source routine
- Invalid use of PL/I for MVS & VM
- Unforeseen errors
- Invalid input data
- Compiler or runtime routine malfunction
- System malfunction
- Unidentified routine malfunction
- Overlaid storage

Logic errors in the source routine

Errors of this type are often difficult to detect because they often appear as compiler or library malfunctions. Some common errors in source routines are:

- Incorrect conversion from arithmetic data
- Incorrect arithmetic and string manipulation operations
- Unmatched data lists and format lists

Invalid use of PL/I for MVS & VM

A misunderstanding of the language or a failure to provide the correct environment for using PL/I for MVS & VM can result in an apparent malfunction of a PL/I for MVS and VM routine. Any of the following, for example, might cause a malfunction:

- Using uninitialized variables
- Using controlled variables that have not been allocated
- Reading records into incorrect structures
- Misusing array subscripts
- Misusing pointer variables
- Incorrect conversion
- Incorrect arithmetic operations
- Incorrect string manipulation operations

Unforeseen errors

If an error is detected during run time and no ON-unit is provided in the routine to terminate the run or attempt recovery, the job terminates abnormally. However, the status of a routine at the point where the error occurred can be recorded by using an ERROR ON-unit that contains the statements. In the following example, the statement `ON ERROR SYSTEM` ensures that further errors do not result in a permanent loop.

```
ON ERROR
 BEGIN;
  ON ERROR SYSTEM;
  CALL PLIDUMP;          /*generates a dump*/
  PUT DATA;              /*displays variables*/
 END;
```

Invalid input data

A routine should contain checks to ensure that any incorrect input data is detected before it can cause the routine to malfunction. Use the COPY option of the GET statement to check values obtained by stream-oriented input. The values are listed on the file named in the COPY option. If no file name is given, SYSPRINT is assumed.

Compiler or runtime routine malfunction

If you are certain that the malfunction is caused by a compiler or runtime routine error, you can either open a PMR or submit an APAR for the error. For more information about handling compiler and runtime routine malfunctions, see the IBM Enterprise PL/I for z/OS library (www.ibm.com/support/docview.wss?uid=swg27036735). Meanwhile, you can try an alternative way to perform the operation that is causing the trouble. A bypass is often feasible, since the PL/I for MVS & VM language frequently provides an alternative method of performing operations.

System malfunction

System malfunctions include machine malfunctions and operating system errors. System messages identify these malfunctions and errors to the operator.

Unidentified routine malfunction

In most circumstances, an unidentified routine malfunction does not occur when using the compiler. If your routine terminates abnormally without an accompanying Language Environment runtime diagnostic message, the error causing the termination might also be inhibiting the production of a message. Check for the following:

- Your job control statements might be in error, particularly in defining data sets.
- Your routine might overwrite main storage areas containing executable instructions. This can happen if you have accidentally:
  - Assigned a value to a nonexistent array element. For example:

```
DCL ARRAY(10);
     ⋮
DO I = 1 TO 100;
ARRAY(I) = VALUE;
```

    To detect this type of error in a compiled module, set the SUBSCRIPTRANGE condition so that each attempt to access an element outside the declared range of subscript values raises the SUBSCRIPTRANGE condition. If there is no ON-unit for this condition, a diagnostic message is printed and the ERROR condition is raised. This facility, though expensive in run time and storage space, is a valuable routine-testing aid.

– Used an incorrect locator value for a locator (pointer or offset) variable. This type of error can occur if a locator value is obtained by means of record-oriented transmission. Ensure that locator values created in one routine, transmitted to a data set, and subsequently retrieved for use in another routine, are valid for use in the second routine.
– Attempted to free a nonbased variable. This can happen when you free a based variable after its qualifying pointer value has been changed. For example:

```
DCL A STATIC,B BASED (P);
ALLOCATE B;
P = ADDR(A);
FREE B;
```

– Used the SUBSTR pseudovariable to assign a string to a location beyond the end of the target string. For example:

```
DCL X CHAR(3);
I=3
SUBSTR(X,2,I) = 'ABC';
```

To detect this type of error, enable the STRINGRANGE condition during compilation.

Storage overlay problems

If you suspect an error in your PL/I for MVS & VM application is a storage overlay problem, check for the following:

1. The use of a subscript outside the declared bounds (check the SUBSCRIPTRANGE condition)
2. An attempt to assign a string to a target with an insufficient maximum length (check the STRINGSIZE condition)
3. The failure of the arguments to a SUBSTR reference to comply with the rules described for the SUBSTR built-in function (check the STRINGRANGE condition)
4. The loss of significant last high-order (left-most) binary or decimal digits during assignment to an intermediate result or variable or during an input/output operation (check the SIZE condition)
5. The reading of a variable-length file into a variable
6. The misuse of a pointer variable
7. The invocation of a Language Environment callable service with fewer arguments than are required

The first four situations are associated with the listed PL/I for MVS & VM conditions, all of which are disabled by default. If you suspect one of these problems exists in your routine, use the appropriate condition prefix on the suspected statement or on the BEGIN or PROCEDURE statement of the containing block.

The fifth situation occurs when you read a data record into a variable that is too small. This type of problem only happens with variable-length files. You can often isolate the problem by examining the data in the file information and buffer.

The sixth situation occurs when you misuse a pointer variable. This type of storage overlay is particularly difficult to isolate. There are a number of ways pointer variables can be misused:

- When a READ statement runs with the SET option, a value is placed in a pointer. If you then run a WRITE statement or another READ SET option with another pointer, you overlay your storage if you try to use the original pointer.
- When you try to use a pointer to allocate storage that has already been freed, you can also cause a storage overlay.
- When you attempt to use a pointer set with the ADDR built-in function as a base for data with different attributes, you can cause a storage overlay.

The seventh situation occurs when a Language Environment callable service is passed fewer arguments than its interface requires. The following example might cause a storage overlay because Language Environment assumes that the fourth item in the argument list is the address of a feedback code, when in reality it could be residue data pointing anywhere in storage.

Invalid calls	Valid calls
`DCL CEEDATE ENTRY OPTIONS(ASM);` `CALL CEEDATE(x,y,z);    /* invalid */`	`DCL CEEDATE ENTRY(*,*,*,* OPTIONAL) OPTIONS(ASM);` `CALL CEEDATE(x,y,z,*);    /* valid   */` `CALL CEEDATE(x,y,z,fc);   /* valid   */`

Using PL/I for MVS & VM compiler listings

The following sections explain how to generate listings that contain information about your routine. PL/I for MVS & VM listings show machine instructions, constants, and external or internal addresses that the linkage editor resolves. This information can help you find other information, such as variable values, in a dump of a PL/I for MVS & VM routine. The PL/I compiler listings included in the following sections are from the PL/I for MVS & VM product.

Generating PL/I for MVS & VM listings and maps

Table 43 on page 262 shows compiler-generated listings that you might find helpful when you use information in dumps to debug PL/I for MVS & VM routines. For more information about supported compiler options that generate listings, reference the IBM Enterprise PL/I for z/OS library (www.ibm.com/support/docview.wss?uid=swg27036735).

Table 43. Compiler-generated PL/I for MVS & VM listings and their contents

Name	Contents	Compiler Option
Source program	Source program statements	SOURCE
Cross reference	Cross reference of names with attributes	XREF and ATTRIBUTES
Aggregate table	Names and layouts of structures and arrays	AGGREGATE
Variable map	Offsets of automatic and static internal variables (from their defining base)	MAP
Object code	Contents of the program control section in hexadecimal notation and translated into a pseudo-assembler format. To limit the size of the object code listing, specify a certain statement or range of statements to be listed; for example, LIST(20) or LIST(10,30).	LIST
Variable map, object code, static storage	Same as MAP and LIST options, plus contents of static internal and static external control sections in hexadecimal notation with comments	MAP and LIST

Finding information in PL/I for MVS & VM listings

Figure 113 on page 263 shows an example PL/I for MVS & VM routine that was compiled with LIST and MAP.

```
*PROCESS SOURCE, LIST, MAP;

                   SOURCE LISTING

   STMT

      1  |EXAMPLE: PROC OPTIONS(MAIN);
      2  |           DCL EXTR ENTRY EXTERNAL;
      3  |           DCL A FIXED BIN(31);
      4  |           DCL B(2,2)  FIXED BIN(31) STATIC EXTERNAL INIT((4)0);
      5  |           DCL C CHAR(20) STATIC INIT('SAMPLE CONSTANT');
      6  |           DCL D FIXED BIN(31) STATIC;
      7  |           DCL E FIXED BIN(31);
      8  |           FETCH EXTR;
      9  |           CALL EXTR(A,B,C,D,E);
     10  |           DISPLAY(C);
     11  |        END;
```

Figure 113. PL/I for MVS & VM routine compiled with LIST and MAP

Figure 114 on page 264 shows the output generated by the LIST and MAP options for this routine, including the static storage map, variable storage map, and the object code listing. The sections following this example describe the contents of each type of listing.

```
                           STATIC INTERNAL STORAGE MAP

000000  E00000E8                PROGRAM ADCON
000004  00000008                PROGRAM ADCON
000008  00000096                PROGRAM ADCON
00000C  00000096                PROGRAM ADCON
000010  00000096                PROGRAM ADCON
000014  00000000                A..IBMSJDSA
000018  00000000                A..IBMSPFRA
00001C  00000000                A..STATIC
000020  0000000000000044        LOCATOR..B
000028  0000008800140000        LOCATOR..C
000030  91E091E0                CONSTANT
000034  0A000000C5E7E3D9        FECB..EXTR
        40404040
000040  80000034                A..FECB..EXTR
000044  0000000C00000008        DESCRIPTOR
        0000000200000001
        0000000400000002
        00000001
000060  80000034                A..FECB..EXTR
000064  00000000                A..B
000068  00000000                A..A
00006C  00000020                A..LOCATOR
000070  00000028                A..LOCATOR
000074  000000A0                A..D
000078  80000000                A..E
00007C  00000000                A..ENTRY EXTR
000080  80000028                A..LOCATOR
000084
000088  E2C1D4D7D3C540C3        INITIAL VALUE..C
        D6D5E2E3C1D5E340
        40404040

                           STATIC EXTERNAL CSECTS

000000  0000000000000000        CSECT FOR EXTERNAL VARIABLE
        0000000000000000
  ⋮
                                    VARIABLE STORAGE MAP

IDENTIFIER                          LEVEL         OFFSET       (HEX)   CLASS     BLOCK

E                                       1           184          B8   AUTO      EXAMPLE
D                                       1           160          A0   STATIC    EXAMPLE
C                                       1           136          88   STATIC    EXAMPLE
A                                       1           188          BC   AUTO      EXAMPLE
  ⋮
  OBJECT LISTING
                                                          000096  58 B0 C 004              L     11,4(0,12)
                                                          00009A  58 FB 0 000              L     15,PR..EXTR
* STATEMENT NUMBER  1                                     00009E  59 F0 C 064              C     15,100(0,12)
000000                              DC    C'EXAMPLE'      0000A2  47 70 2 01E              BNE   CL.5
000007                              DC    AL1(7)          0000A6  41 10 3 040              LA    1,64(0,3)
                                                          0000AA  58 F0 3 018              L     15,A..IBMSPFRA
* PROCEDURE                               EXAMPLE         0000AE  05 EF                    BALR  14,15
                                                          0000B0  58 FB 0 000              L     15,PR..EXTR
* REAL ENTRY                                              0000B4                   CL.5    EQU   *
000008  90 EC D 00C                 STM   14,12,12(13)
00000C  47 F0 F 04C                 B     *+72
000010  00000000                    DC    A(STMT. NO. TABLE)  * STATEMENT NUMBER  9
000014  000000D8                    DC    F'216'          0000B4  D2 13 D 0C0 3 068        MVC   192(20,13),104(3)
000018  00000000                    DC    A(STATIC CSECT)     0000BA  41 70 D 0BC          LA    7,A
00001C  00000000                    DC    A(SYMTAB VECTOR)    0000BE  50 70 D 0C0          ST    7,192(0,13)
000020  00000000                    DC    A(COMPILATION INFO) 0000C2  41 70 D 0B8          LA    7,E
000024  A8000000                    DC    X'A8000000'     0000C6  50 70 D 0D0              ST    7,208(0,13)
000028  00010100                    DC    X'00010100'     0000CA  96 80 D 0D0              OI    208(13),X'80'
00002C  00000000                    DC    X'00000000'     0000CE  58 FB 0 000              L     15,PR..EXTR
000030  00000000                    DC    X'00000000'     0000D2  59 F0 C 064              C     15,100(0,12)
000034  00000000                    DC    A(ENTRY LIST VECTOR)0000D6  47 70 2 052          BNE   CL.6
```

Figure 114. Compiler-generated listings from example PL/I for MVS & VM routine

```
000038  00000000                 DC    X'00000000'
00003C  01008000                 DC    X'01008000'
000040  00000000                 DC    A(REGION TABLE)
000044  00000002                 DC    X'00000002'
000048  00000000                 DC    A(PRIMARY ENTRY)
00004C  00000000                 DC    X'00000000'
000050  00000000                 DC    X'00000000'
000054  58 30 F 010              L     3,16(0,15)
000058  58 10 D 04C              L     1,76(0,13)
00005C  58 00 F 00C              L     0,12(0,15)
000060  1E 01                    ALR   0,1
000062  55 00 C 00C              CL    0,12(0,12)
000066  47 D0 F 068              BNH   *+10
00006A  58 F0 C 074              L     15,116(0,12)
00006E  05 EF                    BALR  14,15
000070  58 E0 D 048              L     14,72(0,13)
000074  18 F0                    LR    15,0
000076  90 E0 1 048              STM   14,0,72(1)
00007A  50 D0 1 004              ST    13,4(0,1)
00007E  92 80 1 000              MVI   0(1),X'80'
000082  92 25 1 001              MVI   1(1),X'25'
000086  92 02 1 076              MVI   118(1),X'02'
00008A  41 D1 0 000              LA    13,0(1,0)
00008E  D2 03 D 054 3 030        MVC   84(4,13),48(3)
000094  05 20                    BALR  2,0

* PROCEDURE BASE

0000DA  41 10 3 060              LA    1,96(0,3)
0000DE  58 F0 3 018              L     15,A..IBMSPFRA
0000E2  05 EF                    BALR  14,15
0000E4  58 FB 0 000              L     15,PR..EXTR
0000E8                   CL.6    EQU   *
0000E8  1B 55                    SR    5,5
0000EA  41 10 D 0C0              LA    1,192(0,13)
0000EE  05 EF                    BALR  14,15

* STATEMENT NUMBER  10
0000F0  41 10 3 080              LA    1,128(0,3)
0000F4  58 F0 3 014              L     15,A..IBMSJDSA
0000F8  05 EF                    BALR  14,15

* STATEMENT NUMBER  11
0000FA  18 0D                    LR    0,13
0000FC  58 D0 D 004              L     13,4(0,13)
000100  58 E0 D 00C              L     14,12(0,13)
000104  98 2C D 01C              LM    2,12,28(13)
000108  05 1E                    BALR  1,14

* END PROCEDURE
00010A  07 07                    NOPR  7

* END PROGRAM
```

Figure 115. Compiler-generated listings from example PL/I for MVS & VM routine (continued)

Static internal storage map

To get a complete variable storage map and static storage map, but not a complete LIST, specify a single statement for LIST to minimize the size of the listing; for example, LIST(1).

Each line of the static storage map contains the following information:

1. Six-digit hexadecimal offset.
2. Hexadecimal text, in 8-byte sections where possible.
3. Comment, indicating the type of item to which the text refers. The comment appears on the first line of the text for an item. Table 44 on page 265 lists some typical comments you might find in a static storage listing.

Table 44. Typical comments in a PL/I for MVS & VM static storage listing

Comment	Explanation
A..*xxx*	Address constant for *xxx*
COMPILER LABEL CL.*n*	Compiler-generated label *n*
CONDITION CSECT	Control section for programmer-named condition
CONSTANT	Constant
CSECT FOR EXTERNAL VARIABLE	Control section for external variable
D..*xxx*	Descriptor for *xxx*
DED..*xxx*	Data element descriptor for *xxx*
DESCRIPTOR	Data descriptor
ENVB	Environment control block
FECB..*xxx*	Fetch control block for *xxx*
DCLCB	Declare control block
FED..*xxx*	Format element descriptor for *xxx*
KD..*xxx*	Key descriptor for *xxx*
LOCATOR..*xxx*	Locator for *xxx*

Comment	Explanation
ONCB	ON statement control block
PICTURED DED..*xxx*	Pictured data element descriptor for *xxx*
PROGRAM ADCON	Program address constant
RD..*xxx*	Record descriptor for *xxx*
SYMBOL TABLE ELEMENT	Symbol table address
SYMBOL TABLE..*xxx*	Symbol table for *xxx*
SYMTAB DED..*xxx*	Symbol table DED for *xxx*
USER LABEL..*xxx*	Source program label for *xxx*
xxx	Variable with name *xxx*. If the variable is not initialized, no text appears against the comment. There is also no static offset if the variable is an array (the static offset can be calculated from the array descriptor, if required).

Table 44. Typical comments in a PL/I for MVS & VM static storage listing (continued)

Variable storage map

For automatic and static internal variables, the variable storage map contains the following information:

- PL/I for MVS & VM identifier name
- Level
- Storage class
- Name of the PL/I for MVS & VM and VM block in which it is declared
- Offset from the start of the storage area, in both decimal and hexadecimal form

If the LIST option is also specified, a map of the static internal and external control sections, called the static storage map, is also produced.

Object code listing

The object code listing consists of the machine instructions and a translation of these instructions into a form that resembles assembler and includes comments, such as source program statement numbers.

The machine instructions are formatted into blocks of code, headed by the statement or line number in the PL/I for MVS & VM source program listing. Generally, only executable statements appear in the listing. DECLARE statements are not normally included. The names of PL/I for MVS & VM variables, rather than the addresses that appear in the machine code, are listed. Special mnemonics are used to refer to some items, including test hooks, descriptors, and address constants.

Statements in the object code listing are ordered by block, as they are sequentially encountered in the source program. Statements in the external procedure are given first, followed by the statements in each inner block. As a result, the order of statements frequently differs from that of the source program.

Every object code listing begins with the name of the external procedure. The actual entry point of the external procedure immediately follows the heading comment REAL ENTRY. The subsequent machine code is the prolog for the block, which performs block activation. The comment PROCEDURE BASE marks the end of the prolog. Following this is a translation of the first executable statement in the PL/I for MVS & VM source program. Table 45 on page 266 summarizes the comment used in the listing.

Table 45. Comments in a PL/I for MVS & VM object code listing

Comment	Function
BEGIN BLOCK *xxx*	Indicates the start of the begin block with label *xxx*
BEGIN BLOCK NUMBER *n*	Indicates the start of the begin block with number *n*

Comment	Function
CALCULATION OF COMMONED EXPRESSION FOLLOWS	Indicates that an expression used more than once in the routine is calculated at this point
CODE MOVED FROM STATEMENT NUMBER *n*	Indicates object code moved by the optimization process to a different part of the routine and gives the number of the statement from which it originated
COMPILER GENERATED SUBROUTINE *xxx*	Indicates the start of compiler-generated subroutine *xxx*
CONTINUATION OF PREVIOUS REGION	Identifies the point at which addressing from the previous routine base recommences
END BLOCK	Indicates the end of a begin block
END INTERLANGUAGE PROCEDURE *xxx*	Identifies the end of an ILC procedure *xxx*
END OF COMMON CODE	Identifies the end of code used in running more than one statement
END OF COMPILER GENERATED SUBROUTINE	Indicates the end of the compiler-generated subroutine
END PROCEDURE	Identifies the end of a procedure
END PROGRAM	Indicates the end of the external procedure
INITIALIZATION CODE FOR *xxx*	Indicates the start of initialization code for variable *xxx*
INITIALIZATION CODE FOR OPTIMIZED LOOP FOLLOWS	Indicates that some of the code that follows was moved from within a loop by the optimization process
INTERLANGUAGE PROCEDURE *xxx*	Identifies the start of an implicitly generated ILC procedure *xxx*
METHOD OR ORDER OF CALCULATING EXPRESSIONS CHANGED	Indicates that the order of the code following was changed to optimize the object code
ON-UNIT BLOCK NUMBER *n*	Indicates the start of an ON-unit block with number *n*
ON-UNIT BLOCK END	Indicates the end of the ON-unit block
PROCEDURE *xxx*	Identifies the start of the procedure labeled *xxx*
PROCEDURE BASE	Identifies the address loaded into the base register for the procedure
PROGRAM ADDRESSABILITY REGION BASE	Identifies the address where the routine base is updated if the routine size exceeds 4096 bytes and consequently cannot be addressed from one base
PROLOGUE BASE	Identifies the start of the prolog code common to all entry points into that procedure
REAL ENTRY	Precedes the actual executable entry point for a procedure
STATEMENT LABEL *xxx*	Identifies the position of source program statement label *xxx*
STATEMENT NUMBER *n*	Identifies the start of code generated for statement number *n* in the source listing

Table 45. Comments in a PL/I for MVS & VM object code listing (continued)

In certain cases, the compiler uses mnemonics (see Table 46 on page 267) to identify the type of operand in an instruction and, where applicable, follows the mnemonic by the name of a PL/I for MVS & VM variable.

Table 46. PL/I for MVS & VM mnemonics

Mnemonic	Explanation
A..*xxx*	Address constant for *xxx*
ADD..*xxx*	Aggregate descriptor for *xxx*
BASE..*xxx*	Base address of variable *xxx*

Table 46. PL/I for MVS & VM mnemonics (continued)

Mnemonic	Explanation
BLOCK.*n*	Identifier created for an otherwise unlabeled block
CL.*n*	Compiler-generated label number *n*
D..*xxx*	Descriptor for *xxx*
DED..*xxx*	Data element descriptor for *xxx*
HOOK...ENTRY	Debugging tool block entry hook
HOOK...BLOCK-EXIT	Debugging tool block exit hook
HOOK...PGM-EXIT	Debugging tool program exit hook
HOOK...PRE-CALL	Debugging tool pre-call hook
HOOK...INFO	Additional pre-call hook information
HOOK...POST-CALL	Debugging tool post call hook
HOOK...STMT	Debugging tool statement hook
HOOK...IF-TRUE	Debugging tool IF true hook
HOOK...IF-FALSE	Debugging tool ELSE hook
HOOK...WHEN	Debugging tool WHEN true hook
HOOK...OTHERWISE	Debugging tool OTHERWISE true hook
HOOK...LABEL	Debugging tool label hook
HOOK...DO	Debugging tool iterative DO hook
HOOK...ALLOC	Debugging tool ALLOCATE controlled hook
WSP.*n*	Workspace, followed by identifying number *n*
L..*xxx*	Length of variable *xxx*
PR..*xxx*	Pseudoregister vector slot for *xxx*
LOCATOR..*xxx*	Locator for *xxx*
RKD..*xxx*	Record or key descriptor for *xxx*
VO..*xxx*	Virtual origin for *xxx* (the address where element 0 is held for a one-dimensional array, element 0,0 for a two-dimensional array, and so on)

Generating a Language Environment dump of a PL/I for MVS & VM routine

To generate a dump of a PL/I for MVS & VM routine, you can call either the Language Environment callable service CEE3DMP or PLIDUMP. For information about calling CEE3DMP, see "Generating a Language Environment dump with CEE3DMP" on page 33.

PLIDUMP syntax and options

PLIDUMP calls intermediate PL/I for MVS & VM library routines, which convert most PLIDUMP options to CEE3DMP options. The following list contains PLIDUMP options and the corresponding CEE3DMP option, if applicable.

Some PLIDUMP options do not have corresponding CEE3DMP options, but continue to function as PL/I for MVS & VM default options. The list following the syntax diagram provides a description of those options.

PLIDUMP now conforms to National Language Support standards.

PLIDUMP can supply information across multiple Language Environment enclaves. If an application running in one enclave fetches a main procedure (an action that creates another enclave), PLIDUMP contains information about both procedures.

The syntax and options for PLIDUMP are shown below.

```
►► PLIDUMP ── ( ── char.-string-exp 1 ── , ── char.-string-exp 2 ── ) ►◄
```

char.-string-exp 1

A dump options character string consisting of one or more of the following values. T, F, C, and A are the default options.

A

All. Results in a dump of all tasks including the ones in the WAIT state.

B

BLOCKS (PL/I for MVS & VM hexadecimal dump). Dumps the control blocks used in Language Environment and member language libraries. For PL/I for MVS & VM, this includes the DSA for every routine on the call chain and PL/I for MVS & VM "global" control blocks, such as Tasking Implementation Appendage (TIA), Task Communication Area (TCA), and the PL/I Tasking Control Block (PTCB). PL/I file control blocks and file buffers are also dumped if the F option is specified.

C

Continue. The routine continues after the dump.

E

Exit. The enclave terminates after the dump. In a multitasking environment, if PLIDUMP is called from the main task, the enclave terminates after the dump. If PLIDUMP is called from a subtask, the subtask and any subsequent tasks created from the subtask terminate after the dump. In a multithreaded environment, if PLIDUMP is called from the Initial Process Thread (IPT), the enclave terminates after the dump. If PLIDUMP is called from a non-IPT, only the non-IPT terminates after the dump.

F

FILE INFORMATION. A set of attributes for all open files is given. The contents of the file buffers are displayed if the B option is specified.

H

STORAGE in hexadecimal. A SNAP dump of the region is produced. A ddname of CEESNAP must be provided to direct the CEESNAP dump report.

K

BLOCKS (when running under CICS). The Transaction Work Area is included.

Note: This option is not supported under Enterprise PL/I.

NB

NOBLOCKS.

NF

NOFILES.

NH

NOSTORAGE.

NK

NOBLOCKS (when running under CICS).

NT

NOTRACEBACK.

O

THREAD(CURRENT). Results in a dump of only the current task or current thread (the invoker of PLIDUMP).

S

Stop. The enclave terminates after the dump. In a multitasking environment, regardless of whether PLIDUMP is called from the main task or a subtask, the enclave terminates after the dump. In a multithreaded environment, regardless of whether PLIDUMP is called from the IPT or a non-IPT, the enclave terminates after the dump (in which case there is no fixed order as to which thread terminates first).

T

TRACEBACK. Includes a traceback of all routines on the call chain. The traceback shows transfers of control from either calls or exceptions. BEGIN blocks and ON-units are also control transfers and are included in the trace. The traceback extends backwards to the main program of the current thread.

char.-string-exp 2

A user-identified character string up to 80 characters long that is printed as the dump header.

PLIDUMP usage notes

If you use PLIDUMP, the following considerations apply:

- If a routine calls PLIDUMP a number of times, use a unique user-identifier for each PLIDUMP invocation. This simplifies identifying the beginning of each dump.
- In MVS or TSO, you can use ddnames of CEEDUMP, PLIDUMP, or PL1DUMP to direct dump output. If no ddname is specified, CEEDUMP is used.
- The data set defined by the PLIDUMP, PL1DUMP, or CEEDUMP DD statement should specify a logical record length (LRECL) of at least 131 to prevent dump records from wrapping.
- When you specify the H option in a call to PLIDUMP, the PL/I for MVS & VM library issues an OS SNAP macro to obtain a dump of virtual storage. The first invocation of PLIDUMP results in a SNAP identifier of 0. For each successive invocation, the ID is increased by one to a maximum of 256, after which the ID is reset to 0.
- Support for SNAP dumps using PLIDUMP is provided only under MVS. SNAP dumps are not produced in a CICS environment.
  - If the SNAP does not succeed, the CEE3DMP DUMP file displays the message:

    ```
    Snap was unsuccessful
    ```

    Failure to define a CEESNAP data set is the most likely cause of an unsuccessful CEESNAP.
  - If the SNAP is successful, CEE3DMP displays the message:

    ```
    Snap was successful; snap ID = nnn
    ```

    where *nnn* corresponds to the SNAP identifier described above. An unsuccessful SNAP does not result in an incrementation of the identifier.
- To ensure portability across system platforms, use PLIDUMP to generate a dump of your PL/I for MVS & VM routine.

Finding PL/I for MVS & VM information in a dump

The following sections discuss PL/I-specific information located in the following sections of a Language Environment dump:

- Traceback
- Control Blocks for Active Routines
- Control Block Associated with the Thread
- File Status and Attributes

Traceback

Examine the traceback section of the dump, shown in Figure 116 on page 271, for condition information about your routine and information about the statement number and address where the exception occurred.

```
CEE3DMP V1 R12.0: Plidump called from error On-unit                              07/16/10 11:45:20 AM           Page:    1
ASID: 003E   Job ID: JOB21950   Job name: LEDGSMP1   Step name: GO         UserID: HEALY

CEE3845I CEEDUMP Processing started.
PLIDUMP was called from statement number 6 at offset +000000D6 from ERR  ON-unit with entry address 20900C58

Information for enclave EXAMPLE

  Information for thread 8000000000000000

  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     CEEKKMRA    +0000081C              CEEPLPKA             CEEKKMRA                       D1908    Call
    2     IBMRKDM     +000000C2              IBMREV10             IBMRKDM                                 Call
    3     ERR  ON-unit+000000D6  6           EXAMPLE              EXAMPLE                                 Call
    4     IBMRERPL    +0000065A              IBMRLIB1             IBMRERPL                                Call
    5     CEEEV010    +0000013A              IBMREV10             CEEEV010                                Call
    6     CEEHDSP     +000017D0              CEEPLPKA             CEEHDSP                        D1908    Call
    7     IBMRERRI    +0000045A              IBMRLIB1             IBMRERRI                                Exception
    8     LABL1: BEGIN+000000BE  11          EXAMPLE              EXAMPLE                                 Call
    9     EXAMPLE     +000000C8  8           EXAMPLE              EXAMPLE                                 Call
    10    IBMRPMIA    +0000051E              IBMRLIB1             IBMRPMIA                                Call
    11    CEEEV010    +00000310              IBMREV10             CEEEV010                                Call
    12    CEEBBEXT    +000001B6              CEEPLPKA             CEEBBEXT                       D1908    Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     20B45B88   209F0420   209F0420   +0000081C  20061214   CEL
    2     00025670   20B1C0A0   20B1C0A0   +000000C2  ********   OS PL/I
    3     20B45A88   20900C58   20900B70   +000001BE  ********   OS PL/I
    4     20B45850   00019F50   00019F50   +0000065A  20061213   LIBRARY
    5     20B457C8   20B02998   20B02998   +0000013A  20061213   LIBRARY
    6     20B426A8   209BF068   209BF068   +000017D0  20061215   CEL
    7     20B42500   0001B328   0001B328   +0000045A  20061213   LIBRARY
    8     20B42430   20900D48   20900B70   +00000296  ********   OS PL/I
    9     20B42330   20900B78   20900B70   +000000D0  ********   OS PL/I
    10    20B42178   000201D0   000201D0   +0000051E  20061214   LIBRARY
    11    20B420F0   20B02998   20B02998   +00000310  20061213   LIBRARY
    12    20B42030   2098DDB8   2098DDB8   +000001B6  20061215   CEL

  Condition Information for Active Routines
    Condition Information for IBMRERRI (DSA address 20B42500)
      CIB Address: 20B42FC8
      Current Condition:
        IBM0281S A prior condition was promoted to the ERROR condition.
      Original Condition:
        IBM0421S  ONCODE=520  The SUBSCRIPTRANGE condition was raised.
      Location:
        Program Unit: IBMRERRI Entry: IBMRERRI Statement:  Offset: +0000045A

    Storage dump near condition, beginning at location: 0001B772
     +000000 0001B772  5050D080 58A0C2B8 58F0A01C 4110D080  05EF9108 404F4710 B4709104 404F47E0  |&&....B..0........j. |....j. |..|
⋮
```

Figure 116. Traceback section of dump

PL/I for MVS & VM task traceback

A task traceback table is produced for multitasking programs showing the task invocation sequence (trace). For each task, the thread ID, CAA address (identified by TCA address in the dump), event variable address, task variable address, and absolute priority appear in the traceback table. An example is shown in Figure 117 on page 272.

```
CEE3DMP V1 R9.0: called from SUBTSK2                                              02/27/07 2:23:10 PM             Page:    1
ASID: 01D2   Job ID: J0020927   Job name: LEDGSMP5   Step name: GO        PID: 33555395   Parent PID: 1   User name: PERFORM

CEE3845I CEEDUMP Processing started.
PLIDUMP was called from statement number 5 at offset +000000E6 from SUBTSK2 within task SUBTSK2

PL/I Task Traceback:
  Task     Attached by  Thread ID         TCA Addr   EV Addr    TV Addr   Absolute Priority
  SUBTSK2  SUBTSK1      1171C16000000003  11489BD8   11200AA0   00035290  000
  SUBTSK1  SUBTASK      1171943000000002  11480BD8   11200AE0   000266F8  000
  SUBTASK  TASKING      1171761000000001  11440D48   11200B20   00025D70  000
  TASKING               1170C15000000000  1120F9C0   000255D4   0002523C  254

Information for enclave TASKING

  Information for thread 1171C16000000003

  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     CEEKKMRA    +0000081C              CEEPLPKA             CEEKKMRA                       D1908    Call
    2     IBMRKDM     +000000C2              IBMREV10             IBMRKDM                                 Call
    3     SUBTSK2     +000000E6  5           GO                   SUBTSK2                                 Call
    4     IBMUPTMM    +0000014E              IBMRLIB1             IBMUPTMM                                Call
    5     CEEOPCMM    +00000908              CEEBINIT             CEEOPCMM                       D1908    Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     00036430   112FD268   112FD268   +0000081C  20061214   CEL       POSIX
    2     000352E8   1141D0A0   1141D0A0   +000000C2  ********   OS PL/I   POSIX
    3     00036308   11201048   11201040   +000000EE  ********   OS PL/I   POSIX
    4     00036040   00021900   00021900   +0000014E  20061214   LIBRARY    POSIX
    5     1148DEE0   0000E460   0000E460   +00000908  20061215   CEL       POSIX

  ⋮

  Information for thread 1170C15000000000

  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     IBMUJWTP    +00000146              IBMREV10             IBMUJWTP                                Call
    2     IBMUJWT     +0000027A              IBMRLIB1             IBMUJWT                                 Call
    3     TASKING     +00000106  11          GO                   TASKING                                 Call
    4     IBMRPMIA    +0000051E              IBMRLIB1             IBMRPMIA                                Call
    5     CEEEV010    +00000310              IBMREV10             CEEEV010                                Call
    6     CEEBBEXT    +000001B6              CEEPLPKA             CEEBBEXT                       D1908    Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     11443530   1143A850   1143A850   +00000146  20061214   LIBRARY    POSIX
    2     11443438   00020E28   00020E28   +0000027A  ********   OS PL/I   POSIX
    3     11443330   11200728   11200720   +0000010E  ********   OS PL/I   POSIX
    4     11443178   000201D0   000201D0   +0000051E  20061214   LIBRARY    POSIX
    5     114430F0   11403998   11403998   +00000310  20061213   LIBRARY    POSIX
    6     11443030   112B1BF8   112B1BF8   +000001B6  20061215   CEL       POSIX

  ⋮
  Information for thread 1171943000000002

  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     IBMUJWTP    +00000146              IBMREV10             IBMUJWTP                                Call
    2     IBMUJWT     +0000027A              IBMRLIB1             IBMUJWT                                 Call
    3     SUBTSK1     +000000D6  13          GO                   SUBTSK1                                 Call
    4     IBMUPTMM    +0000014E              IBMRLIB1             IBMUPTMM                                Call
    5     CEEOPCMM    +00000908              CEEBINIT             CEEOPCMM                       D1908    Call
```

Figure 117. Task traceback section

```
    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     00030508   1143A850   1143A850   +00000146  20061214   LIBRARY    POSIX
    2     00030410   00020E28   00020E28   +0000027A  ********   OS PL/I   POSIX
    3     00030308   11200DD8   11200DD0   +000000DE  ********   OS PL/I   POSIX
    4     00030040   00021900   00021900   +0000014E  20061214   LIBRARY    POSIX
    5     11485EE0   0000E460   0000E460   +00000908  20061215   CEL       POSIX

 ⋮

  Information for thread 1171761000000001

  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     IBMUJWTP    +00000146              IBMREV10             IBMUJWTP                                Call
    2     IBMUJWT     +0000027A              IBMRLIB1             IBMUJWT                                 Call
    3     SUBTASK     +000000D6  13          GO                   SUBTASK                                 Call
    4     IBMUPTMM    +0000014E              IBMRLIB1             IBMUPTMM                                Call
    5     CEEOPCMM    +00000908              CEEBINIT             CEEOPCMM                       D1908    Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     00029508   1143A850   1143A850   +00000146  20061214   LIBRARY    POSIX
    2     00029410   00020E28   00020E28   +0000027A  ********   OS PL/I   POSIX
    3     00029308   11200B68   11200B60   +000000DE  ********   OS PL/I   POSIX
    4     00029040   00021900   00021900   +0000014E  20061214   LIBRARY    POSIX
    5     11479EE0   0000E460   0000E460   +00000908  20061215   CEL       POSIX

 ⋮
```

Figure 118. Task traceback section (continued)

Condition information

If the dump was called from an ON-unit, the type of ON-unit is identified in the traceback as part of the entry information. For ON-units, the values of any relevant condition built-in functions (for example, ONCHAR and ONSOURCE for conversion errors) appear. In cases where the cause of entry into the ON-unit is not stated, usually when the ERROR ON-unit is called, the cause of entry appears in the condition information.

Statement number and address where error occurred

This information, which is the point at which the condition that caused entry to the ON-unit occurred, can be found in the traceback section of the dump.

If the condition occurs in compiled code, and you compiled your routine with either GOSTMT or GONUMBER, the statement numbers appear in the dump. To identify the assembler instruction that caused the error, use the traceback information in the dump to find the program unit (PU) offset of the statement number in which the error occurred. Then find that offset and the corresponding instruction in the object code listing.

Control blocks for active routines

This section shows the stack frames for all active routines, and the static storage. Use this section of the dump to identify variable values, determine the contents of parameter lists, and locate the timestamp. Figure 119 on page 273 shows this section of the dump.

```
Control Blocks for Active Routines:
  DSA for CEEKKMRA: 20B45B88
    +000000  FLAGS.... 0000      member... 4040      BKC...... 00025670  FWC...... 20B46080  R14...... A09F0C3E
    +000010  R15...... A09EB5B8  R0....... 00000000  R1....... 20B45C18  R2....... 000251E8  R3....... 00000000
    +000024  R4....... 00000001  R5....... 20B45E17  R6....... 00025030  R7....... 00000000  R8....... A09104D0
    +000038  R9....... 00000000  R10...... 209F141F  R11...... A09F0420  R12...... 2090E9C0  reserved. 00025760
    +00004C  NAB...... 20B46080  PNAB..... 20B40050  reserved. 00500007  00000000
    +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 00000000
    +000078  reserved. 00000000  reserved. 8000C3C5
  DSA for IBMRKDM: 00025670
    +000000  FLAGS.... 0800      member... 01E0      BKC...... 20B45A88  FWC...... 20B45B88  R14...... A0B1C164
    +000010  R15...... A09F0420  R0....... 80007810  R1....... 20900EBC  R2....... 20B45A88  R3....... A0B1C0A6
    +000024  R4....... 00000064  R5....... 00000000  R6....... 20900EBC  R7....... 20B45938  R8....... 20B45B58
    +000038  R9....... 20B45B7C  R10...... 00000000  R11...... 0001AF4F  R12...... 2090E9C0  reserved. 00025760
    +00004C  NAB...... 20B45B88  PNAB..... 00000000  reserved. 00000000  00000000
    +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 00000000
    +000078  reserved. 00000000  reserved. 00000000
  Library Work Space: 00025670
    +000000 00025670  080001E0 20B45A88 20B45B88 A0B1C164  A09F0420 80007810 20900EBC 20B45A88  |......!h..$h..A...............!h|
    +000020 00025690  A0B1C0A6 00000064 00000000 20900EBC  20B45938 20B45B58 20B45B7C 00000000  |...w.................$...$@....|
    +000040 000256B0  0001AF4F 2090E9C0 00025760 20B45B88  00000000 00000000 00000000 00000000  |...|..Z....-..$h...............|
    +000060 000256D0  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
    +000080 000256F0 - +00009F 0002570F             same as above
  DSA for ERR  ON-unit: 20B45A88
    +000000  FLAGS.... CC25      member... 4040      BKC...... 20B45850  FWC...... 40404040  R14...... A0900D30
    +000010  R15...... A0B1C0A0  R0....... 20B45B88  R1....... 20900EBC  R2....... A0900CE4  R3....... 20900E40
    +000024  R4....... 00000064  R5....... 00000000  R6....... 20B45B40  R7....... 20B45938  R8....... 20B45B58
    +000038  R9....... 20B45B7C  R10...... 00000000  R11...... 0001AF4F  R12...... D6D940C7  reserved. 00025670
    +00004C  NAB...... 20B45B88  PNAB..... 20B45B88  reserved. 91E091E0  20900F00
    +000064  reserved. 40404040  reserved. 40404040  MODE..... 40404040  reserved. 20B45B40
    +000078  reserved. 40404040  reserved. 40404040
  Dynamic save area (ERR  ON-unit): 20B45A88
    +000000 20B45A88  CC254040 20B45850 40404040 A0900D30  A0B1C0A0 20B45B88 20900EBC A0900CE4  |..  ...&    ..........$h.......U|
    +000020 20B45AA8  20900E40 00000064 00000000 20B45B40  20B45938 20B45B58 20B45B7C 00000000  |... ..........$ ......$...$@....|
    +000040 20B45AC8  0001AF4F D6D940C7 00025670 20B45B88  20B45B88 91E091E0 20B42330 20900F00  |...|OR G......$h..$hj.j.........|
    +000060 20B45AE8  40404040 40404040 40404040 40404040  20B45B40 40400240 40404040 40404040  |                    ..$   .      |
    +000080 20B45B08  40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
    +0000A0 20B45B28  40404040 40404040 40404040 40404040  40404040 40404040 0C014040 40404040  |                          ..     |
    +0000C0 20B45B48  A3829586 A2404040 20B45B48 00050000  D7938984 A4949740 83819393 85844086  |tbnfs   ..$.....Plidump called f|
    +0000E0 20B45B68  99969440 85999996 9940D695 60A49589  A3404040 20B45B58 00210000 40404040  |rom error On-unit   ..$.....    |
  Static for procedure EXAMPLE    Timestamp: 27 FEB 07  11:45:18
  Starting from: 20900E40
    +000000 20900E40  E00001E0 20900B78 20900C20 20900C30  20900C58 20900CE4 20900D48 20900DBE  |.......................U........|
    +000020 20900E60  20900DBE 20900DBE 20900DBE 20901E40  B0000002 1F800004 00000000 20900E94  |............... ...............m|
    +000040 20900E80  00000000 00050000 00000000 00210000  91E091E0 00000004 00000004 0000000A  |................j.j.............|
    +000060 20900EA0  00000001 91A091A0 00000014 00000001  0A200000 0000000A 00000002 20B45B50  |....j.j.......................$&|
    +000080 20900EC0  A0B45B7C 20901368 A3829586 A2D79389  84A49497 40838193 93858440 86999694  |..$@....tbnfsPlidump called from|
    +0000A0 20900EE0  40859999 969940D6 9560A495 89A30000  20900C34 20900C30 0C160000 20900C58  | error On-unit..................|
    +0000C0 20900F00  0C960000 00000000 20901038 00000000  00000000 20900F3C 20900F50 20900F6C  |.o.........................&...%|
    +0000E0 20900F20  20900F84 00000000 20900F08 00000000  20900F14 00000000 20900F14 85000001  |...d.........................e...|
    +000100 20900F40  20900E72 000000C8 00000000 0001C900  85000001 20900E72 000000CC 00000000  |.......H......I.e...............|
    +000120 20900F60  0009C1D9 D9C1E86D C5D5C400 81000101  20900E72 000000C0 00000000 0005C1D9  |..ARRAY_END.a.................AR|
    +000140 20900F80  D9C1E800 0D020001 20900E70 20900EF0  00000000 0005D3C1 C2D3F100 00000001  |RAY............0......LABL1.....|
    +000160 20900FA0  20900B78 000000DE 20900FC0 00000001  00B90004 00BD0008 00CF000E 00E00004  |................................|
    +000180 20900FC0  20900C58 000000E8 20900FE0 00000004  008D0005 00910006 00D90007 00E80008  |.......Y.............j...R...Y..|
    +0001A0 20900FE0  20900D48 000000F6 20901008 00000008  00770009 0083000A 009F000B 00D1000C  |.......6.............c.......J..|
    +0001C0 20901000  00ED000D 00EC000D 0E0E0E0E F2F740C6  C5C240F0 F74040F1 F17AF4F5 7AF1F840  |............27 FEB 07  11:45:18 |
    +0001E0 20901020  80000117 20900AF0 01000001 20900B78  20901340 00000000 1D020000 20901054  |.......0........... ............|
 ⋮
  DSA for IBMRERRI: 20B42500
    +000000  FLAGS.... 8800      member... 0000      BKC...... 20B42430  FWC...... 20B425C0  R14...... 8001B784
    +000010  R15...... A09D0B48  R0....... 0000000B  R1....... 20B42580  R2....... 0000000A  R3....... 20900EB0
    +000024  R4....... 00025470  R5....... 000254C4  R6....... 20B42330  R7....... 20B42330  R8....... 00000028
    +000038  R9....... 00000008  R10...... A09104D0  R11...... 0001B328  R12...... 2090E9C0  reserved. 00025290
    +00004C  NAB...... 20B425C0  PNAB..... 008FF4E8  reserved. 2090D658  20AF22BC
    +000064  reserved. 2090E9C0  reserved. 20B420F0  MODE..... 20B2FA47  reserved. A09104D0
    +000078  reserved. 00000000  reserved. 20B42838
```

Figure 119. Control blocks for active routines section of the dump (Part 1 of 3)

```
CIB for IBMRERRI: 20B42FC8
  +000000 20B42FC8  C3C9C240 00000000 00000000 010C0004  00000000 00000000 00030119 59C9C2D4  |CIB ........................IBM|
  +000020 20B42FE8  00000000 20B430D8 000301A5 59C9C2D4  00000001 00000015 20B42330 A0B02998  |.......Q...v.IBM..............q|
  +000040 20B43008  00000000 20B42500 8001B784 2090B6F0  0000000A 20B42430 00000000 00000000  |..........d...0................|
  +000060 20B43028  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...............................|
  +000080 20B43048 - +00009F 20B43067           same as above
  +0000A0 20B43068  00000000 00000000 00000000 00000000  06230000 00000FC6 00000001 00000000  |.....................F........|
  +0000C0 20B43088  00000000 00000000 20B42430 20B42500  0001B782 00000000 00000000 00000001  |..................b...........|
  +0000E0 20B430A8  20B42330 0000000A 00000064 00000000  FFFFFFFC 00000000 00000000 00000000  |...............................|
  +000100 20B430C8  00000000 2090B908 00000000 00000000  E9D4C3C8 02000001 0000000B 20B42580  |...............ZMCH...........|

Dynamic save area (IBMRERRI): 20B42500
  +000000 20B42500  88000000 20B42430 20B425C0 8001B784  A09D0B48 0000000B 20B42580 0000000A  |h.............d................|
  +000020 20B42520  20900EB0 00025470 000254C4 20B42330  20B42330 00000028 00000008 A09104D0  |..........D.................j..|
  +000040 20B42540  0001B328 2090E9C0 00025290 20B425C0  008FF4E8 2090D658 00000000 20AF22BC  |......Z..........4Y..O.........|
  +000060 20B42560  A0997C20 2090E9C0 20B420F0 20B2FA47  A09104D0 2090E9C0 00000000 20B42838  |.r@...Z....0.....j....Z.........|
  +000080 20B42580  000254C4 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...D...........................|
  +0000A0 20B425A0  16000000 20909DB0 00000000 80010000  00000000 209D4520 20B2F7B4 2090E200  |........................7...S.|
DSA for LABL1: BEGIN: 20B42430
  +000000  FLAGS.... 8425      member... 0000      BKC...... 20B42330  FWC...... 20B42500  R14...... A0900E08
  +000010  R15...... 0001B328  R0....... 0000000B  R1....... 20900EB0  R2....... A0900DBE  R3....... 20900E40
  +000024  R4....... 00000001  R5....... 20B42330  R6....... 20B42330  R7....... 20B42330  R8....... 00000028
  +000038  R9....... 00000008  R10...... 20B420B0  R11...... 2090102C  R12...... 2090E9C0  reserved. 00025290
  +00004C  NAB...... 20B42500  PNAB..... 20B42500  reserved. 91A091A0  00000000
  +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 00000000
  +000078  reserved. 00000000  reserved. 20B42030
Dynamic save area (LABL1: BEGIN): 20B42430
  +000000 20B42430  84250000 20B42330 20B42500 A0900E08  0001B328 0000000B 20900EB0 A0900DBE  |d..............................|
  +000020 20B42450  20900E40 00000001 20B42330 20B42330  20B42330 00000028 00000008 20B420B0  |... ...........................|
  +000040 20B42470  2090102C 2090E9C0 00025290 20B42500  20B42500 91A091A0 20B42330 00000000  |......Z............j.j.........|
  +000060 20B42490  00000000 00000000 00000000 00000000  00000000 00000200 00000000 20B42030  |...............................|
  +000080 20B424B0  20B42530 A0B02CEC 20B2EA48 00000800  20B420F0 20B420F0 A0B02998 20901340  |..................0...0...q... |
  +0000A0 20B424D0  2090E880 0000000A 00000000 00000000  20AF2CD6 00000027 A0AF0CD8 2090E9C0  |..Y................O.......Q..Z.|
  +0000C0 20B424F0  20B42330 20B42618 00000014 00000000  88000000 20B42430 20B425C0 8001B784  |................h.............d|
DSA for EXAMPLE: 20B42330
  +000000  FLAGS.... C025      member... 0000      BKC...... 20B42178  FWC...... 00000000  R14...... A0900C42
  +000010  R15...... 20900D48  R0....... 20B42430  R1....... 20B42330  R2....... A0900C30  R3....... 20900E40
  +000024  R4....... 00000001  R5....... 20B42330  R6....... 20B42400  R7....... 00000005  R8....... 20900EF8
  +000038  R9....... 00000008  R10...... 20B420B0  R11...... 2090102C  R12...... 2090E9C0  reserved. 00025290
  +00004C  NAB...... 20B42430  PNAB..... 20B42430  reserved. 91E091A0  20900EF8
  +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 20B423E8
  +000078  reserved. 00000000  reserved. 00000000
Dynamic save area (EXAMPLE): 20B42330
  +000000 20B42330  C0250000 20B42178 00000000 A0900C42  20900D48 20B42430 20B42330 A0900C30  |...............................|
  +000020 20B42350  20900E40 00000001 20B42330 20B42400  00000005 20900EF8 00000008 20B420B0  |... ..................8........|
  +000040 20B42370  2090102C 2090E9C0 00025290 20B42430  20B42430 91E091A0 00000000 20900EF8  |......Z............j.j........8|
  +000060 20B42390  00000000 00000000 00000000 00000000  20B423E8 00000200 00000000 00000000  |..................Y............|
  +000080 20B423B0  20B42124 20B42128 20B4212C 20B42130  20B42138 20B42134 20B4213C 00000000  |...............................|
  +0000A0 20B423D0  00000000 00000000 00000000 00000000  00000000 00000000 0C010000 00000000  |...............................|
  +0000C0 20B423F0  20B42400 20900E94 0000000B 00000014  00000002 00000002 00000002 00000002  |.......m.......................|
  +0000E0 20B42410  00000002 00000002 00000002 00000002  00000002 00000002 00000000 00000000  |...............................|
⋮
Dynamic save area (IBMRERRI): 20B42500
  +000000 20B42500  88000000 20B42430 20B425C0 8001B784  A09D0B48 0000000B 20B42580 0000000A  |h.............d................|
  +000020 20B42520  20900EB0 00025470 000254C4 20B42330  20B42330 00000028 00000008 A09104D0  |..........D.................j..|
  +000040 20B42540  0001B328 2090E9C0 00025290 20B425C0  008FF4E8 2090D658 00000000 20AF22BC  |......Z..........4Y..O.........|
  +000060 20B42560  A0997C20 2090E9C0 20B420F0 20B2FA47  A09104D0 2090E9C0 00000000 20B42838  |.r@...Z....0.....j....Z.........|
  +000080 20B42580  000254C4 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...D...........................|
  +0000A0 20B425A0  16000000 20909DB0 00000000 80010000  00000000 209D4520 20B2F7B4 2090E200  |........................7...S.|
DSA for LABL1: BEGIN: 20B42430
  +000000  FLAGS.... 8425      member... 0000      BKC...... 20B42330  FWC...... 20B42500  R14...... A0900E08
  +000010  R15...... 0001B328  R0....... 0000000B  R1....... 20900EB0  R2....... A0900DBE  R3....... 20900E40
  +000024  R4....... 00000001  R5....... 20B42330  R6....... 20B42330  R7....... 20B42330  R8....... 00000028
  +000038  R9....... 00000008  R10...... 20B420B0  R11...... 2090102C  R12...... 2090E9C0  reserved. 00025290
  +00004C  NAB...... 20B42500  PNAB..... 20B42500  reserved. 91A091A0  00000000
  +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 00000000
  +000078  reserved. 00000000  reserved. 20B42030
```

Figure 120. Control blocks for active routines section of the dump (Part 2 of 3)

```
Dynamic save area (LABL1: BEGIN): 20B42430
  +000000 20B42430  84250000 20B42330 20B42500 A0900E08  0001B328 0000000B 20900EB0 A0900DBE  |d..............................|
  +000020 20B42450  20900E40 00000001 20B42330 20B42330  20B42330 00000028 00000008 20B420B0  |... ...........................|
  +000040 20B42470  2090102C 2090E9C0 00025290 20B42500  20B42500 91A091A0 20B42330 00000000  |......Z............j.j.........|
  +000060 20B42490  00000000 00000000 00000000 00000000  00000000 00000200 00000000 20B42030  |...............................|
  +000080 20B424B0  20B42530 A0B02CEC 20B2EA48 00000800  20B420F0 20B420F0 A0B02998 20901340  |..................0...0...q... |
  +0000A0 20B424D0  2090E880 0000000A 00000000 00000000  20AF2CD6 00000027 A0AF0CD8 2090E9C0  |..Y................O.......Q..Z.|
  +0000C0 20B424F0  20B42330 20B42618 00000014 00000000  88000000 20B42430 20B425C0 8001B784  |................h.............d|
DSA for EXAMPLE: 20B42330
  +000000  FLAGS.... C025      member... 0000      BKC...... 20B42178  FWC...... 00000000  R14...... A0900C42
  +000010  R15...... 20900D48  R0....... 20B42430  R1....... 20B42330  R2....... A0900C30  R3....... 20900E40
  +000024  R4....... 00000001  R5....... 20B42330  R6....... 20B42400  R7....... 00000005  R8....... 20900EF8
  +000038  R9....... 00000008  R10...... 20B420B0  R11...... 2090102C  R12...... 2090E9C0  reserved. 00025290
  +00004C  NAB...... 20B42430  PNAB..... 20B42430  reserved. 91E091A0  20900EF8
  +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 20B423E8
  +000078  reserved. 00000000  reserved. 00000000
Dynamic save area (EXAMPLE): 20B42330
  +000000 20B42330  C0250000 20B42178 00000000 A0900C42  20900D48 20B42430 20B42330 A0900C30  |...............................|
  +000020 20B42350  20900E40 00000001 20B42330 20B42400  00000005 20900EF8 00000008 20B420B0  |... ..................8........|
  +000040 20B42370  2090102C 2090E9C0 00025290 20B42430  20B42430 91E091A0 00000000 20900EF8  |......Z............j.j........8|
  +000060 20B42390  00000000 00000000 00000000 00000000  20B423E8 00000200 00000000 00000000  |..................Y............|
  +000080 20B423B0  20B42124 20B42128 20B4212C 20B42130  20B42138 20B42134 20B4213C 00000000  |...............................|
  +0000A0 20B423D0  00000000 00000000 00000000 00000000  00000000 00000000 0C010000 00000000  |...............................|
  +0000C0 20B423F0  20B42400 20900E94 0000000B 00000014  00000002 00000002 00000002 00000002  |.......m.......................|
  +0000E0 20B42410  00000002 00000002 00000002 00000002  00000002 00000002 00000000 00000000  |...............................|
⋮
```

Figure 121. Control blocks for active routines section of the dump (Part 3 of 3)

Automatic variables

To find automatic variables, use an offset from the stack frame of the block in which they are declared. This information appears in the variable storage map generated when the MAP compiler option is in effect. If you have not used the MAP option, you can determine the offset by studying the listing of compiled code instructions.

Static variables

If your routine is compiled with the MAP option, you can find static variables by using an offset in the variable storage map. If the MAP option is not in effect, you can determine the offset by studying the listing of compiled code.

Based variables

To locate based variables, use the value of the defining pointer. Find this value by using one of the methods described above to find static and automatic variables. If the pointer is itself based, you must find its defining pointer and follow the chain until you find the correct value. The following is an example of typical code for X BASED (P), with P AUTOMATIC:

```
58 60 D 0C8        L 6,P

58 E0 6 000        L 14,X
```

P is held at offset X'C8' from register 13. This address points to X.

Take care when examining a based variable to ensure that the pointers are still valid.

Area variables

Area variables are located using one of the methods described above, according to their storage class. The following is an example of typical code: for an area variable A declared AUTOMATIC:

```
41 60 D 0F8        LA 6,A
```

The area starts at offset X'F8' from register 13.

Variables in areas

To find variables in areas, locate the area and use the offset to find the variable.

Contents of parameter lists

To find the contents of a passed parameter list, first find the register 1 value in the save area of the calling routine's stack frame. Use this value to locate the parameter list in the dump. If R1=0, no parameters passed. For additional information about parameter lists, see the IBM Enterprise PL/I for z/OS library (www.ibm.com/support/docview.wss?uid=swg27036735).

Timestamp

If the TSTAMP compiler installation option is in effect, the date and time of compilation appear within the last 32 bytes of the static internal control section. The last three bytes of the first *word* give the offset to this information. The offset indicates the end of the timestamp. Register 3 addresses the static internal control section. If the BLOCK option is in effect, the timestamp appears in the static storage section of the dump.

Control blocks associated with the thread

This section of the dump, shown in Figure 122 on page 276, includes information about PL/I for MVS & VM fields of the CAA and other control block information.

```
  Control Blocks Associated with the Thread:
    CAA: 2090E9C0
      +000000 2090E9C0  00000000 00025658 20B42018 20B62018  00000000 2090E9D0 00000000 000251B0  |.....................Z.........|
      +000020 2090E9E0  00000000 00000000 00025030 00000000  00025240 00000000 00025208 00000000  |..........&........ ...........|
      +000040 2090EA00  000251D0 00000000 00020028 00000000  00020AB0 00019D38 00000000 00000000  |...............................|
      +000060 2090EA20  00000000 00019CB8 00025658 0001FB70  0001FEE0 80014608 0001B328 70002323  |...............................|
⋮
    DUMMY DSA: 2090F360
      +000000  FLAGS.... 0000      member... 0000      BKC...... 00006F60  FWC...... 20B42030  R14...... A0900D66
      +000010  R15...... A098DDB8  R0....... 7D000008  R1....... 2090D778  R2....... 00000000  R3....... 00000000
      +000024  R4....... 00000000  R5....... 00000000  R6....... 00000000  R7....... A09104D0  R8....... 20900808
      +000038  R9....... 008DCCD0  R10...... 00000000  R11...... A0900C92  R12...... 2090E9C0  reserved. 00025290
      +00004C  NAB...... 20B42030  PNAB..... 20B42030  reserved. 00000000  00000000
      +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 00000000
      +000078  reserved. 00000000  reserved. 00000000
    PL/I TCA Appendage: 00025030
      +000000 00025030  00000000 00000000 00000000 00000030  00000000 00000000 00000000 00000000  |...............................|
      +000020 00025050  000251E8 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...Y...........................|
      +000040 00025070  00000000 00000000 00000000 00000000  2090E9C0 00000000 00000000 00000000  |.................Z.............|
      +000060 00025090  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...............................|
      +000080 000250B0 - +0000BF 000250EF             same as above
      +0000C0 000250F0  00000000 00000000 00000000 00000000  00000000 00000000 20900838 00000000  |...............................|
      +0000E0 00025110  00000000 00000000 00000000 00000000  00000000 00000000 7FFFFFFF 00000000  |........................"......|
      +000100 00025130  00000000 00000000 00000000 00000000  00000000 00000000 00000000 20B3E034  |...............................|
      +000120 00025150  00000000 0000FB00 0002519D 00008000  0002519C 00010000 0002519D 00008000  |...............................|
      +000140 00025170  0002519D 00008000 0002519D 00008000  00000000 00000000 00000000 00000000  |...............................|
      +000160 00025190  00000000 00000000 00000000 40000000  00000000 00000000 00000000 00000000  |........... ...................|
      +000180 000251B0  00010000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...............................|
      +0001A0 000251D0  00000000 000076B6 00000000 00000000  00000000 00000000 80C16800 20B45A68  |.......................A....!.|
      +0001C0 000251F0  00000000 209004A8 00000000 00000000  00000000 00000000 00000000 00000000  |.......y.......................|
      +0001E0 00025210  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...............................|
      +000200 00025230 - +00023F 0002526F             same as above
      +000240 00025270  00000000 00000000 00000000 00000000  00000000 00000000 D7404040 E9D3E6E2  |.......................P   ZLWS|
      +000260 00025290  080001E0 20B42460 00000000 5E007744  00CBA600 00027290 00029F78 A090055C  |.......-....;.....w...........*|
      +000280 000252B0  800076BC 00028004 00000015 00029F78  00028004 00028090 00000008 00000010  |...............................|
      +0002A0 000252D0  20B42538 2090E9C0 00025380 20B42560  00000000 00000000 000000B4 00000000  |......Z........-...............|
      +0002C0 000252F0  00000000 00150000 00000000 00000000  00000000 00000000 00000000 00000000  |...............................|
      +0002E0 00025310  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...............................|
      +000300 00025330 - +00033F 0002536F             same as above
      +000340 00025370  00000000 00000000 00000000 00000000  080000F0 00000000 00000000 00000000  |..................0............|
      +000360 00025390  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...............................|
      +000380 000253B0  00000000 00000000 00000000 00000000  00000000 00000000 00025380 00000000  |...............................|
      +0003A0 000253D0  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...............................|
      +0003C0 000253F0 - +00043F 0002546F             same as above
      +000440 00025470  00025150 02000000 00000000 00000000  00000000 00010000 00000000 00000000  |...&...........................|
      +000460 00025490  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...............................|
      +000480 000254B0  00000000 00000000 00000000 40000000  0000000C 00030119 59C9C2D4 00000000  |............ ...........IBM....|
      +0004A0 000254D0  00000000 00025670 00000000 A0B1C156  8000FCD8 00025558 00025524 20B45940  |..............A....Q.......... |
      +0004C0 000254F0  A0B1C0A6 00000064 00000000 209005A8  20B457F0 20B45A30 20B45A60 00000000  |...w..........y...0..!...!-....|
      +0004E0 00025510  0001AF4F 2090E9C0 00000000 00000000  8000FCD8 00025544 00025548 0002554C  |...|..Z............Q..........<|
      +000500 00025530  00025550 00025554 00025558 0002555C  00025560 20B1C220 00000008 00000000  |...&...........*...-..B........|
      +000520 00025550  00000000 800075B0 00000100 00000000  00000000 00000000 00000000 00000000  |...............................|
      +000540 00025570  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...............................|
      +000560 00025590 - +00061F 0002564F             same as above
      +000620 00025650  00019CB8 00028004 00020AE8 00020AE8  00020AE8 00000000 00025000 00000248  |...........Y...Y...Y......&.....|

  Enclave Control Blocks:
    EDB: 2090D658
      +000000 2090D658  C3C5C5C5 C4C24040 C0000001 2090E880  2090DD60 00000000 00000000 00000000  |CEEEDB  ......Y....-............|
      +000020 2090D678  2090DB68 2090DB98 A09104D0 2090D1A8  00000000 00000000 2090D778 00000000  |.......q.j....Jy..........P.....|
      +000040 2090D698  00000000 00000000 00006F60 00000000  00000000 A0A2E878 20909880 2090D6B0  |..........?-.........sY...q...O.|
      +000060 2090D6B8  0000F460 00000000 00000000 00000000  00000000 00000000 20AEF660 2090E9C0  |..4-......................6-..Z.|
      +000080 2090D6D8  40000000 0000FAF6 00000000 00000000  00000001 0002A060 00006FF8 008FF4E8  | ......6...............-..?8..4Y|
      +0000A0 2090D6F8  00000001 00000100 20909988 2090D700  00000000 00000000 00000000 00000001  |..........rh..P.................|
    MEML: 2090E880
      +000000 2090E880  00000000 00000000 20990160 00000000  00000000 00000000 20990160 00000000  |.........r.-.............r.-....|
      +000020 2090E8A0 - +00009F 2090E91F             same as above
      +0000A0 2090E920  00000000 00000000 A0B02998 00000000  00000000 00000000 20990160 00000000  |...........q.............r.-....|
      +0000C0 2090E940  00000000 00000000 20990160 00000000  00000000 00000000 20990160 00000000  |.........r.-.............r.-....|
      +0000E0 2090E960 - +00011F 2090E99F             same as above
```

Figure 122. Control blocks associated with the thread section of the dump (Part 1 of 2)

```
  File Status and Attributes:
    Attributes of file: SYSPRINT
     STREAM OUTPUT PRINT ENVIRONMENT( VB BLKSIZE(129) RECSIZE(125) BUFFERS(1) )
    Contents of buffers
    BUFFER: 00029F78
      +000000 00029F78  000E0000 40E2A482 F140E2A3 8199A389  95874087 40000000 00000000 00000000  |.... Sub1 Starting g ...........|
      +000020 00029F98  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...............................|
      +000040 00029FB8 - +00007F 00029FF7             same as above
      +000080 00029FF8  00000000 00000000 D4C4E2E3 01004000  00000000 0002C000 E2E8E2D6 E4E34040  |........MDST.. .........SYSOUT  |

  File Control Blocks:
    FILE CONTROL BLOCK (FCB): 00028004
      +000000 00028004  00000000 00000000 0001D170 000076B4  000280F4 00028090 00000000 00000000  |..........J........4............|
      +000020 00028024  00000000 49291100 50000000 00000004  00810000 00000079 00029F78 E3E50114  |........&........a..........TV..|
      +000040 00028044  00000000 00000000 00000000 00029F8B  006A0001 003C0078 0002007D 00000000  |...........................'....|
      +000060 00028064  00000000 00000000 00000000 20B42538  00000000 00000000 00000000 00000000  |...............................|
    DATA CONTROL BLOCK (DCB): 00028090
      +000000 00028090  00000000 00000000 00000000 01000000  00020000 01029F70 00814000 00006DE0  |........................a ..._.|
      +000020 000280B0  42007DB0 54000000 00540048 008CC038  92CBA600 00000001 000078D6 08090081  |..'.............k.w........O...a|
      +000040 000280D0  00000000 00006C80 00029FF5 00029FF5  0000007D 80000001 00000000 00000001  |......%....5...5...'............|
    DECLARE CONTROL BLOCK (DCLCB): 000280F4
      +000000 000280F4  FFFFFFFC 41201000 02D70F00 00000000  00000014 0008E2E8 E2D7D9C9 D5E30000  |.........P............SYSPRINT..|

 Process Control Blocks:

  PCB: 2090D1A8
    +000000 2090D1A8  C3C5C5D7 C3C24040 03030288 00000000  00000000 00000000 2090D3E0 A0AF24D0  |CEEPCB  ...h..............L.....|
    +000020 2090D1C8  A0AE8B50 A0AEFA08 A0AEF528 20907AE8  2090CF78 00000000 00000000 2090D658  |...&......5...:Y..............O.|
    +000040 2090D1E8  A0AEF858 7F800000 00000000 000141D4  00000000 80000000 00000000 00000000  |..8."..........M................|

  MEML: 2090D3E0
    +000000 2090D3E0  00000000 00000000 20990160 00000000  00000000 00000000 20990160 00000000  |.........r.-.............r.-....|
    +000020 2090D400 - +00009F 2090D47F             same as above
    +0000A0 2090D480  00024038 00000000 A0B02998 00000000  00000000 00000000 20990160 00000000  |.. ........q.............r.-....|
    +0000C0 2090D4A0  00000000 00000000 20990160 00000000  00000000 00000000 20990160 00000000  |.........r.-.............r.-....|
    +0000E0 2090D4C0 - +00011F 2090D4FF             same as above

  PL/I Process Control Block: 00024038
    +000000 00024038  E9D7D9C2 40404040 00024000 00028004  00000000 00000000 00019CB8 00000000  |ZPRB    .. .....................|
    +000020 00024058  00000000 00000000 00000000 80000000  00000000 00000000 00000000 00000000  |...............................|
    +000040 00024078  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...............................|
 CEE3846I CEEDUMP Processing completed.
```

Figure 123. Control blocks associated with the thread section of the dump (Part 2 of 2)

CAA address

The address of the CAA control block appears in this section of the dump. If the BLOCK option is in effect, the complete CAA (including the PL/I for MVS & VM implementation appendage) appears separately from the body of the dump. Register 12 addresses the CAA.

File status and attribute information

This part of the dump includes the following information:

- The default and declared attributes of all open files
- Buffer contents of all file buffers
- The contents of FCBs, DCBs, DCLCBs, IOCBs, and control blocks for the process or enclave

PL/I for MVS & VM contents of the Language Environment trace table

Language Environment provides three PL/I for MVS & VM trace table entry types that contain character data:

- Trace entry 100 occurs when a task is created.
- Trace entry 101 occurs when a task that contains the tasking CALL statements is terminated.
- Trace entry 102 occurs when a task that does not contain a tasking CALL statement is terminated.

The format for trace table entries 100, 101, and 102 is shown in the following example. For more information about the Language Environment trace table format, see "Understanding the trace table entry (TTE)" on page 151.

```
-->(100) NameOfCallingTask NameOfCalledTask OffsetOfCallStmt
            UserAgrPtr CalledTaskPtr TaskVarPtr EventVarPtr
            PriorityPtr CallingR2-R5 CallingR12-R14

-->(101) NameOfReturnTask ReturnerR2-R5 ReturnerR12-R14

-->(102) NameOfReturnTask
```

Debugging example of PL/I for MVS & VM routines

This section contains examples of PL/I for MVS & VM routines and instructions for using information in the Language Environment dump to debug them. Important areas in the source code and in the dump for each routine are highlighted.

Subscript range error

The following example illustrates an error caused by an array subscript value outside the declared range. In this example, the declared array value is 10. This routine was compiled with the options LIST, TEST, GOSTMT, and MAP. It was run with the TERMTHDACT(TRACE) option to generate a traceback for the condition.

```
5688-235 IBM PL/I for MVS & VM          Ver 1 Rel 1 Mod 1                              27 FEB 07
11:45:18     PAGE   1
OPTIONS
SPECIFIED

*PROCESS  GOSTMT LIST S STG TEST MAP
NOOPTIONS;
5688-235 IBM PL/I for MVS & VM          EXAMPLE:  PROC
OPTIONS(MAIN);                                         PAGE   2
                    SOURCE
LISTING

STMT



       1  EXAMPLE:  PROC
OPTIONS(MAIN);
```

```
       2      DCL Array(10) Fixed
bin(31);
       3      DCL (I,Array_End)   Fixed
bin(31);
       4      On
error

Begin;

       5          On error
system;
       6          Call plidump('tbnfs','Plidump called from error On-
unit');
       7
End;


       8      (subrg):              /* Enable subscriptrange condition
*/
              Labl1:
Begin;

       9        Array_End =
20;
      10        Do I = 1 to Array_End;   /* Loop to initialize array
*/
      11          Array(I) = 2;    /* Set array elements to 2
*/
      12
End;

      13      End
Labl1;

      14   End
Example;
⋮

5688-235 IBM PL/I for MVS & VM          EXAMPLE:  PROC
OPTIONS(MAIN);                                         PAGE   5
                                  VARIABLE STORAGE
MAP
IDENTIFIER                        LEVEL         OFFSET       (HEX)   CLASS
BLOCK


I                                    1            200          C8   AUTO
EXAMPLE
ARRAY_END                            1            204          CC   AUTO
EXAMPLE
ARRAY                                1            208          D0   AUTO
EXAMPLE
5688-235 IBM PL/I for MVS & VM          EXAMPLE:  PROC
OPTIONS(MAIN);                                         PAGE   6
```

The following examples show sections of the dump generated by a call to PLIDUMP.

```
CEE3DMP V1 R9.0: Plidump called from error On-unit                              02/27/07 11:45:20 AM               Page:    1
ASID: 003E   Job ID: JOB21950   Job name: LEDGSMP1   Step name: GO        UserID: HEALY

CEE3845I CEEDUMP Processing started.
PLIDUMP was called from statement number 6 at offset +000000D6 from ERR  ON-unit with entry address 20900C58

Information for enclave EXAMPLE

  Information for thread 8000000000000000

  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     CEEKKMRA    +0000081C              CEEPLPKA             CEEKKMRA                       D1908    Call
    2     IBMRKDM     +000000C2              IBMREV10             IBMRKDM                                 Call
    3     ERR  ON-unit+000000D6  6           EXAMPLE              EXAMPLE                                 Call
    4     IBMRERPL    +0000065A              IBMRLIB1             IBMRERPL                                Call
    5     CEEEV010    +0000013A              IBMREV10             CEEEV010                                Call
    6     CEEHDSP     +000017D0              CEEPLPKA             CEEHDSP                        D1908    Call
    7     IBMRERRI    +0000045A              IBMRLIB1             IBMRERRI                                Exception
    8     LABL1: BEGIN+000000BE  11          EXAMPLE              EXAMPLE                                 Call
    9     EXAMPLE     +000000C8  8           EXAMPLE              EXAMPLE                                 Call
    10    IBMRPMIA    +0000051E              IBMRLIB1             IBMRPMIA                                Call
    11    CEEEV010    +00000310              IBMREV10             CEEEV010                                Call
    12    CEEBBEXT    +000001B6              CEEPLPKA             CEEBBEXT                       D1908    Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     20B45B88   209F0420   209F0420   +0000081C  20061214   CEL
    2     00025670   20B1C0A0   20B1C0A0   +000000C2  ********   OS PL/I
    3     20B45A88   20900C58   20900B70   +000001BE  ********   OS PL/I
    4     20B45850   00019F50   00019F50   +0000065A  20061213   LIBRARY
    5     20B457C8   20B02998   20B02998   +0000013A  20061213   LIBRARY
    6     20B426A8   209BF068   209BF068   +000017D0  20061215   CEL
    7     20B42500   0001B328   0001B328   +0000045A  20061213   LIBRARY
    8     20B42430   20900D48   20900B70   +00000296  ********   OS PL/I
    9     20B42330   20900B78   20900B70   +000000D0  ********   OS PL/I
    10    20B42178   000201D0   000201D0   +0000051E  20061214   LIBRARY
    11    20B420F0   20B02998   20B02998   +00000310  20061213   LIBRARY
    12    20B42030   2098DDB8   2098DDB8   +000001B6  20061215   CEL

  Condition Information for Active Routines
    Condition Information for IBMRERRI (DSA address 20B42500)
      CIB Address: 20B42FC8
      Current Condition:
        IBM0281S A prior condition was promoted to the ERROR condition.
      Original Condition:
        IBM0421S  ONCODE=520  The SUBSCRIPTRANGE condition was raised.
      Location:
        Program Unit: IBMRERRI Entry: IBMRERRI Statement:  Offset: +0000045A

    Storage dump near condition, beginning at location: 0001B772
      +000000 0001B772  5050D080 58A0C2B8 58F0A01C 4110D080  05EF9108 404F4710 B4709104 404F47E0  |&&....B..0........j. |....j. |..|

  Control Blocks for Active Routines:
:
    DSA for CEEHDSP: 20B426A8
      +000000  FLAGS.... 0808      member... CEE1      BKC...... 20B42500  FWC...... 20B457C8  R14...... A09C083A
      +000010  R15...... A0B02998  R0....... 00000020  R1....... 2090B2E8  R2....... 20B42FC8  R3....... 20B42330
      +000024  R4....... 209C3C94  R5....... FFFFFF20  R6....... 00000001  R7....... 00000007  R8....... A09C0542
      +000038  R9....... 20B446A6  R10...... 20B436A7  R11...... A09BF068  R12...... 2090E9C0  reserved. 00025670
      +00004C  NAB...... 20B457C8  PNAB..... 00000000  reserved. 00000000  20B4271C
      +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 00000000
      +000078  reserved. 00000000  reserved. 00000000
    DSA for IBMRERRI: 20B42500
      +000000  FLAGS.... 8800      member... 0000      BKC...... 20B42430  FWC...... 20B425C0  R14...... 8001B784
      +000010  R15...... A09D0B48  R0....... 0000000B  R1....... 20B42580  R2....... 0000000A  R3....... 20900EB0
      +000024  R4....... 00025470  R5....... 000254C4  R6....... 20B42330  R7....... 20B42330  R8....... 00000028
      +000038  R9....... 00000008  R10...... A09104D0  R11...... 0001B328  R12...... 2090E9C0  reserved. 00025290
      +00004C  NAB...... 20B425C0  PNAB..... 008FF4E8  reserved. 2090D658  20AF22BC
      +000064  reserved. 2090E9C0  reserved. 20B420F0  MODE..... 20B2FA47  reserved. A09104D0
      +000078  reserved. 00000000  reserved. 20B42838
```

Figure 124. Sections of the Language Environment dump (Part 1 of 2)

```
    CIB for IBMRERRI: 20B42FC8
      +000000 20B42FC8  C3C9C240 00000000 00000000 010C0004  00000000 00000000 00030119 59C9C2D4  |CIB ........................IBM|
      +000020 20B42FE8  00000000 20B430D8 000301A5 59C9C2D4  00000001 00000015 20B42330 A0B02998  |.......Q...v.IBM..............q|
      +000040 20B43008  00000000 20B42500 8001B784 2090B6F0  0000000A 20B42430 00000000 00000000  |..........d...0................|
      +000060 20B43028  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...............................|
      +000080 20B43048 - +00009F 20B43067             same as above
      +0000A0 20B43068  00000000 00000000 00000000 00000000  06230000 00000FC6 00000001 00000000  |......................F........|
      +0000C0 20B43088  00000000 00000000 20B42430 20B42500  0001B782 00000000 00000000 00000001  |..................b............|
      +0000E0 20B430A8  20B42330 0000000A 00000064 00000000  FFFFFFFC 00000000 00000000 00000000  |...............................|
      +000100 20B430C8  00000000 2090B908 00000000 00000000  E9D4C3C8 02000001 0000000B 20B42580  |................ZMCH...........|
    Dynamic save area (IBMRERRI): 20B42500
      +000000 20B42500  88000000 20B42430 20B425C0 8001B784  A09D0B48 0000000B 20B42580 0000000A  |h.............d................|
      +000020 20B42520  20900EB0 00025470 000254C4 20B42330  20B42330 00000028 00000008 A09104D0  |..........D.................j..|
      +000040 20B42540  0001B328 2090E9C0 00025290 20B425C0  008FF4E8 2090D658 00000000 20AF22BC  |......Z...........4Y..O........|
      +000060 20B42560  A0997C20 2090E9C0 20B420F0 20B2FA47  A09104D0 2090E9C0 00000000 20B42838  |.r@...Z....0.....j....Z........|
      +000080 20B42580  000254C4 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...D...........................|
      +0000A0 20B425A0  16000000 20909DB0 00000000 80010000  00000000 209D4520 20B2F7B4 2090E200  |.........................7...S.|
    DSA for LABL1: BEGIN: 20B42430
      +000000  FLAGS.... 8425      member... 0000      BKC...... 20B42330  FWC...... 20B42500  R14...... A0900E08
      +000010  R15...... 0001B328  R0....... 0000000B  R1....... 20900EB0  R2....... A0900DBE  R3....... 20900E40
      +000024  R4....... 00000001  R5....... 20B42330  R6....... 20B42330  R7....... 20B42330  R8....... 00000028
      +000038  R9....... 00000008  R10...... 20B420B0  R11...... 2090102C  R12...... 2090E9C0  reserved. 00025290
      +00004C  NAB...... 20B42500  PNAB..... 20B42500  reserved. 91A091A0  00000000
      +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 00000000
      +000078  reserved. 00000000  reserved. 20B42030
    Dynamic save area (LABL1: BEGIN): 20B42430
      +000000 20B42430  84250000 20B42330 20B42500 A0900E08  0001B328 0000000B 20900EB0 A0900DBE  |d..............................|
      +000020 20B42450  20900E40 00000001 20B42330 20B42330  20B42330 00000028 00000008 20B420B0  |... ...........................|
      +000040 20B42470  2090102C 2090E9C0 00025290 20B42500  20B42500 91A091A0 20B42330 00000000  |......Z.............j.j........|
      +000060 20B42490  00000000 00000000 00000000 00000000  00000000 00000200 00000000 20B42030  |...............................|
      +000080 20B424B0  20B42530 A0B02CEC 20B2EA48 00000800  20B420F0 20B420F0 A0B02998 20901340  |..................0...0...q... |
      +0000A0 20B424D0  2090E880 0000000A 00000000 00000000  20AF2CD6 00000027 A0AF0CD8 2090E9C0  |..Y................O.......Q..Z.|
      +0000C0 20B424F0  20B42330 20B42618 00000014 00000000  88000000 20B42430 20B425C0 8001B784  |................h..............d|
    DSA for EXAMPLE: 20B42330
      +000000  FLAGS.... C025      member... 0000      BKC...... 20B42178  FWC...... 00000000  R14...... A0900C42
      +000010  R15...... 20900D48  R0....... 20B42430  R1....... 20B42330  R2....... A0900C30  R3....... 20900E40
      +000024  R4....... 00000001  R5....... 20B42330  R6....... 20B42400  R7....... 00000005  R8....... 20900EF8
      +000038  R9....... 00000008  R10...... 20B420B0  R11...... 2090102C  R12...... 2090E9C0  reserved. 00025290
      +00004C  NAB...... 20B42430  PNAB..... 20B42430  reserved. 91E091A0  20900EF8
      +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 20B423E8
      +000078  reserved. 00000000  reserved. 00000000
    Dynamic save area (EXAMPLE): 20B42330
      +000000 20B42330  C0250000 20B42178 00000000 A0900C42  20900D48 20B42430 20B42330 A0900C30  |...............................|
      +000020 20B42350  20900E40 00000001 20B42330 20B42400  00000005 20900EF8 00000008 20B420B0  |... ..................8........|
      +000040 20B42370  2090102C 2090E9C0 00025290 20B42430  20B42430 91E091A0 00000000 20900EF8  |......Z.............j.j.......8|
      +000060 20B42390  00000000 00000000 00000000 00000000  20B423E8 00000200 00000000 00000000  |...................Y...........|
      +000080 20B423B0  20B42124 20B42128 20B4212C 20B42130  20B42138 20B42134 20B4213C 00000000  |...............................|
      +0000A0 20B423D0  00000000 00000000 00000000 00000000  00000000 00000000 0C010000 00000000  |...............................|
      +0000C0 20B423F0  20B42400 20900E94 0000000B 00000014  00000002 00000002 00000002 00000002  |.......m.......................|
      +0000E0 20B42410  00000002 00000002 00000002 00000002  00000002 00000002 00000000 00000000  |...............................|
:
```

Figure 125. Sections of the Language Environment dump (Part 2 of 2)

```
CEE3DMP V1 R9.0: Plidump called from error On-unit                              02/27/07 11:45:20 AM               Page:    1
ASID: 003E   Job ID: JOB21950   Job name: LEDGSMP1   Step name: GO        UserID: HEALY

CEE3845I CEEDUMP Processing started.
PLIDUMP was called from statement number 6 at offset +000000D6 from ERR  ON-unit with entry address 20900C58

Information for enclave EXAMPLE

  Information for thread 8000000000000000

  Traceback:
```

```
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     CEEKKMRA    +0000081C              CEEPLPKA             CEEKKMRA                       D1908    Call
    2     IBMRKDM     +000000C2              IBMREV10             IBMRKDM                                 Call
    3     ERR  ON-unit+000000D6  6           EXAMPLE              EXAMPLE                                 Call
    4     IBMRERPL    +0000065A              IBMRLIB1             IBMRERPL                                Call
    5     CEEEV010    +0000013A              IBMREV10             CEEEV010                                Call
    6     CEEHDSP     +000017D0              CEEPLPKA             CEEHDSP                        D1908    Call
    7     IBMRERRI    +0000045A              IBMRLIB1             IBMRERRI                                Exception
    8     LABL1: BEGIN+000000BE  11          EXAMPLE              EXAMPLE                                 Call
    9     EXAMPLE     +000000C8  8           EXAMPLE              EXAMPLE                                 Call
    10    IBMRPMIA    +0000051E              IBMRLIB1             IBMRPMIA                                Call
    11    CEEEV010    +00000310              IBMREV10             CEEEV010                                Call
    12    CEEBBEXT    +000001B6              CEEPLPKA             CEEBBEXT                       D1908    Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     20B45B88   209F0420   209F0420   +0000081C  20061214   CEL
    2     00025670   20B1C0A0   20B1C0A0   +000000C2  ********   OS PL/I
    3     20B45A88   20900C58   20900B70   +000001BE  ********   OS PL/I
    4     20B45850   00019F50   00019F50   +0000065A  20061213   LIBRARY
    5     20B457C8   20B02998   20B02998   +0000013A  20061213   LIBRARY
    6     20B426A8   209BF068   209BF068   +000017D0  20061215   CEL
    7     20B42500   0001B328   0001B328   +0000045A  20061213   LIBRARY
    8     20B42430   20900D48   20900B70   +00000296  ********   OS PL/I
    9     20B42330   20900B78   20900B70   +000000D0  ********   OS PL/I
    10    20B42178   000201D0   000201D0   +0000051E  20061214   LIBRARY
    11    20B420F0   20B02998   20B02998   +00000310  20061213   LIBRARY
    12    20B42030   2098DDB8   2098DDB8   +000001B6  20061215   CEL

  Condition Information for Active Routines
    Condition Information for IBMRERRI (DSA address 20B42500)
      CIB Address: 20B42FC8
      Current Condition:
        IBM0281S A prior condition was promoted to the ERROR condition.
      Original Condition:
        IBM0421S  ONCODE=520  The SUBSCRIPTRANGE condition was raised.
      Location:
        Program Unit: IBMRERRI Entry: IBMRERRI Statement:  Offset: +0000045A

    Storage dump near condition, beginning at location: 0001B772
      +000000 0001B772  5050D080 58A0C2B8 58F0A01C 4110D080  05EF9108 404F4710 B4709104 404F47E0  |&&....B..0........j. |....j. |..|

  Control Blocks for Active Routines:
⋮
    DSA for CEEHDSP: 20B426A8
      +000000  FLAGS.... 0808      member... CEE1      BKC...... 20B42500  FWC...... 20B457C8  R14...... A09C083A
      +000010  R15...... A0B02998  R0....... 00000020  R1....... 2090B2E8  R2....... 20B42FC8  R3....... 20B42330
      +000024  R4....... 209C3C94  R5....... FFFFFF20  R6....... 00000001  R7....... 00000007  R8....... A09C0542
      +000038  R9....... 20B446A6  R10...... 20B436A7  R11...... A09BF068  R12...... 2090E9C0  reserved. 00025670
      +00004C  NAB...... 20B457C8  PNAB..... 00000000  reserved. 00000000  20B4271C
      +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 00000000
      +000078  reserved. 00000000  reserved. 00000000
    DSA for IBMRERRI: 20B42500
      +000000  FLAGS.... 8800      member... 0000      BKC...... 20B42430  FWC...... 20B425C0  R14...... 8001B784
      +000010  R15...... A09D0B48  R0....... 0000000B  R1....... 20B42580  R2....... 0000000A  R3....... 20900EB0
      +000024  R4....... 00025470  R5....... 000254C4  R6....... 20B42330  R7....... 20B42330  R8....... 00000028
      +000038  R9....... 00000008  R10...... A09104D0  R11...... 0001B328  R12...... 2090E9C0  reserved. 00025290
      +00004C  NAB...... 20B425C0  PNAB..... 008FF4E8  reserved. 2090D658  20AF22BC
      +000064  reserved. 2090E9C0  reserved. 20B420F0  MODE..... 20B2FA47  reserved. A09104D0
      +000078  reserved. 00000000  reserved. 20B42838
```

```
    CIB for IBMRERRI: 20B42FC8
      +000000 20B42FC8  C3C9C240 00000000 00000000 010C0004  00000000 00000000 00030119 59C9C2D4  |CIB .........................IBM|
      +000020 20B42FE8  00000000 20B430D8 000301A5 59C9C2D4  00000001 00000015 20B42330 A0B02998  |.......Q...v.IBM...............q|
      +000040 20B43008  00000000 20B42500 8001B784 2090B6F0  0000000A 20B42430 00000000 00000000  |...........d...0................|
      +000060 20B43028  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000080 20B43048 - +00009F 20B43067             same as above
      +0000A0 20B43068  00000000 00000000 00000000 00000000  06230000 00000FC6 00000001 00000000  |.......................F........|
      +0000C0 20B43088  00000000 00000000 20B42430 20B42500  0001B782 00000000 00000000 00000001  |...................b............|
      +0000E0 20B430A8  20B42330 0000000A 00000064 00000000  FFFFFFFC 00000000 00000000 00000000  |................................|
      +000100 20B430C8  00000000 2090B908 00000000 00000000  E9D4C3C8 02000001 0000000B 20B42580  |................ZMCH............|
    Dynamic save area (IBMRERRI): 20B42500
      +000000 20B42500  88000000 20B42430 20B425C0 8001B784  A09D0B48 0000000B 20B42580 0000000A  |h..............d................|
      +000020 20B42520  20900EB0 00025470 000254C4 20B42330  20B42330 00000028 00000008 A09104D0  |...........D.................j..|
      +000040 20B42540  0001B328 2090E9C0 00025290 20B425C0  008FF4E8 2090D658 00000000 20AF22BC  |......Z...........4Y..O.........|
      +000060 20B42560  A0997C20 2090E9C0 20B420F0 20B2FA47  A09104D0 2090E9C0 00000000 20B42838  |.r@...Z....0.....j....Z.........|
      +000080 20B42580  000254C4 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...D............................|
      +0000A0 20B425A0  16000000 20909DB0 00000000 80010000  00000000 209D4520 20B2F7B4 2090E200  |.........................7...S..|
    DSA for LABL1: BEGIN: 20B42430
      +000000  FLAGS.... 8425      member... 0000      BKC...... 20B42330  FWC...... 20B42500  R14...... A0900E08
      +000010  R15...... 0001B328  R0....... 0000000B  R1....... 20900EB0  R2....... A0900DBE  R3....... 20900E40
      +000024  R4....... 00000001  R5....... 20B42330  R6....... 20B42330  R7....... 20B42330  R8....... 00000028
      +000038  R9....... 00000008  R10...... 20B420B0  R11...... 2090102C  R12...... 2090E9C0  reserved. 00025290
      +00004C  NAB...... 20B42500  PNAB..... 20B42500  reserved. 91A091A0  00000000
      +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 00000000
      +000078  reserved. 00000000  reserved. 20B42030
    Dynamic save area (LABL1: BEGIN): 20B42430
      +000000 20B42430  84250000 20B42330 20B42500 A0900E08  0001B328 0000000B 20900EB0 A0900DBE  |d...............................|
      +000020 20B42450  20900E40 00000001 20B42330 20B42330  20B42330 00000028 00000008 20B420B0  |... ............................|
      +000040 20B42470  2090102C 2090E9C0 00025290 20B42500  20B42500 91A091A0 20B42330 00000000  |......Z.............j.j.........|
      +000060 20B42490  00000000 00000000 00000000 00000000  00000000 00000200 00000000 20B42030  |................................|
      +000080 20B424B0  20B42530 A0B02CEC 20B2EA48 00000800  20B420F0 20B420F0 A0B02998 20901340  |...................0...0...q... |
      +0000A0 20B424D0  2090E880 0000000A 00000000 00000000  20AF2CD6 00000027 A0AF0CD8 2090E9C0  |..Y................O.......Q..Z.|
      +0000C0 20B424F0  20B42330 20B42618 00000014 00000000  88000000 20B42430 20B425C0 8001B784  |................h..............d|
    DSA for EXAMPLE: 20B42330
      +000000  FLAGS.... C025      member... 0000      BKC...... 20B42178  FWC...... 00000000  R14...... A0900C42
      +000010  R15...... 20900D48  R0....... 20B42430  R1....... 20B42330  R2....... A0900C30  R3....... 20900E40
      +000024  R4....... 00000001  R5....... 20B42330  R6....... 20B42400  R7....... 00000005  R8....... 20900EF8
      +000038  R9....... 00000008  R10...... 20B420B0  R11...... 2090102C  R12...... 2090E9C0  reserved. 00025290
      +00004C  NAB...... 20B42430  PNAB..... 20B42430  reserved. 91E091A0  20900EF8
      +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 20B423E8
      +000078  reserved. 00000000  reserved. 00000000
    Dynamic save area (EXAMPLE): 20B42330
      +000000 20B42330  C0250000 20B42178 00000000 A0900C42  20900D48 20B42430 20B42330 A0900C30  |................................|
      +000020 20B42350  20900E40 00000001 20B42330 20B42400  00000005 20900EF8 00000008 20B420B0  |... ...................8........|
      +000040 20B42370  2090102C 2090E9C0 00025290 20B42430  20B42430 91E091A0 00000000 20900EF8  |......Z.............j.j........8|
      +000060 20B42390  00000000 00000000 00000000 00000000  20B423E8 00000200 00000000 00000000  |...................Y............|
      +000080 20B423B0  20B42124 20B42128 20B4212C 20B42130  20B42138 20B42134 20B4213C 00000000  |................................|
      +0000A0 20B423D0  00000000 00000000 00000000 00000000  00000000 00000000 0C010000 00000000  |................................|
      +0000C0 20B423F0  20B42400 20900E94 0000000B 00000014  00000002 00000002 00000002 00000002  |.......m........................|
      +0000E0 20B42410  00000002 00000002 00000002 00000002  00000002 00000002 00000000 00000000  |................................|
⋮
```

To debug this routine, use the following steps:

1. In the dump, PLIDUMP was called by the ERROR ON-unit in statement 6. The traceback information in the dump shows that the exception occurred following statement 11.
2. Locate the Original Condition message in the Condition Information for Active Routines section of the dump. The message is

   ```
   IBM0421S ONCODE=520 The SUBSCRIPTRANGE condition was raised.
   ```

   It indicates that the exception occurred when an array element value exceeded the subscript range value (in this case, 10). For more information about this message, see PL/I runtime messages in *z/OS Language Environment Runtime Messages*.
3. Locate statement 9 in the routine in "#unique_272/unique_272_Connect_42_pliex1" on page 277. The instruction is `Array_End = 20`. This statement assigns a 20 value to the variable `Array_End`.
4. Statement 10 begins the DO-loop instruction `Do I = 1 to Array_End`. Since the previous instruction (statement 9) specified that `Array_End = 20`, the loop in statement 10 should run until `I` reaches a 20 value.

   The instruction in statement 2, however, declared a 10 value for the array range. Therefore, when the I value reached 11, the SUBSCRIPTRANGE condition was raised.

The following steps provide another method for finding the value that raised the SUBSCRIPTRANGE condition.

1. Locate the offset of variable I in the variable storage map in "#unique_272/unique_272_Connect_42_pliex1" on page 277. Use this offset to find the I value at the time of the dump. In this example, the offset is X'C8'.
2. Now, find offset X'C8' from the start of the stack frame for the entry EXAMPLE in Figure 124 on page 279.

   The block located at this offset contains the value that exceeded the array range, X'B' or 11.

Calling a nonexistent subroutine

Figure 126 on page 281 demonstrates the error of calling a nonexistent subroutine. This routine was compiled with the LIST, MAP, and GOSTMT compiler options. It was run with the TERMTHDACT(DUMP) runtime option to generate a traceback.

```
5688-235 IBM PL/I for MVS & VM         Ver 1 Rel 1 Mod 1                         27 FEB 07   11:45:18     PAGE   1
OPTIONS SPECIFIED
*PROCESS  GOSTMT LIST S STG TEST MAP NOOPTIONS;
5688-235 IBM PL/I for MVS & VM         EXAMPLE1:  PROC  OPTIONS(MAIN);                                    PAGE   2
                    SOURCE LISTING
    STMT

       1  EXAMPLE1:  PROC  OPTIONS(MAIN);

       2      DCL Prog01 entry external;

       3      On error
                Begin;
       4          On error system;
       5          Call plidump('tbnfs','Plidump called from error On-unit');
       6        End;

       7      Call prog01;        /* Call enternal program PROG01 */

       8   End Example1;
5688-235 IBM PL/I for MVS & VM         EXAMPLE1:  PROC  OPTIONS(MAIN);                                    PAGE   3
                    STORAGE REQUIREMENTS
BLOCK, SECTION OR STATEMENT     TYPE                  LENGTH   (HEX)    DSA SIZE   (HEX)
EXAMLE11                        PROGRAM CSECT            444     1BC
EXAMLE12                        STATIC CSECT             292     124
EXAMPLE1                        PROCEDURE BLOCK          210      D2         192      C0
BLOCK 2      STMT 3             ON UNIT                  232      E8         256     100
5688-235 IBM PL/I for MVS & VM         EXAMPLE1:  PROC  OPTIONS(MAIN);                                    PAGE   4
                          STATIC INTERNAL STORAGE MAP
```

Figure 126. Example of calling a nonexistent subroutine

Figure 127 on page 282 shows the traceback and condition information from the dump.

```
CEE3DMP V1 R12.0: Plidump called from error On-unit                            04/10/10 11:45:20 AM           Page:    1
ASID: 00B5   Job ID: JOB21952   Job name: LEDGSMP2   Step name: GO         UserID: HEALY

CEE3845I CEEDUMP Processing started.
PLIDUMP was called from statement number 5 at offset +000000D6 from ERR  ON-unit with entry address 20900DF4

Information for enclave EXAMPLE1

  Information for thread 8000000000000000

  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     CEEKKMRA    +0000081C              CEEPLPKA             CEEKKMRA                       D1908    Call
    2     IBMRKDM     +000000C2              IBMREV10             IBMRKDM                                 Call
    3     ERR  ON-unit+000000D6  5           EXAMPLE1             EXAMPLE1                                Call
    4     IBMRERPL    +0000065A              IBMRLIB1             IBMRERPL                                Call
    5     CEEEV010    +0000013A              IBMREV10             CEEEV010                                Call
    6     CEEHDSP     +000017D0              CEEPLPKA             CEEHDSP                        D1908    Call
    7     EXAMPLE1    -20900D2C              EXAMPLE1             EXAMPLE1                                Exception
    8     IBMRPMIA    +0000051E              IBMRLIB1             IBMRPMIA                                Call
    9     CEEEV010    +00000310              IBMREV10             CEEEV010                                Call
    10    CEEBBEXT    +000001B6              CEEPLPKA             CEEBBEXT                       D1908    Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     20B458D0   209F0420   209F0420   +0000081C  20061214   CEL
    2     00025670   20B1C0A0   20B1C0A0   +000000C2  ********   OS PL/I
    3     20B457D0   20900DF4   20900D20   +000001AA  ********   OS PL/I
    4     20B45598   00019F50   00019F50   +0000065A  20061213   LIBRARY
    5     20B45510   20B02998   20B02998   +0000013A  20061213   LIBRARY
    6     20B423F0   209BF068   209BF068   +000017D0  20061215   CEL
    7     20B42330   20900D2C   20900D20   -20900D20  ********   OS PL/I
    8     20B42178   000201D0   000201D0   +0000051E  20061214   LIBRARY
    9     20B420F0   20B02998   20B02998   +00000310  20061213   LIBRARY
    10    20B42030   2098DDB8   2098DDB8   +000001B6  20061215   CEL

  Condition Information for Active Routines
    Condition Information for EXAMPLE1 (DSA address 20B42330)
      CIB Address: 20B42D10
      Current Condition:
        CEE3201S The system detected an operation exception (System Completion Code=0C1).
      Location:
        Program Unit: EXAMPLE1 Entry: EXAMPLE1 Statement:  Offset: -20900D2C
        Possible Bad Branch:  Statement: 7  Offset: +000000C0
      Machine State:
        ILC..... 0002    Interruption Code..... 0001
        PSW..... 078D0E00 80000002
        GPR0..... 00000000_20B423F0  GPR1..... 00000000_00000000  GPR2..... 00000000_A0900DD4  GPR3..... 00000000_20900EE0
        GPR4..... 00000000_00000001  GPR5..... 00000000_00000000  GPR6..... 00000000_20B423E8  GPR7..... 00000000_00000005
        GPR8..... 00000000_20900F50  GPR9..... 00000000_00000008  GPR10.... 00000000_20B420B0  GPR11.... 00000000_2090100C
        GPR12.... 00000000_2090E9C0  GPR13.... 00000000_20B42330  GPR14.... 00000000_A0900DE2  GPR15.... 00000000_00000000
  Storage dump near condition, beginning at location: 00000000
    +000000 00000000  Inaccessible storage.
  GPREG STORAGE:
    Storage around GPR0 (20B423F0)
      -0020 20B423D0  00000000 00000000 00000000 00000000  00000000 00000000 0C010000 00000000 |................................|
      +0000 20B423F0  0808CEE1 20B42330 20B45510 A09C083A  A0B02998 00000020 2090B2E8 20B42D10 |...................q.......Y....|
      +0020 20B42410  20B42330 209C3C94 FFFFFF20 00000001  00000007 A09C0542 20B443EE 20B433EF |.......m........................|
    Storage around GPR1 (00000000)
      +0000 00000000    Inaccessible storage.
      +0020 00000020    Inaccessible storage.
      +0040 00000040    Inaccessible storage.
    Storage around GPR2 (20900DD4)
      -0020 20900DB4  92C01000 92251001 92021076 41D10000  41803070 5080D05C D203D054 30300520 |k...k...k....J......&..*K.......|
      +0000 20900DD4  920CD0B8 1B111B55 58F03040 05EF180D  58D0D004 58E0D00C 982CD01C 051E0707 |k........0. ............q.......|
      +0020 20900DF4  90ECD00C 47F0F02C 20900FC4 00000100  20900EE0 20900F78 20900D58 10000000 |.....00....D....................|
    Storage around GPR3 (20900EE0)
      -0020 20900EC0  1B554110 303458F0 303C05EF 180D58D0  D00458E0 D00C982C D01C051E 00000000 |.......0.............q.........|
      +0000 20900EE0  E000011C 20900D2C 20900DD4 20900DF4  20900E80 20900E80 20900E80 20900E80 |...........M...4................|
      +0020 20900F00  00000000 00050000 00000000 00210000  91E091E0 20B45898 A0B458C4 20901368 |................j.j....q...D....|
    Storage around GPR4 (00000001)
      -0001 00000000    Inaccessible storage.
      +001F 00000020    Inaccessible storage.
      +003F 00000040    Inaccessible storage.
```

Figure 127. Sections of the Language Environment dump (Part 1 of 2)

```
Storage around GPR5 (00000000)
  +0000 00000000    Inaccessible storage.
  +0020 00000020    Inaccessible storage.
  +0040 00000040    Inaccessible storage.
Storage around GPR6 (20B423E8)
  -0020 20B423C8  20B4213C 00000000 00000000 00000000  00000000 00000000 00000000 00000000 |................................|
  +0000 20B423E8  0C010000 00000000 0808CEE1 20B42330  20B45510 A09C083A A0B02998 00000020 |...........................q....|
  +0020 20B42408  2090B2E8 20B42D10 20B42330 209C3C94  FFFFFF20 00000001 00000007 A09C0542 |...Y...........m................|
Storage around GPR7 (00000005)
  -0005 00000000    Inaccessible storage.
  +001B 00000020    Inaccessible storage.
  +003B 00000040    Inaccessible storage.
Storage around GPR8 (20900F50)
  -0020 20900F30  40838193 93858440 86999694 40859999  969940D6 9560A495 89A30000 00000000 | called from error On-unit......|
  +0000 20900F50  0C160000 20900DF4 0C960000 00000000  20901038 00000000 00000000 20901018 |.......4.o......................|
  +0020 20900F70  00000000 20900F60 00000000 20900F6C  20900F20 00000001 00000000 00000000 |.......-.......%................|
Storage around GPR9 (00000008)
  -0008 00000000    Inaccessible storage.
  +0018 00000020    Inaccessible storage.
  +0038 00000040    Inaccessible storage.
Storage around GPR10(20B420B0)
  -0020 20B42090  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000 |................................|
  +0000 20B420B0  2098E080 2090100C 20B420E0 2090D790  20B420D0 20B420D8 20B420D4 00000000 |.q...........P........Q...M.....|
  +0020 20B420D0  2090D778 00000000 00000000 00000000  00000001 00000000 00000000 00000000 |..P.............................|
Storage around GPR11(2090100C)
  -0020 20900FEC  C5C240F0 F74040F1 F17AF4F5 7AF1F840  80000117 20900CA0 00000000 01000001 |EB 07  11:45:18 ................|
  +0000 2090100C  20900D2C 20901340 00000000 1D020001  20901030 00000000 00000000 0006D7D9 |....... ......................PR|
  +0020 2090102C  D6C7F0F1 B4000A00 00000000 1D020000  20901054 20900D2C 00000000 0008C5E7 |OG01..........................EX|
Storage around GPR12(2090E9C0)
  -0020 2090E9A0  00000000 00000000 C3C5C5C3 C1C14040  00000000 E9E3C3C1 000058C0 D0640CCC |........CEECAA  ....ZTCA........|
  +0000 2090E9C0  00000000 00025658 20B42018 20B62018  00000000 2090E9D0 00000000 000251B0 |.....................Z..........|
  +0020 2090E9E0  00000000 00000000 00025030 00000000  00025240 00000000 00025208 00000000 |..........&........ ............|
Storage around GPR13(20B42330)
  -0020 20B42310  00000000 00000000 00000000 0000000E  0E000000 00000000 00000000 00000000 |................................|
  +0000 20B42330  C0250000 20B42178 00000000 80000002  00000000 20B423F0 00000000 A0900DD4 |.......................0.......M|
  +0020 20B42350  20900EE0 00000001 00000000 20B423E8  00000005 20900F50 00000008 20B420B0 |...............Y.......&........|
Storage around GPR14(20900DE2)
  -0020 20900DC2  00004180 30705080 D05CD203 D0543030  0520920C D0B81B11 1B5558F0 304005EF |......&..*K.......k........0. ..|
  +0000 20900DE2  180D58D0 D00458E0 D00C982C D01C051E  070790EC D00C47F0 F02C2090 0FC40000 |..........q............00....D..|
  +0020 20900E02  01002090 0EE02090 0F782090 0D581000  00000002 02000000 00000000 00005830 |................................|
Storage around GPR15(00000000)
  +0000 00000000    Inaccessible storage.
  +0020 00000020    Inaccessible storage.
  +0040 00000040    Inaccessible storage.
⋮
```

Figure 128. Sections of the Language Environment dump (Part 2 of 2)

To understand the traceback and debug this example routine, use the following steps:

1. Find the Current Condition message in the Condition Information for Active Routines section of the dump. The message is `CEE3201S. The system detected an Operation exception.` For more information about this message, see *z/OS Language Environment Runtime Messages*.

   This section of the dump also provides such information as the name of the active routine and the current statement number at the time of the dump. The Location section indicates that the exception occurred at offset X'-20900D2C' within entry EXAMPLE1 and that there might have been a bad branch from offset X'+000000C0' statement 7 within entry EXAMPLE1 .
2. Locate statement 7 in the routine (Figure 126 on page 281). This statement calls subroutine Prog01. The message CEE3201S, which indicates an operations exception, was generated because of an unresolved external reference.
3. Check the linkage editor output for error messages.

Divide-by-zero error

Figure 129 on page 284 demonstrates a divide-by-zero error. In this example, the main PL/I for MVS & VM routine passed bad data to a PL/I for MVS & VM subroutine. The bad data in this example is 0, and the error occurred when the subroutine SUB1 attempted to use this data as a divisor.

```
5688-235 IBM PL/I for MVS & VM          Ver 1 Rel 1 Mod 1                              27 FEB 07   13:57:59     PAGE   1
OPTIONS SPECIFIED
*PROCESS  GOSTMT LIST S STG TEST MAP NOOPTIONS;
5688-235 IBM PL/I for MVS & VM          SAMPLE: PROC  OPTIONS(MAIN) ;                                           PAGE   2
                    SOURCE LISTING
    STMT

       1  SAMPLE: PROC  OPTIONS(MAIN) ;
       2       On error
                 begin;
       3           On error system;        /* prevent nested error conditions */
       4           Call PLIDUMP('TBC','PLIDUMP called from error ON-unit');
       5           Put Data;               /* Display variables */
       6       End;

       7       DECLARE
                 A_number    Fixed Bin(31),
                 My_Name     Char(13),
                 An_Array(3) Fixed Bin(31) init(1,3,5);

       8       Put skip list('Sample Starting');
       9       A_number = 0;
      10       My_Name = 'Tery Gillaspy';

      11       Call Sub1(a_number, my_name, an_array);

      12    SUB1:  PROC(divisor, name1, Array1);
      13          Declare
                   Divisor   Fixed Bin(31),
                   Name1     Char(13),
                   Array1(3) Fixed Bin(31);
      14           Put skip list('Sub1 Starting');
      15           Array1(1) = Array1(2) / Divisor;
      16           Put skip list('Sub1 Ending');
      17    End SUB1;

      18      Put skip list('Sample Ending');

      19  End;
5688-235 IBM PL/I for MVS & VM          SAMPLE: PROC  OPTIONS(MAIN) ;                                           PAGE   3
                    STORAGE REQUIREMENTS
BLOCK, SECTION OR STATEMENT     TYPE                  LENGTH   (HEX)    DSA SIZE   (HEX)
*SAMPLE1                        PROGRAM CSECT           1060     424
*SAMPLE2                        STATIC CSECT             860     35C
SAMPLE                          PROCEDURE BLOCK          428     1AC         304     130
BLOCK 2      STMT 2             ON UNIT                  298     12A         296     128
SUB1                            PROCEDURE BLOCK          332     14C         256     100
5688-235 IBM PL/I for MVS & VM          SAMPLE: PROC  OPTIONS(MAIN) ;                                           PAGE   4
                          STATIC INTERNAL STORAGE MAP       0000F0  80000000             A..LOCATOR
```

Figure 129. PL/I for MVS & VM routine with a divide-by-zero error

Since variables are not normally displayed in a PLIDUMP dump, this routine included a PUT DATA statement, which generated a listing of arguments and variables used in the routine. Figure 130 on page 284 shows this output.

```
1Sample Starting
 Sub1 Starting       A_NUMBER=             0 MY_NAME='Tery Gillaspy' AN_ARRAY(1)=  1
 AN_ARRAY(2)=         3                      AN_ARRAY(3)=             5;
```

Figure 130. Variables from routine SAMPLE

The routine in Figure 129 on page 284 was compiled with the LIST compiler option, which generated the object code listing shown in Figure 131 on page 284.

```
* STATEMENT NUMBER  15
0003A2  58 B0 D 0C8              L     11,200(0,13)
0003A6  58 40 B 004              L     4,4(0,11)
0003AA  58 90 3 0B4              L     9,180(0,3)
0003AE  5C 80 4 004              M     8,4(0,4)
0003B2  58 70 3 0D4              L     7,212(0,3)
0003B6  5C 60 4 004              M     6,4(0,4)
0003BA  58 80 D 0C0              L     8,192(0,13)
0003BE  58 60 B 000              L     6,0(0,11)
0003C2  5F 60 4 000              SL    6,0(0,4)
0003C6  58 E7 6 000              L     14,VO..ARRAY1(7)
0003CA  8E E0 0 020              SRDA  14,32
0003CE  5D E0 8 000              D     14,DIVISOR
0003D2  50 F9 6 000              ST    15,VO..ARRAY1(9)
```

Figure 131. Object code listing from example PL/I for MVS & VM routine

Figure 132 on page 285 shows the Language Environment dump for routine SAMPLE.

```
CEE3DMP V1 R12.0: PLIDUMP called from error ON-unit                            05/23/10 1:58:02 PM                 Page:    1
ASID: 003E   Job ID: JOB29826   Job name: LEDGSMP3   Step name: GO        UserID: HEALY

CEE3845I CEEDUMP Processing started.
PLIDUMP was called from statement number 4 at offset +000000D6 from ERR  ON-unit with entry address 2090022C

Information for enclave SAMPLE

  Information for thread 8000000000000000

  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     CEEKKMRA    +0000081C              CEEPLPKA             CEEKKMRA                       D1908    Call
    2     IBMRKDM     +000000C2              IBMREV10             IBMRKDM                                 Call
    3     ERR  ON-unit+000000D6  4           SAMPLE               SAMPLE                                  Call
    4     IBMRERPL    +0000065A              IBMRLIB1             IBMRERPL                                Call
    5     CEEEV010    +0000013A              IBMREV10             CEEEV010                                Call
    6     CEEHDSP     +000017D0              CEEPLPKA             CEEHDSP                        D1908    Call
    7     SUB1        +000000EE  15          SAMPLE               SAMPLE                                  Exception
    8     SAMPLE      +00000154  11          SAMPLE               SAMPLE                                  Call
    9     IBMRPMIA    +0000051E              IBMRLIB1             IBMRPMIA                                Call
    10    CEEEV010    +00000310              IBMREV10             CEEEV010                                Call
    11    CEEBBEXT    +000001B6              CEEPLPKA             CEEBBEXT                       D1908    Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     20B45A68   209F0420   209F0420   +0000081C  20061214   CEL
    2     00025670   20B1C0A0   20B1C0A0   +000000C2  ********   OS PL/I
    3     20B45940   2090022C   20900080   +00000282  ********   OS PL/I
    4     20B45708   00019F50   00019F50   +0000065A  20061213   LIBRARY
    5     20B45680   20B02998   20B02998   +0000013A  20061213   LIBRARY
    6     20B42560   209BF068   209BF068   +000017D0  20061215   CEL
    7     20B42460   20900360   20900080   +000003CE  ********   OS PL/I
    8     20B42330   20900088   20900080   +0000015C  ********   OS PL/I
    9     20B42178   000201D0   000201D0   +0000051E  20061214   LIBRARY
    10    20B420F0   20B02998   20B02998   +00000310  20061213   LIBRARY
    11    20B42030   2098DDB8   2098DDB8   +000001B6  20061215   CEL

  Condition Information for Active Routines
    Condition Information for SAMPLE (DSA address 20B42460)
      CIB Address: 20B42E80
      Current Condition:
        IBM0281S A prior condition was promoted to the ERROR condition.
      Original Condition:
        CEE3209S The system detected a fixed-point divide exception (System Completion Code=0C9).
      Location:
        Program Unit: SAMPLE Entry: SUB1 Statement: 15 Offset: +000000EE
      Machine State:
        ILC..... 0004    Interruption Code..... 0009
  PSW..... 078D2E00 A0900452

        GPR0..... 00000000_20B42560  GPR1..... 00000000_20B42538  GPR2..... 00000000_A09003E4  GPR3..... 00000000_209004A8
        GPR4..... 00000000_2090056C  GPR5..... 00000000_20B42330  GPR6..... 00000000_20B42404  GPR7..... 00000000_00000008
        GPR8..... 00000000_20B42400  GPR9..... 00000000_00000004  GPR10.... 00000000_20B420B0  GPR11.... 00000000_20B423F8
        GPR12.... 00000000_2090E9C0  GPR13.... 00000000_20B42460  GPR14.... 00000000_00000000  GPR15.... 00000000_00000003
```

Figure 132. Language Environment dump from example PL/I for MVS & VM routine (Part 1 of 3)

```
    Storage dump near condition, beginning at location: 2090043E
      +000000 2090043E  5860B000 5F604000 58E76000 8EE00020  5DE08000 50F96000 41E0D0D8 50E0312C  |.-..^- ..X-.....)...&9-....Q&...|
    GPREG STORAGE:
      Storage around GPR0 (20B42560)
        -0020 20B42540  20909DB0 A090055C 00409D00 00028004  008FF4E8 2090D658 00010000 00025470  |.......*. ........4Y..O.........|
        +0000 20B42560  0808CEE1 20B42460 20B45680 A09C083A  A0B02998 00000020 2090B2E8 20B42E80  |.......-...........q.......Y....|
        +0020 20B42580  20B42330 209C3C94 FFFFFF20 00000001  00000007 A09C0542 20B4455E 20B4355F  |.......m..................;...^|
⋮
  Control Blocks for Active Routines:
⋮
    DSA for ERR  ON-unit: 20B45940
      +000000  FLAGS.... CC25      member... 4040      BKC...... 20B45708  FWC...... 40404040  R14...... A0900304
      +000010  R15...... A0B1C0A0  R0....... 20B45A68  R1....... 209005A8  R2....... A09002B8  R3....... 209004A8
      +000024  R4....... 00000064  R5....... 00000000  R6....... 20B459F8  R7....... 20B457F0  R8....... 20B45A30
      +000038  R9....... 20B45A60  R10...... 00000000  R11...... 0001AF4F  R12...... D6D940C7  reserved. 00025670
      +00004C  NAB...... 20B45A68  PNAB..... 20B45A68  reserved. 91E091E0  20900650
      +000064  reserved. 40404040  reserved. 40404040  MODE..... 40404040  reserved. 20B459F8
      +000078  reserved. 40404040  reserved. 40404040
    Dynamic save area (ERR  ON-unit): 20B45940
      +000000 20B45940  CC254040 20B45708 40404040 A0900304  A0B1C0A0 20B45A68 209005A8 A09002B8  |..  ....    ..........!....y....|
      +000020 20B45960  209004A8 00000064 00000000 20B459F8  20B457F0 20B45A30 20B45A60 00000000  |...y...........8...0..!...!-....|
      +000040 20B45980  0001AF4F D6D940C7 00025670 20B45A68  20B45A68 91E091E0 20B42330 20900650  |...|OR G......!...!.j.j........&|
      +000060 20B459A0  40404040 40404040 40404040 40404040  20B459F8 40400240 40404040 40404040  |                        ...8  .  |
      +000080 20B459C0  20B42E80 00025470 A0B1120A A0B11190  20B42560 20B457D8 00025470 A0B11190  |..................-...Q........|
      +0000A0 20B459E0  209C3C94 20B42E80 00025470 20B42E80  2090E880 00016038 0C010027 20B1218F  |...m..............Y...-.........|
      +0000C0 20B45A00  2090E9C0 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |..Z.                            |
      +0000E0 20B45A20  40404040 40404040 40404040 40404040  E3C2C340 20B45A30 00030000 D7D3C9C4  |                    TBC ..!.....PLID|
      +000100 20B45A40  E4D4D740 83819393 85844086 99969440  85999996 9940D6D5 60A49589 A32C0000  |UMP called from error ON-unit...|
      +000120 20B45A60  20B45A3C 00210000 0000F3C3 00025670  20B45F60 A09F0C3E A09EB5B8 00000000  |..!.......3C......^-............|
    Static for procedure SAMPLE    Timestamp: 27 FEB 07  13:57:59
    Starting from: 209004A8
      +000000 209004A8  E0000354 20900088 20900130 20900166  2090022C 209002B8 20900360 209003E4  |.......h...................-...U|
      +000020 209004C8  209003E4 209003E4 209003E4 20900C78  20900C60 20900C48 20900C30 20900C18  |...U...U...U.......-............|
      +000040 209004E8  20900C00 20901BF8 20901BE0 20900BE8  20901BC8 20901BB0 20900BD0 20900BB8  |.......8.......Y...H............|
      +000060 20900508  B4000A00 20000002 1F800000 00000000  209005DC 000F0000 00000000 000D0000  |................................|
      +000080 20900528  00000000 2090056C 209005F8 000D0000  00000000 00030000 00000000 00210000  |.......%...8....................|
      +0000A0 20900548  20900629 000D0000 20900636 000B0000  91E091E0 00000001 00000003 00000005  |...............j.j..............|
      +0000C0 20900568  00000000 00000004 00000004 00000003  00000001 00000002 20900838 20900838  |................................|
      +0000E0 20900588  20B42438 A090055C 20B42400 20B423F0  A0B423F8 20900838 00000000 A090055C  |.......*.......0...8...........*|
      +000100 209005A8  20B45A34 A0B45A60 20900BA0 20900838  80000000 00000000 A0900658 20900838  |..!...!-........................|
      +000120 209005C8  20B42538 A090055C 20900838 00000000  A090055C E2819497 938540E2 A38199A3  |.......*...........*Sample Start|
      +000140 209005E8  899587E3 8599A840 C7899393 81A297A8  E2819497 938540C5 95848995 87E3C2C3  |ingTery GillaspySample EndingTBC|
      +000160 20900608  D7D3C9C4 E4D4D740 83819393 85844086  99969440 85999996 9940D6D5 60A49589  |PLIDUMP called from error ON-uni|
      +000180 20900628  A3E2A482 F140E2A3 8199A389 9587E2A4  82F140C5 95848995 87000000 00000000  |tSub1 StartingSub1 Ending.......|
      +0001A0 20900648  0C160000 2090022C 0C960000 00000000  2090066C 20900688 209006A4 00000000  |.........o.........%...h...u....|
      +0001C0 20900668  00000000 85000001 2090050E 000000D0  00000000 0008C16D D5E4D4C2 C5D90000  |....e.................A_NUMBER..|
      +0001E0 20900688  81000001 2090050C 000000C0 00000000  0007D4E8 6DD5C1D4 C5000000 81000101  |a.................MY_NAME...a...|
      +000200 209006A8  2090050E 000000C8 00000000 0008C1D5  6DC1D9D9 C1E80000 20900818 00000000  |.......H......AN_ARRAY..........|
      +000220 209006C8  00000000 2090066C 20900688 209006A4  20900750 20900858 00000000 209006C0  |.......%...h...u...&............|
      +000240 209006E8  00000000 209006CC 20900704 20900720  20900738 00000000 209006CC A5000002  |............................v...|
      +000260 20900708  2090050E 000000C0 00000000 0007C4C9  E5C9E2D6 D9000000 A1000002 2090050C  |..............DIVISOR...........|
      +000280 20900728  000000C4 00000000 0005D5C1 D4C5F100  A1000102 2090050E 000000C8 00000000  |...D......NAME1............H....|
      +0002A0 20900748  0006C1D9 D9C1E8F1 0D020001 20900508  20900360 00000000 0004E2E4 C2F10000  |..ARRAY1...........-......SUB1..|
      +0002C0 20900768  00000001 20900088 000001A4 2090079C  00000001 00DF0002 00E30008 01210009  |.......h...u.............T......|
      +0002E0 20900788  0129000A 012F000B 01570012 01950013  01A40002 2090022C 0000012A 209007C0  |.............n...u..............|
      +000300 209007A8  00000002 008D0003 00910004 00D90005  011B0006 012C000C 20900360 00000144  |.........j...R..............-....|
      +000320 209007C8  209007E4 0000000C 0085000E 00C3000F  00F70010 01350011 01340011 0E0E0E0E  |...U.....e...C...7..............|
      +000340 209007E8  F2F740C6 C5C240F0 F74040F1 F37AF5F7  7AF5F940 80000117 20900000 00000000  |27 FEB 07  13:57:59 ............|
⋮
    DSA for CEEHDSP: 20B42560
      +000000  FLAGS.... 0808      member... CEE1      BKC...... 20B42460  FWC...... 20B45680  R14...... A09C083A
      +000010  R15...... A0B02998  R0....... 00000020  R1....... 2090B2E8  R2....... 20B42E80  R3....... 20B42330
      +000024  R4....... 209C3C94  R5....... FFFFFF20  R6....... 00000001  R7....... 00000007  R8....... A09C0542
      +000038  R9....... 20B4455E  R10...... 20B4355F  R11...... 209BF068  R12...... 2090E9C0  reserved. 00025670
      +00004C  NAB...... 20B45680  PNAB..... 00000000  reserved. 20B424F0  20B424F0
      +000064  reserved. A0AF2F14  reserved. 00010280  MODE..... 000272F0  reserved. 20B4269C
      +000078  reserved. 20B42598  reserved. 20900838
    DSA for SUB1: 20B42460
      +000000  FLAGS.... 8025      member... 0000      BKC...... 20B42330  FWC...... 00000000  R14...... A0900452
      +000010  R15...... 00000003  R0....... 20B42560  R1....... 20B42538  R2....... A09003E4  R3....... 209004A8
      +000024  R4....... 2090056C  R5....... 20B42330  R6....... 20B42404  R7....... 00000008  R8....... 20B42400
      +000038  R9....... 00000004  R10...... 20B420B0  R11...... 20B423F8  R12...... 2090E9C0  reserved. 00025290
      +00004C  NAB...... 20B42560  PNAB..... 20B42560  reserved. 91E091E0  00000800
      +000064  reserved. 20B420F0  reserved. A0B02998  MODE..... 20900B78  reserved. 2090E880
      +000078  reserved. 00000000  reserved. 00000000
```

Figure 133. Language Environment dump from example PL/I for MVS & VM routine (Part 2 of 3)

```
   CIB for SUB1: 20B42E80
     +000000 20B42E80  C3C9C240 00000000 00000000 010C0004  00000000 00000000 00030119 59C9C2D4  |CIB .........................IBM|
     +000020 20B42EA0  00000000 20B42F90 00030C89 59C3C5C5  00000001 00000005 20B42330 A0B02998  |...........i.CEE...............q|
     +000040 20B42EC0  00000000 20B42460 20900452 2090B6F0  0000000A 20B42460 00000000 00000000  |.......-.......0.......-........|
     +000060 20B42EE0  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
     +000080 20B42F00 - +00009F 20B42F1F              same as above
     +0000A0 20B42F20  00000000 00000000 00000000 00000000  44230000 940C9000 00000009 00000000  |...................m...........|
     +0000C0 20B42F40  00000000 00000000 20B42460 20B42460  2090044E 00000000 00000000 00000001  |...........-...-...+............|
     +0000E0 20B42F60  20B42330 0000000A 00000064 00000000  FFFFFFFC 00000000 00000000 00000000  |................................|
     +000100 20B42F80  00000000 2090B908 00000000 00000000  E9D4C3C8 02000001 20B42560 20B42538  |................ZMCH.......-....|

   Dynamic save area (SUB1): 20B42460
     +000000 20B42460  80250000 20B42330 00000000 A0900452  00000003 20B42560 20B42538 A09003E4  |.......................-.......U|
     +000020 20B42480  209004A8 2090056C 20B42330 20B42404  00000008 20B42400 00000004 20B420B0  |...y...%........................|
     +000040 20B424A0  20B423F8 2090E9C0 00025290 20B42560  20B42560 91E091E0 20B42330 00000800  |...8..Z........-...-j.j.........|
     +000060 20B424C0  20B420F0 20B420F0 A0B02998 20900B78  2090E880 0000020A 00000000 00000000  |...0...0...q......Y.............|
     +000080 20B424E0  20AF2CD6 C9C2D4D9 D6D7C1C1 209005DC  000F0000 00027258 20B425B8 A0B2C18E  |...OIBMROPAA..................A.|
     +0000A0 20B42500  A0AF24D0 000272F0 20B42570 000272F0  A0B2C0F0 20900838 00000001 2090D1A8  |.......0.......0...0..........Jy|
     +0000C0 20B42520  20B42400 20B423F0 20B423F8 00000001  20B42538 20B420B0 20900548 2090050C  |.......0...8....................|
     +0000E0 20B42540  20909DB0 A090055C 00409D00 00028004  008FF4E8 2090D658 00010000 00025470  |.......*. ........4Y..O.........|
   DSA for SAMPLE: 20B42330
     +000000  FLAGS.... C025      member... 0000      BKC...... 20B42178  FWC...... 00000000  R14...... A09001DE
     +000010  R15...... 20900360  R0....... 20B42460  R1....... 20900590  R2....... A0900166  R3....... 209004A8
     +000024  R4....... 00000005  R5....... 20B42330  R6....... 20B42408  R7....... 20B423F8  R8....... 00000001
     +000038  R9....... 00000008  R10...... 20B420B0  R11...... 2090080C  R12...... 2090E9C0  reserved. 00025290
     +00004C  NAB...... 20B42460  PNAB..... 20B42460  reserved. 91E091E0  20900648
     +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 20B423E8
     +000078  reserved. 00000000  reserved. 00000000
   Dynamic save area (SAMPLE): 20B42330
     +000000 20B42330  C0250000 20B42178 00000000 A09001DE  20900360 20B42460 20900590 A0900166  |...................-...-........|
     +000020 20B42350  209004A8 00000005 20B42330 20B42408  20B423F8 00000001 00000008 20B420B0  |...y...............8............|
     +000040 20B42370  2090080C 2090E9C0 00025290 20B42460  20B42460 91E091E0 00000000 20900648  |......Z........-...-j.j.........|
     +000060 20B42390  00000000 00000000 00000000 00000000  20B423E8 00000200 00000000 00000000  |...................Y............|
     +000080 20B423B0  20B42124 20B42128 20B4212C 20B42130  20B42138 20B42134 20B4213C 00000000  |................................|
     +0000A0 20B423D0  00000000 00000000 00000000 00000000  00000000 00000000 0C010000 00000000  |................................|
     +0000C0 20B423F0  20B42414 000D0000 20B42408 2090056C  00000000 00000000 00000001 00000003  |..............%.................|
     +0000E0 20B42410  00000005 E38599A8 40C78993 9381A297  A8000000 00000000 00000000 00000000  |....Tery Gillaspy...............|
     +000100 20B42430  20B42438 00000000 20900518 2090050C  00000000 A090055C 00400000 00028004  |.......................*. ......|
     +000120 20B42450  00000000 00000000 00010000 00025470  80250000 20B42330 00000000 A0900452  |................................|
 ⋮
```

Figure 134. Language Environment dump from example PL/I for MVS & VM routine (Part 3 of 3)

To understand the dump information and debug this routine, use the following steps:

1. Notice the title of the dump: `PLIDUMP called from error ON-unit`. This was the title specified when PLIDUMP was invoked, and it indicates that the ERROR condition was raised and PLIDUMP was called from within the ERROR ON-unit.
2. Locate the messages in the Condition Information section of the dump.

   There are two messages. The current condition message indicates that a prior condition was promoted to the ERROR condition. The promotion of a condition occurs when the original condition is left unhandled (no PL/I for MVS & VM ON-units are assigned to gain control). The original condition message is

   `CEE3209S. The system detected a Fixed Point divide exception.`

   The original condition usually indicates the actual problem. For more information about this message, see Language Environment runtime messages in *z/OS Language Environment Runtime Messages*.
3. In the traceback section, note the sequence of calls in the call chain. SAMPLE called SUB1 at statement 11, and SUB1 raised an exception at statement 15, PU offset X'3CE'.
4. Find the statement in the listing for SUB1 that raised the ZERODIVIDE condition. If SUB1 was compiled with GOSTMT and SOURCE, find statement 15 in the source listing.

   Since the object listing was generated in this example, you can also locate the actual assembler instruction causing the exception at offset X'3CE' in the object listing for this routine, shown in Figure 131 on page 284. Either method shows that *divisor* was used as the divisor in a divide operation.
5. You can see from the declaration of SUB1 that *divisor* is a parameter passed from SAMPLE. Because of linkage conventions, you can infer that register 1 in the SAMPLE save area points to a parameter list that was passed to SUB1. *divisor* is the first parameter in the list.
6. In the SAMPLE DSA, the R1 value is X'20900590'. This is the address of the parameter list, which is located in static storage.
7. Find the parameter list in the stack frame; the address of the first parameter is X'20B42400' and the value of the first parameter is X'00000000'. Thus, the exception occurred when SAMPLE passed a 0 value used as a divisor in subroutine SUB1.

Chapter 8. Debugging Enterprise PL/I routines

This topic contains information that can help you debug applications that contain one or more Enterprise PL/I routines. Following a discussion about potential errors in Enterprise PL/I routines, the first part of this information discusses how to use compiler-generated listings to obtain information about Enterprise PL/I routines, and how to use PLIDUMP to generate a Language Environment dump of an Enterprise PL/I routine. The last part of the chapter provides examples of Enterprise PL/I routines and explains how to debug them using information contained in the traceback information provided in the dump.

Determining the source of errors in Enterprise PL/I routines

Most errors in Enterprise PL/I routines can be identified by the information provided in Enterprise PL/I runtime messages, which begin with the prefix IBM. For a list of these messages, see PL/I runtime messages in *z/OS Language Environment Runtime Messages*.

A malfunction in running an Enterprise PL/I routine can be caused by:

- Logic errors in the source routine
- Invalid use of Enterprise PL/I
- Unforeseen errors
- Invalid input data
- Compiler or runtime routine malfunction
- System malfunction
- Unidentified routine malfunction
- Overlaid storage

Logic errors in the source routine

Errors of this type are often difficult to detect because they often appear as compiler or library malfunctions. Some common errors in source routines are:

- Incorrect conversion from arithmetic data
- Incorrect arithmetic and string manipulation operations
- Unmatched data lists and format lists

Invalid use of Enterprise PL/I

A misunderstanding of the language or a failure to provide the correct environment for using Enterprise PL/I can result in an apparent malfunction of an Enterprise PL/I routine. Any of the following, for example, might cause a malfunction:

- Using uninitialized variables
- Using controlled variables that have not been allocated
- Reading records into incorrect structures
- Misusing array subscripts
- Misusing pointer variables
- Incorrect conversion
- Incorrect arithmetic operations
- Incorrect string manipulation operations

Unforeseen errors

If an error is detected during run time and no ON-unit is provided in the routine to terminate the run or attempt recovery, the job terminates abnormally. However, the status of a routine at the point where the error occurred can be recorded by using an ERROR ON-unit that contains the following statements. `ON ERROR SYSTEM` ensures that further errors do not result in a permanent loop.

```
ON ERROR
 BEGIN;
  ON ERROR SYSTEM;
  CALL PLIDUMP;         /*generates a dump*/
  PUT DATA;             /*displays variables*/
 END;
```

Invalid input data

A routine should contain checks to ensure that any incorrect input data is detected before it can cause the routine to malfunction. Use the COPY option of the GET statement to check values obtained by stream-oriented input. The values are listed on the file named in the COPY option. If no file name is given, SYSPRINT is assumed.

Compiler or runtime routine malfunction

If you are certain that the malfunction is caused by a compiler or runtime routine error, you can either open a PMR or submit an APAR for the error. Meanwhile, you can try an alternative way to perform the operation that is causing the trouble. A bypass is often feasible, since the Enterprise PL/I language frequently provides an alternative method of performing operations.

System malfunction

System malfunctions include machine malfunctions and operating system errors. System messages identify these malfunctions and errors to the operator.

Unidentified routine malfunction

In most circumstances, an unidentified routine malfunction does not occur when using the compiler. If your routine terminates abnormally without an accompanying Language Environment runtime diagnostic message, the error causing the termination might also be inhibiting the production of a message. Check for the following:

- Your job control statements might be in error, particularly in defining data sets.
- Your routine might overwrite main storage areas containing executable instructions. This can happen if you have accidentally:
  - Assigned a value to a nonexistent array element. For example:

    ```
    DCL ARRAY(10);
         ⋮
    DO I = 1 TO 100;
    ARRAY(I) = VALUE;
    ```

    To detect this type of error in a compiled module, set the SUBSCRIPTRANGE condition so that each attempt to access an element outside the declared range of subscript values raises the SUBSCRIPTRANGE condition. If there is no ON-unit for this condition, a diagnostic message is printed and the ERROR condition is raised. This facility, though expensive in run time and storage space, is a valuable routine-testing aid.
  - Used an incorrect locator value for a locator (pointer or offset) variable. This type of error can occur if a locator value is obtained by means of record-oriented transmission. Ensure that locator values

created in one routine, transmitted to a data set, and subsequently retrieved for use in another routine, are valid for use in the second routine.

– Attempted to free a nonbased variable. This can happen when you free a based variable after its qualifying pointer value has been changed. For example:

```
DCL A STATIC,B BASED (P);
ALLOCATE B;
P = ADDR(A);
FREE B;
```

– Used the SUBSTR pseudovariable to assign a string to a location beyond the end of the target string. For example:

```
DCL X CHAR(3);
I=3
SUBSTR(X,2,I) = 'ABC';
```

To detect this type of error, enable the STRINGRANGE condition during compilation.

Storage overlay problems

If you suspect an error in your Enterprise PL/I application is a storage overlay problem, check for the following:

1. The use of a subscript outside the declared bounds (check the SUBSCRIPTRANGE condition)
2. An attempt to assign a string to a target with an insufficient maximum length (check the STRINGSIZE condition)
3. The failure of the arguments to a SUBSTR reference to comply with the rules described for the SUBSTR built-in function (check the STRINGRANGE condition)
4. The loss of significant last high-order (left-most) binary or decimal digits during assignment to an intermediate result or variable or during an input/output operation (check the SIZE condition)
5. The reading of a variable-length file into a variable
6. The misuse of a pointer variable
7. The invocation of a Language Environment callable service with fewer arguments than are required

The first four situations are associated with the listed Enterprise PL/I conditions, all of which are disabled by default. If you suspect one of these problems exists in your routine, use the appropriate condition prefix on the suspected statement or on the BEGIN or PROCEDURE statement of the containing block.

The fifth situation occurs when you read a data record into a variable that is too small. This type of problem only happens with variable-length files. You can often isolate the problem by examining the data in the file information and buffer.

The sixth situation occurs when you misuse a pointer variable. This type of storage overlay is particularly difficult to isolate. There are a number of ways pointer variables can be misused:

- When a READ statement runs with the SET option, a value is placed in a pointer. If you then run a WRITE statement or another READ SET option with another pointer, you overlay your storage if you try to use the original pointer.
- When you try to use a pointer to allocate storage that has already been freed, you can also cause a storage overlay.
- When you attempt to use a pointer set with the ADDR built-in function as a base for data with different attributes, you can cause a storage overlay.

The seventh situation occurs when a Language Environment callable service is passed fewer arguments than its interface requires. The following example might cause a storage overlay because Language Environment assumes that the fourth item in the argument list is the address of a feedback code, when in reality it could be residue data pointing anywhere in storage.

Invalid calls	Valid calls
`DCL CEEDATE ENTRY OPTIONS(ASM);` `CALL CEEDATE(x,y,z);   /* invalid */`	`DCL CEEDATE ENTRY(*,*,*,* OPTIONAL) OPTIONS(ASM);` `CALL CEEDATE(x,y,z,*);    /* valid   */` `CALL CEEDATE(x,y,z,fc);   /* valid   */`

Using Enterprise PL/I compiler listings

The following sections explain how to generate listings that contain information about your routine. Enterprise PL/I listings show machine instructions, constants, and external or internal addresses that the linkage editor resolves. This information can help you find other information, such as variable values, in a dump of an Enterprise PL/I routine.

Note: Enterprise PL/I shares a common compiler back-end with C/C++. The Enterprise PL/I assembler listing will, consequently, have a similar form to those from the XL C/C++ compiler.

The compiler listings included below are from the Enterprise PL/I product.

Generating Enterprise PL/I listings and maps

Table 47 on page 290 shows compiler-generated listings that you might find helpful when you use information in dumps to debug Enterprise PL/I routines.

Table 47. Compiler-generated PL/I listings and their contents

Name	Contents	Compiler Option
Source program	Source program statements	SOURCE
Cross reference	Cross reference of names with attributes	XREF and ATTRIBUTES
Aggregate table	Names and layouts of structures and arrays	AGGREGATE
Variable map	Offsets of automatic and static internal variables (from their defining base)	MAP
Object code	Contents of the program control section in hexadecimal notation and translated into a pseudo-assembler format.	LIST
Variable map, object code, static storage	Same as MAP and LIST options above, plus contents of static internal and static external control sections in hexadecimal notation with comments	MAP and LIST

Finding information in Enterprise PL/I listings

Figure 135 on page 291 shows the first two pages of an example Enterprise PL/I routine that was compiled with the LIST, MAP and SOURCE options.

```
5655-H31  IBM(R) Enterprise PL/I for z/OS       V3.R6.M0 (Built:20070119)
                     Options Specified
  Install:
  Command: s
  Line.File Process Statements
     1.0    *PROCESS SOURCE LIST MAP;
  Install:

5655-H31  IBM(R) Enterprise PL/I for z/OS
 Compiler Source
    Line.File
       2.0
       3.0      EXAMPLE: PROC OPTIONS(MAIN);
       4.0        DCL EXTR ENTRY EXTERNAL;
       5.0        DCL A FIXED BIN(31);
       6.0        DCL B(2,2)  FIXED BIN(31) STATIC EXTERNAL INIT((4)0);
       7.0        DCL C CHAR(20) STATIC INIT('SAMPLE CONSTANT');
       8.0        DCL D FIXED BIN(31) STATIC;
       9.0        DCL E FIXED BIN(31);
      10.0        FETCH EXTR;
      11.0        CALL EXTR(A,B,C,D,E);
      12.0        DISPLAY(C);
      13.0      END;
```

Figure 135. Enterprise PL/I routine compiled with LIST, MAP, and SOURCE

Figure 136 on page 292 shows the output generated by the LIST and MAP options for this routine, including the pseudo-assembly listing, the external symbol dictionary and reference, the storage offset listing and the static and automatic storage maps. The sections following this example describe the contents of each type of listing.

```
OFFSET OBJECT CODE        LINE#  FILE#    P S E U D O   A S S E M B L Y   L I S T I N G

                           Timestamp and Version Information
 000000  F2F0  F0F7                                =C'2007'           Compiled Year
 000004  F0F2  F0F1                                =C'0201'           Compiled Date MMDD
 000008  F1F5  F3F2  F5F0                          =C'153250'         Compiled Time HHMMSS
 00000E  F0F3  F0F6  F0F0                          =C'030600'         Compiler Version

 000014  002C  ****                                Service String     20070122
                           Timestamp and Version End

 5655-H31  IBM(R) Enterprise PL/I for z/OS                           : EXAMPLE

 OFFSET OBJECT CODE        LINE#  FILE#    P S E U D O   A S S E M B L Y   L I S T I N G

 000000                    000003 |        EXAMPLE  DS    0D
 000000  47F0  F024        000003 |                 B     36(,r15)
 000004  01C3C5C5                                         CEE eyecatcher
 000008  000000C8                                         DSA size
 00000C  00000180                                         =A(PPA1-EXAMPLE)
 000010  47F0  F001        000003 |                 B     1(,r15)
 000014  58F0  C31C        000003 |                 L     r15,796(,r12)
 000018  184E              000003 |                 LR    r4,r14
 00001A  05EF              000003 |                 BALR  r14,r15
 00001C  00000000                                         =F'0'
 000020  A7F4  000C        000003 |                 J     *+24
 000024  90E8  D00C        000003 |                 STM   r14,r8,12(r13)
 000028  58E0  D04C        000003 |                 L     r14,76(,r13)
 00002C  4100  E0C8        000003 |                 LA    r0,200(,r14)
 000030  5500  C314        000003 |                 CL    r0,788(,r12)
 000034  A724  FFF0        000003 |                 JH    *-32
 000038  58F0  C280        000003 |                 L     r15,640(,r12)
 00003C  90F0  E048        000003 |                 STM   r15,r0,72(r14)
 000040  9210  E000        000003 |                 MVI   0(r14),16
 000044  50D0  E004        000003 |                 ST    r13,4(,r14)
 000048  18DE              000003 |                 LR    r13,r14
 00004A  C030  0000  008A  000003 |                 LARL  r3,F'138'
 000050                    End of Prolog

 000050  5860  3002        000000 |                 L     r6,=A(EXAMPLE2)(,r3,2)
 000054  C070  0000  0092  000000 |                 LARL  r7,F'146'
 00005A  4110  6008        000003 |                 LA    r1,EXTR(,r6,8)
 00005E  4100  0000        000003 |                 LA    r0,0
 000062  5000  1000        000003 |                 ST    r0,_shadow3(,r1,0)
 000066  4110  6008        000010 |                 LA    r1,EXTR(,r6,8)
 00006A  5800  1000        000010 |                 L     r0,_shadow2(,r1,0)
 00006E  1200              000010 |                 LTR   r0,r0
 000070  A774  0012        000010 |                 JNE   @1L2
 000074  4100  6018        000010 |                 LA    r0,_Dsc_000002(,r6,24)
 000078  4120  6008        000010 |                 LA    r2,EXTR(,r6,8)
 00007C  58F0  3006        000010 |                 L     r15,=V(IBMQFRG)(,r3,6)
 000080  4110  D098        000010 |                 LA    r1,#MX_TEMP1(,r13,152)
 000084  5020  D098        000010 |                 ST    r2,#MX_TEMP1(,r13,152)
 000088  1827              000010 |                 LR    r2,r7
 00008A  5020  D09C        000010 |                 ST    r2,#MX_TEMP1(,r13,156)
 00008E  5000  D0A0        000010 |                 ST    r0,#MX_TEMP1(,r13,160)
 000092  05EF              000010 |                 BALR  r14,r15
 000094                    000010 |        @1L2     DS    0H
 000094  5800  300A        000011 |                 L     r0,=A(B)(,r3,10)
 000098  5000  D0C0        000011 |                 ST    r0,192(,r13)
 00009C  4100  6040        000011 |                 LA    r0,_Dsc_000005(,r6,64)
 0000A0  5000  D0C4        000011 |                 ST    r0,196(,r13)
 0000A4  4100  6028        000011 |                 LA    r0,C(,r6,40)
 0000A8  5000  D0B8        000011 |                 ST    r0,184(,r13)
 0000AC  4110  6004        000011 |                 LA    r1,_Dsc_000003(,r6,4)
 0000B0  5800  1000        000011 |                 L     r0,_shadow1(,r1,0)
 0000B4  5000  D0BC        000011 |                 ST    r0,_temp1(,r13,188)
 0000B8  4110  6008        000011 |                 LA    r1,EXTR(,r6,8)
 0000BC  5800  1000        000011 |                 L     r0,_shadow2(,r1,0)
 0000C0  1200              000011 |                 LTR   r0,r0
```

Figure 136. Compiler-generated listings from example Enterprise PL/I routine (Part 1 of 4)

```
5655-H31  IBM(R) Enterprise PL/I for z/OS                                  : EXAMPLE

OFFSET OBJECT CODE       LINE#  FILE#    P S E U D O   A S S E M B L Y   L I S T I N G

0000C2  A774  0012       000011 |                JNE   @1L3
0000C6  4100  6018       000011 |                LA    r0,_Dsc_000002(,r6,24)
0000CA  4120  6008       000011 |                LA    r2,EXTR(,r6,8)
0000CE  58F0  3006       000011 |                L     r15,=V(IBMQFRG)(,r3,6)
0000D2  4110  D098       000011 |                LA    r1,#MX_TEMP1(,r13,152)
0000D6  5020  D098       000011 |                ST    r2,#MX_TEMP1(,r13,152)
0000DA  1827             000011 |                LR    r2,r7
0000DC  5020  D09C       000011 |                ST    r2,#MX_TEMP1(,r13,156)
0000E0  5000  D0A0       000011 |                ST    r0,#MX_TEMP1(,r13,160)
0000E4  05EF             000011 |                BALR  r14,r15
0000E6                   000011 |       @1L3     DS    0H
0000E6  4110  6008       000011 |                LA    r1,EXTR(,r6,8)
0000EA  58F0  1000       000011 |                L     r15,_shadow2(,r1,0)
0000EE  4100  D0B4       000011 |                LA    r0,E(,r13,180)
0000F2  1826             000011 |                LR    r2,r6
0000F4  4140  D0B8       000011 |                LA    r4,_temp1(,r13,184)
0000F8  4150  D0C0       000011 |                LA    r5,_temp2(,r13,192)
0000FC  4180  D0B0       000011 |                LA    r8,A(,r13,176)
000100  4110  D098       000011 |                LA    r1,#MX_TEMP1(,r13,152)
000104  5080  D098       000011 |                ST    r8,#MX_TEMP1(,r13,152)
000108  5050  D09C       000011 |                ST    r5,#MX_TEMP1(,r13,156)
00010C  5040  D0A0       000011 |                ST    r4,#MX_TEMP1(,r13,160)
000110  5020  D0A4       000011 |                ST    r2,#MX_TEMP1(,r13,164)
000114  5000  D0A8       000011 |                ST    r0,#MX_TEMP1(,r13,168)
000118  05EF             000011 |                BALR  r14,r15
00011A  4120  6010       000012 |                LA    r2,_Dsc_000001(,r6,16)
00011E  4100  6020       000012 |                LA    r0,_Dsc_000004(,r6,32)
000122  4140  6028       000012 |                LA    r4,C(,r6,40)
000126  58F0  300E       000012 |                L     r15,=V(IBMQJDSB)(,r3,14)
00012A  4110  D098       000012 |                LA    r1,#MX_TEMP1(,r13,152)
00012E  5040  D098       000012 |                ST    r4,#MX_TEMP1(,r13,152)
000132  5000  D09C       000012 |                ST    r0,#MX_TEMP1(,r13,156)
000136  4100  0000       000012 |                LA    r0,0
00013A  5000  D0A0       000012 |                ST    r0,#MX_TEMP1(,r13,160)
00013E  5020  D0A4       000012 |                ST    r2,#MX_TEMP1(,r13,164)
000142  5000  D0A8       000012 |                ST    r0,#MX_TEMP1(,r13,168)
000146  05EF             000012 |                BALR  r14,r15
000148                   000013 |       @1L1     DS    0H
000148  58F0  3012       000013 |                L     r15,=V(IBMQEFSH)(,r3,18)
00014C  05EF             000013 |                BALR  r14,r15
00014E                   000013 |       @1L4     DS    0H

00014E                   Start of Epilog
00014E  58D0  D004       000013 |                L     r13,4(,r13)
000152  58E0  D00C       000013 |                L     r14,12(,r13)
000156  9828  D01C       000013 |                LM    r2,r8,28(r13)
00015A  051E             000013 |                BALR  r1,r14
00015C  0707             000013 |                NOPR  7
00015E  0000

000160                   Start of Literals
000160  00000000                                       =A(EXAMPLE2)
000164  00000000                                       =V(IBMQFRG)
000168  00000000                                       =A(B)
00016C  00000000                                       =V(IBMQJDSB)

5655-H31  IBM(R) Enterprise PL/I for z/OS                                  : EXAMPLE

OFFSET OBJECT CODE       LINE#  FILE#    P S E U D O   A S S E M B L Y   L I S T I N G

000170  00000000                                       =V(IBMQEFSH)
000174                   End of Literals
```

Figure 137. Compiler-generated listings from example Enterprise PL/I routine (Part 2 of 4)

```
                          ***   General purpose registers used: 1111111110001111
                          ***   Floating point  registers used: 1111111100000000
                          ***   Size of register spill area: 512(max) 0(used)
                          ***   Size of dynamic storage: 200
                          ***   Size of executable code: 350
                          ***   CSECT Offset: 72 : 0x48

0001BC  0000  0000

                          Constant Area
000000  0004C5E7 E3D9                           |..EXTR          |
5655-H31  IBM(R) Enterprise PL/I for z/OS

OFFSET OBJECT CODE        LINE#  FILE#    P S E U D O   A S S E M B L Y   L I S T I N G

                          PPA1: Entry Point Constants
000000  1CCEA166                                       =F'483303782'      Flags
000004  000001C8                                       =A(PPA2-EXAMPLE)
000008  00000000                                       =F'0'              No PPA3
00000C  00000000                                       =F'0'              No EPD
000010  FFE00000                                       =F'-2097152'       Register save mask
000014  00000000                                       =F'0'              Member flags
000018  90                                             =AL1(144)          Flags
000019  000000                                         =AL3(0)            Callee's DSA use/8
00001C  0040                                           =H'64'             Flags
00001E  0012                                           =H'18'             Offset/2 to CDL
000020  00000000                                       =F'0'              State variable location
000024  500000AF                                       =F'1342177455'     CDL function length/2
000028  FFFFFE80                                       =F'-384'           CDL function EP offset
00002C  38280000                                       =F'942145536'      CDL prolog
000030  400800A7                                       =F'1074266279'     CDL epilog
000034  00000000                                       =F'0'              CDL end
000038  0007  ****                                     AL2(7),C'EXAMPLE'
                          PPA1 End

                          PPA2: Compile Unit Block
000000  0B00  3203                                     =F'184562179'      Flags
000004  FFFF  FDF0                                     =A(CEESTART-PPA2)
000008  0000  0000                                     =F'0'              No PPA4
00000C  FFFF  FDF0                                     =A(TIMESTMP-PPA2)
000010  0000  0000                                     =F'0'              No primary
000014  0200  0000                                     =F'33554432'       Flags
                          PPA2 End
5655-H31  IBM(R) Enterprise PL/I for z/OS

                                E X T E R N A L   S Y M B O L   D I C T I O N A R Y

          NAME        TYPE  ID  ADDR    LENGTH           NAME        TYPE  ID  ADDR    LENGTH

          EXAMPLE1     SD    1 000000   000228           EXAMPLE2     SD    2 000000   00005C
          @EXAMPLE     SD    3 000000   000004           B            SD    4 000000   000010
          EXAMPLE      LD    0 000048   000001           CEESG011     ER    5 000000
          IBMQFRG      ER    6 000000                    IBMQJDSB     ER    7 000000
          IBMQEFSH     ER    8 000000                    CEESTART     ER    9 000000
          CEEMAIN      SD   10 000000   00000C           IBMPINPL     ER   11 000000
          EXAMPLE      ER   12 000000
5655-H31  IBM(R) Enterprise PL/I for z/OS

                          E X T E R N A L   S Y M B O L   C R O S S   R E F E R E N C E

          ORIGINAL NAME                                  EXTERNAL SYMBOL NAME

          EXAMPLE1                                       EXAMPLE1
          EXAMPLE2                                       EXAMPLE2
          _EXAMPLE                                       @EXAMPLE
          B                                              B
          EXAMPLE                                        EXAMPLE
          CEESG011                                       CEESG011
          IBMQFRG                                        IBMQFRG
          IBMQJDSB                                       IBMQJDSB
          IBMQEFSH                                       IBMQEFSH
          CEESTART                                       CEESTART
          CEEMAIN                                        CEEMAIN
          IBMPINPL                                       IBMPINPL
```

Figure 138. Compiler-generated listings from example Enterprise PL/I routine (Part 3 of 4)

```
5655-H31  IBM(R) Enterprise PL/I for z/OS

                              * * * * *   S T O R A G E   O F F S E T   L I S T I N G   * * * * *

IDENTIFIER          DEFINITION      ATTRIBUTES
                                    <SEQNBR>-<FILE NO="">:<FILE LINE="">

A                   1-0:5           Class = automatic,          Location = 176 : 0xB0(r13),                 Length = 4

B                   1-0:6           Class = external definition, Location = CSECT B,                        Length = 16

C                   1-0:7           Class = static,             Location = 40 : 0x28 + CSECT EXAMPLE2,      Length = 20

D                   1-0:8           Class = static,             Location = 0 : 0x0 + CSECT EXAMPLE2,        Length = 4

E                   1-0:9           Class = automatic,          Location = 180 : 0xB4(r13),                 Length = 4

EXTR                1-0:4           Class = static,             Location = 8 : 0x8 + CSECT EXAMPLE2,        Length = 8

                        * * * * *   E N D   O F   S T O R A G   O F F S E T   L I S T I N G   * * * * *
5655-H31  IBM(R) Enterprise PL/I for z/OS

                                        * * * * *   S T A T I C    M A P   * * * * *

OFFSET (HEX)   LENGTH (HEX)   NAME

         0              4    D
         4              4    _Dsc_000003
         8              8    EXTR
        10              8    _Dsc_000001
        18              8    _Dsc_000002
        20              8    _Dsc_000004
        28             14    C
        40             1C    _Dsc_000005

                                 * * * * *   E N D   O F    S T A T I C    M A P   * * * * *
5655-H31  IBM(R) Enterprise PL/I for z/OS

                                     * * * * *   A U T O M A T I C    M A P   * * * * *

Block name: EXAMPLE

OFFSET (HEX)   LENGTH (HEX)   NAME

        98             18    #MX_TEMP1
        B0              4    A
        B4              4    E
        B8              8    _temp1
        C0              8    _temp2

                              * * * * *   E N D    O F    A U T O M A T I C    M A P   * * * * *
```

Figure 139. Compiler-generated listings from example Enterprise PL/I routine (Part 4 of 4)

Pseudo assembly listing

The pseudo assembly listing consists of the machine instructions and a translation of these instructions into a form that resembles assembler code. This listing always starts with a small section of non-executable data that records the date and time when the object was produced as well as the version of the compiler used to produce the object. This section ends with a service string which in the listing is followed by the build date for the compiler back-end that generated this part of the listing (and this date may be different from the build date for the compiler front-end that generated the first pages of the listing).

The majority of the pseudo assembly listing consists of the object code arranged in columns that specify for each instructions:

- Its offset.
- the instruction in object code format.
- Its associated line number.
- Its associated file number if non-zero (for example, if from an include file).
- the instruction in mnemonic format.

External symbol dictionary

The external symbol dictionary lists all the external symbols generated for this compilation. For each symbol, it also lists its linkage type and size (in hex).

External symbol cross reference

The external symbol dictionary cross reference shows for each external symbol the name that will be visible externally to the linker.

Storage offset listing

Each line of the storage offset listing contains the following information for each user variable:

- Its name.
- the number of the block in which it was declared.
- the number of the file in which it was declared.
- the number of the line in which it was declared.
- Its class (automatic, static, etc).
- Its location (as appropriate for its class).
- Its byte length in decimal.

This list is sorted by block number and then by name within each block.

Static map

Each line of the static storage map contains the following information for each internal static variable:

- Its hexadecimal offset.
- Its byte length in hex.
- Its name.

This list is sorted by the offset of the variables in static. This list of variables may also include compiler-generated variables.

Automatic map

Each line of the automatic storage map contains the following information, grouped by named block, for each automatic variable in that block:

- Its hexadecimal offset.
- Its byte length in hex.
- Its name.

These lists are sorted by the offset of the variables in automatic for each block. These lists of variables may also include compiler-generated variables.

Generating a Language Environment dump of an Enterprise PL/I routine

To generate a dump of an Enterprise PL/I routine, you can call either the Language Environment callable service CEE3DMP or PLIDUMP. For information about calling CEE3DMP, see "Generating a Language Environment dump with CEE3DMP" on page 33.

PLIDUMP syntax and options

PLIDUMP calls intermediate Enterprise PL/I library routines, which convert most PLIDUMP options to CEE3DMP options. The following list contains PLIDUMP options and the corresponding CEE3DMP option, if applicable. Some PLIDUMP options do not have corresponding CEE3DMP options, but continue to function as Enterprise PL/I default options. The list following the syntax diagram provides a description of those options.

PLIDUMP conforms to National Language Support standards. PLIDUMP can supply information across multiple Language Environment enclaves. If an application running in one enclave fetches a main procedure (an action that creates another enclave), PLIDUMP contains information about both procedures. The syntax and options for PLIDUMP are shown below.

Syntax

▶▶— PLIDUMP — (— *char.-string-exp 1* — , — *char.-string-exp 2* —) —▶◀

char.-string-exp 1

A dump options character string consisting of one or more of the following values. T, F, C, and A are the default options.

A

All. Results in a dump of all tasks including the ones in the WAIT state.

B

BLOCKS (Enterprise PL/I hexadecimal dump). Dumps the control blocks used in Language Environment and member language libraries. For Enterprise PL/I, this includes the DSA for every routine on the call chain and Enterprise PL/I "global" control blocks, such as Tasking Implementation Appendage (TIA), Task Communication Area (TCA), and the PL/I Tasking Control Block (PTCB). Enterprise PL/I file control blocks and file buffers are also dumped if the F option is specified.

C

Continue. The routine continues after the dump.

E

Exit. The enclave terminates after the dump. In a multitasking environment, if PLIDUMP is called from the main task, the enclave terminates after the dump. If PLIDUMP is called from a subtask, the subtask and any subsequent tasks created from the subtask terminate after the dump. In a multithreaded environment, if PLIDUMP is called from the Initial Process Thread (IPT), the enclave terminates after the dump. If PLIDUMP is called from a non-IPT, only the non-IPT terminates after the dump.

F

FILE INFORMATION. A set of attributes for all open files is given. The contents of the file buffers are displayed if the B option is specified.

H

STORAGE in hexadecimal. A SNAP dump of the region is produced. A ddname of CEESNAP must be provided to direct the CEESNAP dump report.

K

BLOCKS (when running under CICS). The Transaction Work Area is included.

Note: This option is not supported under Enterprise PL/I.

NB

NOBLOCKS.

NF

NOFILES.

NH

NOSTORAGE.

NK

NOBLOCKS (when running under CICS).

NT

NOTRACEBACK.

O

THREAD(CURRENT). Results in a dump of only the current task or current thread (the invoker of PLIDUMP).

S

Stop. The enclave terminates after the dump. In a multitasking environment, regardless of whether PLIDUMP is called from the main task or a subtask, the enclave terminates after the dump. In a multithreaded environment, regardless of whether PLIDUMP is called from the IPT or a non-IPT, the enclave terminates after the dump (in which case there is no fixed order as to which thread terminates first).

T

TRACEBACK. Includes a traceback of all routines on the call chain. The traceback shows transfers of control from either calls or exceptions. BEGIN blocks and ON-units are also control transfers and are included in the trace. The traceback extends backwards to the main program of the current thread.

char.-string-exp 2

A user-identified character string up to 80 characters long that is printed as the dump header.

PLIDUMP usage notes

If you use PLIDUMP, the following considerations apply:

- If a routine calls PLIDUMP a number of times, use a unique user-identifier for each PLIDUMP invocation. This simplifies identifying the beginning of each dump.
- In MVS or TSO, you can use ddnames of CEEDUMP, PLIDUMP, or PL1DUMP to direct dump output. If no ddname is specified, CEEDUMP is used.
- The data set defined by the PLIDUMP, PL1DUMP, or CEEDUMP DD statement should specify a logical record length (LRECL) of at least 131 to prevent dump records from wrapping.
- When you specify the H option in a call to PLIDUMP, the Enterprise PL/I library issues an OS SNAP macro to obtain a dump of virtual storage. The first invocation of PLIDUMP results in a SNAP identifier of 0. For each successive invocation, the ID is increased by one to a maximum of 256, after which the ID is reset to 0.
- Support for SNAP dumps using PLIDUMP is provided only under MVS. SNAP dumps are not produced in a CICS environment.
  - If the SNAP does not succeed, the CEE3DMP DUMP file displays the message:

    ```
    Snap was unsuccessful
    ```

    Failure to define a CEESNAP data set is the most likely cause of an unsuccessful CEESNAP.
  - If the SNAP is successful, CEE3DMP displays the message, where *nnn* corresponds to the SNAP identifier described above. An unsuccessful SNAP does not result in an incrementation of the identifier.

    ```
    Snap was successful; snap ID = nnn
    ```
- To ensure portability across system platforms, use PLIDUMP to generate a dump of your Enterprise PL/I routine.

Finding Enterprise PL/I information in a dump

The following sections discuss Enterprise PL/I-specific information located in the following sections of a Language Environment dump:

- Traceback
- Control Blocks for Active Routines
- Control Block Associated with the Thread
- File Status and Attributes

Traceback

Examine the traceback section of the dump, shown in Figure 140 on page 299, for condition information about your routine and information about the statement number and address where the exception occurred.

```
CEE3DMP V1 R9.0: Plidump called from error On-unit          01/31/07 3:59:39 PM                 Page:    1
ASID: 010E   Job ID: J0009410   Job name: LEDGSMP1   Step name: GO        UserID: BARBARA

CEE3845I CEEDUMP Processing started.
PLIDUMP was called from statement number 9 at offset +000000D2 from _ON_Begin_7_Blk_2 with entry address 11200240

Information for enclave EXAMPLE

  Information for thread 8000000000000000

  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     IBMPDUMP    +000002AE              IBMPEV11                                            PQ78306  Call
    2     _ON_Begin_7_Blk_2
                      +000000D2  9           EXAMPLE              _Begin_12_Blk_3                         Call
    3     IBMPEONR    +000002A2              IBMPEV11                                            PQ76426  Call
    4     IBMPEBOP    +000004DC              IBMPEV11                                            LE19BAS  Call
    5     CEEEV011    +00000132              IBMPEV11             CEEEV011                                Call
    6     CEEHDSP     +000017D0              CEEPLPKA             CEEHDSP                        D1908    Call
    7     IBMBERRI    +000000AA              IBMPEV11                                            LE19BAS  Exception
    8     ERR_RAISE_COND
                      +00000090              IBMPEV11                                            LE19BAS  Call
    9     IBMPERSU    +00000082              IBMPEV11                                            LE19BAS  Call
    10    _Begin_12_Blk_3
                      +00000100  16          EXAMPLE              _Begin_12_Blk_3                         Call
    11    EXAMPLE     +000000B0  12          EXAMPLE              _Begin_12_Blk_3                         Call
    12    IBMPMINV    +000004DE              IBMPEV11             IBMPMINV                                Call
    13    CEEEV011    +00000202              IBMPEV11             CEEEV011                                Call
    14    CEEBBEXT    +000001B6              CEEPLPKA             CEEBBEXT                       D1908    Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     11A3DE50   114A4E38   114A4E38   +000002AE  20061214   LIBRARY   EBCDIC  HFP
    2     11A3DD70   11200240   112000D0   +00000242  20070131   ENT PL/I EBCDIC  HFP
    3     11A3DBD8   114A7B98   114A7B98   +000002A2  20061214   LIBRARY   EBCDIC  HFP
    4     11A3DA08   114AF390   114AF390   +000004DC  20061214   LIBRARY   EBCDIC  HFP
    5     11A3D978   114062E8   114062E8   +00000132  20061214   LIBRARY
    6     11A3A858   112C3238   112C3238   +000017D0  20061215   CEL
    7     11A3A6B8   114AAA18   114AAA18   +000000AA  20061214   LIBRARY   EBCDIC  HFP
    8     11A3A618   114A9FA8   114A9FA8   +00000090  20061214   LIBRARY   EBCDIC  HFP
    9     11A3A570   114AB120   114AB120   +00000082  20061214   LIBRARY   EBCDIC  HFP
    10    11A3A4A8   112000D0   112000D0   +00000100  20070131   ENT PL/I EBCDIC  HFP
    11    11A3A3B8   11200340   112000D0   +00000320  20070131   ENT PL/I EBCDIC  HFP
    12    11A3A180   114DD990   114DD990   +000004DE  20061214   LIBRARY
    13    11A3A0F0   114062E8   114062E8   +00000202  20061214   LIBRARY
    14    11A3A030   11291208   11291208   +000001B6  20061215   CEL

  Condition Information for Active Routines
    Condition Information for  (DSA address 11A3A6B8)
      CIB Address: 11A3B178
      Current Condition:
        IBM0281S A prior condition was promoted to the ERROR condition.
      Original Condition:
        IBM0421S  ONCODE=520  The SUBSCRIPTRANGE condition was raised.
      Location:
        Program Unit:  Entry: IBMBERRI Statement:  Offset: +000000AA

  Storage dump near condition, beginning at location: 114AAAB2
   +000000 114AAAB2  4110D098 5050D098 5040D09C 5040D0A0  05EF1F00 43002016 A7010080 A7840009  |...q&&.q& ..& ..........x...xd..|
:
```

Figure 140. Traceback section of dump (Enterprise PL/I)

Condition information

If the dump was called from an ON-unit, the type of ON-unit is identified in the traceback as part of the entry information. For ON-units, the values of any relevant condition built-in functions (for example, ONCHAR and ONSOURCE for conversion errors) appear. In cases where the cause of entry into the ON-unit is not stated, usually when the ERROR ON-unit is called, the cause of entry appears in the condition information.

Statement number and address where error occurred

This information, which is the point at which the condition that caused entry to the ON-unit occurred, can be found in the traceback section of the dump. If the condition occurs in compiled code, and you compiled your routine with either GOSTMT or GONUMBER, the statement numbers appear in the dump. To identify the assembler instruction that caused the error, use the traceback information in the dump to find the program unit (PU) offset of the statement number in which the error occurred. Then find that offset and the corresponding instruction in the object code listing.

Control blocks for active routines

This section shows the stack frames for all active routines, and the static storage. Use this section of the dump to identify variable values, determine the contents of parameter lists, and locate the timestamp. Figure 141 on page 300 shows this section of the dump.

```
 Control Blocks for Active Routines:
:
   DSA for EXAMPLE: 11A3A3B8
     +000000  FLAGS.... 10A3      member... A12C      BKC...... 11A3A180  FWC...... 11A3A138  R14...... 912003F2
     +000010  R15...... 112000D0  R0....... 11A3A3B8  R1....... 11200240  R2....... 11211768  R3....... 1120037A
     +000024  R4....... 11A3A0D8  R5....... 11A3A3B8  R6....... 11200800  R7....... 00000000  R8....... 11211648
     +000038  R9....... 00000008  R10...... 11A3A0B0  R11...... 11200ACC  R12...... 112129B0  reserved. 00000000
     +00004C  NAB...... 11A3A4A8  PNAB..... 00000000  reserved. 00000000  00000000
     +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 00000000
     +000078  reserved. 00000000  reserved. 00000000
   Dynamic save area (EXAMPLE): 11A3A3B8
     +000000 11A3A3B8  10A3A12C 11A3A180 11A3A138 912003F2  112000D0 11A3A3B8 11200240 11211768  |.t...t...t..j..2.....tt.... ....|
     +000020 11A3A3D8  1120037A 11A3A0D8 11A3A3B8 11200800  00000000 11211648 00000008 11A3A0B0  |...:.t.Q.tt..................t..|
     +000040 11A3A3F8  11200ACC 112129B0 00000000 11A3A4A8  00000000 00000000 00000000 00000000  |.............tuy................|
     +000060 11A3A418  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
     +000080 11A3A438  00000000 00000000 00000000 00000000  00000000 00000000 00100000 00000000  |................................|
     +0000A0 11A3A458  00180180 11A3A3B8 00000000 11200980  0B300000 11200240 11A3A3B8 00000000  |.....tt................ .tt.....|
     +0000C0 11A3A478  00000002 00000002 00000002 00000002  00000002 00000002 00000002 00000002  |................................|
     +0000E0 11A3A498  00000002 00000002 0000000B 00000014  10000000 11A3A3B8 11A3A7D8 912001D2  |.....................tt..txQj..K|
   ENTERPRISE PL/I OPTIONS:
    AFP, ARCH( 5), BACKREG(5), BIFPREC(15), CHECK(NOCONFORMANCE, NOSTORAGE), CMPAT(V2), CODEPAGE( 1140), COMMON,
    NOCOMPACT, CSECT, CSECTCUT( 4) CURRENCY( $), NODBCS, DECIMAL( FOFLONASGN, NOFORCEDSIGN), DEFAULT( IBM, ASSIGNABLE,
    NOINITFILL, NONCONNECTED, DESCRIPTOR, DESCLOCATOR, DUMMY(ALIGNED), ORDINAL(MIN), BYADDR, RETURNS(BYADDR),
    LINKAGE(OPTLINK), NORETCODE, NOINLINE, ORDER, NOOVERLAP, NONRECURSIVE, ALIGNED, NULL370, EVENDEC, SHORT(HEXADEC),
    EBCDIC, HEXADEC, NATIVE, NATIVEADDR, E(HEXADEC) ), DISPLAY(WTO), NODLLINIT, EXTRN(FULL), NOGRAPHIC, NOINITAUTO,
    NOINITBASED, NOINITCTL, NOINITSTATIC, NOINTERRUPT, LIMITS( EXTNAME( 7), FIXEDBIN( 31, 31), FIXEDDEC( 15, 15), NAME( 100
    )), OPTIMIZE( 0), PREFIX( CONVERSION, FIXEDOVERFLOW, INVALIDOP, OVERFLOW, PRECTYPE(ANS), NOSIZE, NOSTRINGRANGE,
    NOSTRINGSIZE, NOSUBSCRIPTRANGE, UNDERFLOW, ZERODIVIDE), REDUCE, NORENT, RESEXP, RESPECT(), RULES(IBM), NOSTDSYS,
    NOSCHEDULER, STRINGOFGRAPHIC(GRAPHIC), SYSTEM(MVS), TEST(ALL ,SYM ,HOOK ,NOSEPARATE), TUNE( 5), USAGE( ROUND(IBM),
    UNSPEC(IBM)), WIDECHAR(BIGENDIAN), WINDOW( 1950), WRITABLE, XINFO(NODEF, NOXML)
   Static for procedure EXAMPLE    Timestamp: 2007.01.31 15:59:36 V03.R06.M00: 11200800
     +000000 11200800  02020240 00000005 02020240 00000021  00000000 11200898 00000000 11200830  |... ....... ...........q........|
     +000020 11200820  00000000 11200898 00000000 11200830  00000000 11200838 00000000 00000000  |.......q........................|
     +000040 11200840  31010001 00000000 00000000 00000000  00000010 00000000 00000000 00000000  |................................|
     +000060 11200860  112008B0 00000000 00000000 00000000  00000004 00000004 0000000A 00000001  |................................|
     +000080 11200880  0000001B 00000024 0000002D 00000032  00000000 00000000 112008D0 112008F0  |...............................0|
     +0000A0 112008A0  11200910 11200930 00000000 11200860  02002200 11200340 00000000 00000000  |...............-....... ........|
     +0000C0 112008C0  11200840 11200438 00090107 00000000  42002201 000000A2 00000000 00000000  |... ....................s........|
     +0000E0 112008E0  30000000 11200444 00090105 00000000  48012401 D00000C0 11200870 00000000  |................................|
     +000100 11200900  00001F80 1120044C 00010105 00000000  40002401 D00000E8 00000000 00000000  |.......<........ ......Y........|
     +000120 11200920  00001F80 11200454 00010101 00000000  40002401 D00000EC 00000000 00000000  |................ ...............|
     +000140 11200940  00001F80 11200458 00010109 00000000  00000003 00000010 00000002 0000002D  |................................|
     +000160 11200960  00000024 0000000F 00000002 0000002D  00000032 0000000E 00000001 00000032  |................................|
     +000180 11200980  D0000098 00100000 6E3BFFE0 00000000  11200898 11200A80 11200830 90010000  |...q....>..........q............|
     +0001A0 112009A0  11200340 00000000 00000000 00000004  11200880 00000000 112009C0 00000000  |... ............................|
     +0001C0 112009C0  D00000A8 00100000 6E3BFFE0 00000000  11200820 11200A80 11200828 83010000  |...y....>...................c...|
     +0001E0 112009E0  11200240 11200980 11200A00 00000000  00000000 00000000 00000000 00000000  |... ............................|
     +000200 11200A00  D0000098 00000000 6E7BFFE0 00000000  11200810 11200A80 11200818 01000000  |...q....>#......................|
     +000220 11200A20  112000D0 11200980 00000000 00000000  00000000 11200950 00000000 00000000  |.......................&........|
     +000240 11200A40  00000000 00000000 00000000 00000000  00010007 C5E7C1D4 D7D3C500 010005D3  |.....................EXAMPLE....L|
     +000260 11200A60  C1C2D3F1 00010005 C1D9D9C1 E8000100  01C90001 0009C1D9 D9C1E86D C5D5C400  |ABL1....ARRAY....I....ARRAY_END.|
     +000280 11200A80  00000000 11200464 E1100FF2 F0F0F7F0  F1F3F1F1 F5F5F9F3 F6F0F0F0 0000003F  |...........20070131155936000....|
     +0002A0 11200AA0  11200A40 11200860 11200838 00000001  11200850 00220000 00000000 11200980  |... ...-...........&............|
     +0002C0 11200AC0  11200438 00000000 01000001 11200340  11200FC0 00000000 18AF47F0 A016C3C5  |............... ...........0..CE|
:
```

Figure 141. Control blocks for active routines section of the dump (Enterprise PL/I)

Automatic variables

To find automatic variables, use an offset from the stack frame of the block in which they are declared. This information appears in the variable storage map generated when the MAP compiler option is in effect. If you have not used the MAP option, you can determine the offset by studying the listing of compiled code instructions.

Static variables

If your routine is compiled with the MAP option, you can find static variables by using an offset in the variable storage map. If the MAP option is not in effect, you can determine the offset by studying the listing of compiled code.

Based variables

To locate based variables, use the value of the defining pointer. Find this value by using one of the methods described above to find static and automatic variables. If the pointer is itself based, you must find its defining pointer and follow the chain until you find the correct value.

The following is an example of typical code for X BASED (P), with P AUTOMATIC. P is held at offset X'C8' from register 13. This address points to X.

```
58 60 D 0C8        L 6,P
58 E0 6 000        L 14,X
```

Take care when examining a based variable to ensure that the pointers are still valid.

Area variables

Area variables are located using one of the methods described above, according to their storage class.

The following is an example of typical code: for an area variable A declared AUTOMATIC. The area starts at offset X'F8' from register 13

```
41 60 D 0F8        LA 6,A
```

Variables in areas

To find variables in areas, locate the area and use the offset to find the variable.

Contents of parameter lists

To find the contents of a passed parameter list, first find the register 1 value in the save area of the calling routine's stack frame. Use this value to locate the parameter list in the dump. If R1=0, no parameters passed.

Control blocks associated with the thread

This section of the dump, shown in Figure 142 on page 301, includes information about Enterprise PL/I fields of the CAA and other control block information.

```
  Control Blocks Associated with the Thread:
    CAA: 112139B0
      +000000 112139B0  00000800 00000000 11A3B018 11A5B018  00000000 00000000 00000000 00000000  |.........t...v..................|
      +000020 112139D0  00000000 00000000 11210A58 00000000  00000000 00000000 00000000 00000000  |................................|
      +000040 112139F0  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000060 11213A10  00000000 00000000 00000000 00000000  00000000 80014608 00000000 00000000  |................................|
⋮
    DUMMY DSA: 11214350
      +000000  FLAGS.... 0000      member... 0000      BKC...... 00006F60  FWC...... 11A3B030  R14...... 9120132E
      +000010  R15...... 91292208  R0....... 7D000008  R1....... 11212768  R2....... 00000000  R3....... 00000000
      +000024  R4....... 00000000  R5....... 00000000  R6....... 00000000  R7....... 91215770  R8....... 11200FE0
      +000038  R9....... 008FF7D0  R10...... 00000000  R11...... 9120125A  R12...... 112139B0  reserved. 00000000
      +00004C  NAB...... 11A3B030  PNAB..... 11A3B030  reserved. 00000000  00000000
      +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 00000000
      +000078  reserved. 00000000  reserved. 00000000
⋮
    PL/I TCA Appendage: 11A5BCE8
      +000000 11A5BCE8  00000000 00000000 00000000 11A5BEF8  0000047B 00000000 00000000 00000000  |............v.8...#.............|
      +000020 11A5BD08  00000000 00000000 11A5BE48 1154AAC8  00000000 00009600 00000000 00000000  |.........v.....H......o.........|
      +000040 11A5BD28  00000000 00000000 00000000 00000000  11A5C960 11A3EAC0 00004000 00000000  |................vI-.t.... ......|
      +000060 11A5BD48  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000080 11A5BD68  114B38C8 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...H............................|
      +0000A0 11A5BD88  00000000 00000000 00000000 00000000  00000000 00000000 00000001 00000000  |................................|
      +0000C0 11A5BDA8  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +0000E0 11A5BDC8 - +0000FF 11A5BDE7             same as above
      +000100 11A5BDE8  00000000 00000000 00000000 11A5C380  00000002 00000000 00000000 00000000  |.............vC.................|
      +000120 11A5BE08  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000140 11A5BE28 - +00015F 11A5BE47             same as above
      +000160 11A5BE48  11A5CFB0 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |.v..............................|
      +000180 11A5BE68  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +0001A0 11A5BE88 - +0001BF 11A5BEA7             same as above
    PL/I OCA: 11A3EAC0
      +000000 11A3EAC0  D6C3C100 11A5CA28 000000FF 00000000  00000000 00000000 00000000 00000000  |OCA..v..........................|
      +000020 11A3EAE0  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000040 11A3EB00 - +0000BF 11A3EB7F             same as above
      +0000C0 11A3EB80  00000000 00000000 40404040 40404040  40404096 002C0000 A3404EF0 F0F0F0F0  |........           o....t +00000|
    PL/I OCA: 11A5CA28
      +000000 11A5CA28  D6C3C100 11A5C960 0B0220FF 00000000  01400030 00000200 00000000 00000000  |OCA..vI-......... ..............|
      +000020 11A5CA48  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000040 11A5CA68 - +00005F 11A5CA87             same as above
      +000060 11A5CA88  00000000 00000000 00000000 00000000  00000000 00000000 00000000 11200952  |................................|
      +000080 11A5CAA8  02020000 00000004 11A3E978 00000000  00000000 00000000 00000000 00000000  |.........tZ.....................|
      +0000A0 11A5CAC8  00000000 00000000 00000000 00000000  00000000 00000000 00030119 59C9C2D4  |.............................IBM|
      +0000C0 11A5CAE8  00000000 00000000 11A5B018 00000040  C3C4D3D3 00000000 40000000 00000000  |.........v..... CDLL.... .......|
    PL/I OCA: 11A5C960
      +000000 11A5C960  D6C3C100 00000000 000000FF 00000000  0000FFFF 00000000 00000000 11A5BD40  |OCA..........................v. |
      +000020 11A5C980  02040000 00000000 11A5BD42 02020000  00000001 11A5BD40 02040000 00000000  |.........v..........v. .........|
      +000040 11A5C9A0  11A5BD40 02040000 00000000 11A5BD40  02040000 00000000 11A5BD40 02040000  |.v. .........v. .........v. ....|
      +000060 11A5C9C0  00000000 11A5BD40 020D0000 00000000  11A5BE1C 020D0000 00000001 11A5BD40  |.....v. .........v...........v. |
      +000080 11A5C9E0  02040000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +0000A0 11A5CA00  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +0000C0 11A5CA20  00000000 00000000 D6C3C100 11A5C960  0B0220FF 00000000 01400030 00000200  |........OCA..vI-......... ......|

  Enclave Control Blocks:
    EDB: 11212648
      +000000 11212648  C3C5C5C5 C4C24040 C0000001 11213870  11212D50 00000000 00000000 00000000  |CEEEDB  ...........&............|
      +000020 11212668  11212B58 11212B88 91215770 11212198  00000000 00000000 11212768 00000000  |.......hj......q................|
      +000040 11212688  00000000 00000000 00006F60 00000000  00000000 91333B58 1120A880 112126A0  |..........?-........j.....y.....|
      +000060 112126A8  0000F460 00000000 11211E58 00000000  11214550 00000000 113F4660 112139B0  |..4-...............&.......-....|
      +000080 112126C8  40000000 0000FAF6 00000000 00000000  00000001 0001F060 00006FF8 008CCE00  | ......6..............0-..?8....|
      +0000A0 112126E8  00000001 00000100 1120A988 112126F0  00000000 00000000 00000000 00000001  |..........zh...0................|
    MEML: 11213870
      +000000 11213870  00000000 00000000 112945B0 00000000  00000000 00000000 112945B0 00000000  |................................|
      +000020 11213890  00000000 00000000 112945B0 00000000  1120F8D8 00000000 91575288 00000000  |.................8Q....j..h.....|
      +000040 112138B0  00000000 00000000 112945B0 00000000  00000000 00000000 112945B0 00000000  |................................|
      +000060 112138D0 - +00009F 1121390F             same as above
      +0000A0 11213910  00000000 00000000 112945B0 00000000  00000000 00000000 914072E8 00000000  |.......................j .Y.....|
      +0000C0 11213930  00000000 00000000 112945B0 00000000  00000000 00000000 112945B0 00000000  |................................|
      +0000E0 11213950 - +00011F 1121398F             same as above

    WSA address.................00000000
```

Figure 142. Control blocks associated with the thread section of the dump (Enterprise PL/I) (Part 1 of 2)

```
  File Status and Attributes:
⋮
    Attributes of file: SYSPRINT
     STREAM OUTPUT PRINT ENVIRONMENT( CONSECUTIVE VB BLKSIZE( 129) RECSIZE( 125) LINESIZE( 120) PAGESIZE( 60) CTLASA )
    CURRENT RECORD IN BUFFER
    BUFFER: 11A5CF20
      +000000 11A5CF20  40E2A482 F140E2A3 8199A389 95874000  40000000 00000000 00000000 00000000  | Sub1 Starting . ...............|
      +000020 11A5CF40  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000040 11A5CF60 - +00007F 11A5CF9F             same as above

  File Control Blocks:
    FILE CONTROL BLOCK (FCB): 11A5CB38
      +000000 11A5CB38  11A5CB38 00000000 11A5CFB0 114F5440  114F53E8 114F4FF0 114F53E8 114F4F50  |.v.......v...|. .|.Y.||0.|.Y.||&|
      +000020 11A5CB58  114F4ED8 1153CA88 114F5440 114F5440  114F5440 114F5440 114F5440 114F53E8  |.|+Q...h.|. .|. .|. .|. .|. .|.Y|
      +000040 11A5CB78  114F53E8 11537648 114F53E8 114F4E20  114F53E8 114F53E8 114F53E8 114F46A0  |.|.Y.....|.Y.|+..|.Y.|.Y.|.Y.|..|
      +000060 11A5CB98  114F4618 114F4548 114F53E8 11A5CD20  00000000 00000000 00000000 00000000  |.|...|...|.Y.v..................|
      +000080 11A5CBB8  00000000 00454842 11A5D02C 00000000  000001DA 11A64024 11A5CF20 00000081  |.........v...........w ..v.....a|
      +0000A0 11A5CBD8  00000000 00000000 00000078 00000010  00000079 00000000 00000000 00000000  |................................|
      +0000C0 11A5CBF8  00000000 00080150 20000720 000A6080  00000000 00000000 00000000 00000000  |.......&......-.................|
      +0000E0 11A5CC18  1154DA70 11A5CF21 00000000 00000000  11A3B5FC 1154AAC8 00000000 0000000E  |.....v...........t.....H........|
      +000100 11A5CC38  00000000 11A5CF20 00000001 00000001  00000002 003C0078 08000000 00000000  |.....v..........................|
      +000120 11A5CC58  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000140 11A5CC78  00000000 00000000 00000000 003BA682  6B409985 8386947E E5C2C16B 40939985  |.............wb, recfm=VBA, lre|
      +000160 11A5CC98  83937EF1 F2F56B40 829392A2 89A9857E  F1F2F96B 40A3A897 857E9985 83969984  |cl=125, blksize=129, type=record|
      +000180 11A5CCB8  6B409596 A2858592 00000000 00000000  00000000 00000000 00000000 00000000  |, noseek........................|
      +0001A0 11A5CCD8  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +0001C0 11A5CCF8 - +0001DF 11A5CD17             same as above
    CURRENT ACTIVE ICO CONTROL BLOCK:
    ICO: 11A5CF21
      +000000 11A5CF21  E2A482F1 40E2A381 99A38995 87400040  00000000 00000000 00000000 00000000  |Sub1 Starting . ................|
      +000020 11A5CF41  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000040 11A5CF61 - +00007F 11A5CFA0             same as above

 Process Control Blocks:

  PCB: 11212198
    +000000 11212198  C3C5C5D7 C3C24040 03030288 00000000  00000000 00000000 112123D0 913F74D0  |CEEPCB  ...h................j...|
    +000020 112121B8  913EDB50 913F4A08 913F4528 11208AE8  11211F68 00000000 00000000 11212648  |j..&j...j......Y................|
    +000040 112121D8  913F4858 7F800000 00000000 000141D4  00000000 80000000 00000000 00000000  |j..."..........M................|

  MEML: 112123D0
    +000000 112123D0  00000000 00000000 112945B0 00000000  00000000 00000000 112945B0 00000000  |................................|
    +000020 112123F0  00000000 00000000 112945B0 00000000  1120DE68 00000000 91575288 11A35000  |........................j..h.t&.|
    +000040 11212410  00000000 00000000 112945B0 00000000  00000000 00000000 112945B0 00000000  |................................|
    +000060 11212430 - +00009F 1121246F             same as above
    +0000A0 11212470  00000000 00000000 112945B0 00000000  11A36000 00000000 914072E8 00000000  |................t-.....j .Y....|
    +0000C0 11212490  00000000 00000000 112945B0 00000000  00000000 00000000 112945B0 00000000  |................................|
    +0000E0 112124B0 - +00011F 112124EF             same as above

  PL/I Process Control Block: 11212198
    +000000 11212198  C3C5C5D7 C3C24040 03030288 00000000  00000000 00000000 112123D0 913F74D0  |CEEPCB  ...h................j...|
    +000020 112121B8  913EDB50 913F4A08 913F4528 11208AE8  11211F68 00000000 00000000 11212648  |j..&j...j......Y................|
⋮
```

Figure 143. Control blocks associated with the thread section of the dump (Enterprise PL/I) (Part 2 of 2)

CAA address

The address of the CAA control block appears in this section of the dump. If the BLOCK option is in effect, the complete CAA (including the Enterprise PL/I implementation appendage) appears separately from the body of the dump. Register 12 addresses the CAA.

File status and attribute information

This part of the dump includes the following information:

- The default and declared attributes of all open files
- Buffer contents of all file buffers
- The contents of FCBs, DCBs, DCLCBs, IOCBs, and control blocks for the process or enclave

Enterprise PL/I contents of the Language Environment trace table

Language Environment provides three Enterprise PL/I trace table entry types that contain character data:

- Trace entry 100 occurs when a task is created.
- Trace entry 101 occurs when a task that contains the tasking CALL statements is terminated.
- Trace entry 102 occurs when a task that does not contain a tasking CALL statement is terminated.

The format for trace table entries 100, 101, and 102 follows. For more information about the Language Environment trace table format, see "Understanding the trace table entry (TTE)" on page 151.

```
-->(100) NameOfCallingTask NameOfCalledTask OffsetOfCallStmt
            UserAgrPtr CalledTaskPtr TaskVarPtr EventVarPtr
            PriorityPtr CallingR2-R5 CallingR12-R14

-->(101) NameOfReturnTask ReturnerR2-R5 ReturnerR12-R14

-->(102) NameOfReturnTask
```

Debugging example of Enterprise PL/I routines

This section contains examples of Enterprise PL/I routines and instructions for using information in the Language Environment dump to debug them. Important areas in the source code and in the dump for each routine are highlighted.

Subscript range error

Figure 144 on page 303 illustrates an error caused by an array subscript value outside the declared range. In this example, the declared array value is 10. This routine was compiled with the options LIST, TEST, GONUMBER, and MAP. It was run with the TERMTHDACT(TRACE) option to generate a traceback for the condition.

```
5655-H31  IBM(R) Enterprise PL/I for z/OS       V3.R6.M0 (Built:20070119)                      2007.01.31 15:59:36   Page     1
                     Options Specified
  Install:
  Command:
  Line.File Process Statements
     1.0    *PROCESS  GONUMBER LIST S STG TEST MAP;
  Install:
5655-H31  IBM(R) Enterprise PL/I for z/OS       EXAMPLE:  PROC  OPTIONS(M                      2007.01.31 15:59:36   Page     2
 Compiler Source
    Line.File
       2.0      EXAMPLE:  PROC  OPTIONS(MAIN);
       3.0
       4.0          DCL Array(10) Fixed bin(31);
       5.0          DCL (I,Array_End)   Fixed bin(31);
       6.0          On error
       7.0            Begin;
       8.0              On error system;
       9.0              Call plidump('tbnfs','Plidump called from error On-unit');
      10.0            End;
      11.0
      12.0          (subrg):              /* Enable subscriptrange condition */
      13.0          Labl1: Begin;
      14.0            Array_End = 20;
      15.0            Do I = 1 to Array_End;   /* Loop to initialize array */
      16.0              Array(I) = 2;    /* Set array elements to 2 */
      17.0            End;
      18.0          End Labl1;
      19.0       End Example;
5655-H31  IBM(R) Enterprise PL/I for z/OS       EXAMPLE:  PROC  OPTIONS(M                      2007.01.31 15:59:36   Page     3
                     Block Name List
    Number  Name
         1  EXAMPLE
         2  _ON_Begin_7_Blk_2
         3  _Begin_12_Blk_3
5655-H31  IBM(R) Enterprise PL/I for z/OS       EXAMPLE:  PROC  OPTIONS(M                      2007.01.31 15:59:36   Page     4

OFFSET OBJECT CODE        LINE#  FILE#    P S E U D O    A S S E M B L Y    L I S T I N G

                          Timestamp and Version Information
000000  F2F0  F0F7                                      =C'2007'          Compiled Year
000004  F0F1  F3F1                                      =C'0131'          Compiled Date MMDD
000008  F1F5  F5F9  F3F6                                =C'155936'        Compiled Time HHMMSS
00000E  F0F3  F0F6  F0F0                                =C'030600'        Compiler Version

000014  0036  ****                                      Service String    20070122
                          Timestamp and Version End

5655-H31  IBM(R) Enterprise PL/I for z/OS       EXAMPLE:  PROC  OPTIONS(M  : _Begin_12_Blk_3   2007.01.31 15:59:36   Page     5

OFFSET OBJECT CODE        LINE#  FILE#    P S E U D O    A S S E M B L Y    L I S T I N G

:
5655-H31  IBM(R) Enterprise PL/I for z/OS       EXAMPLE:  PROC  OPTIONS(M                      2007.01.31 15:59:36   Page    17

                               * * * * *   S T O R A G E    O F F S E T    L I S T I N G    * * * * *

IDENTIFIER          DEFINITION       ATTRIBUTES
                                     <SEQNBR>-<FILE NO="">:<FILE LINE="">

ARRAY               1-0:4            Class = automatic,           Location = 192 : 0xC0(r13),                 Length = 40

ARRAY_END           1-0:5            Class = automatic,           Location = 236 : 0xEC(r13),                 Length = 4

I                   1-0:5            Class = automatic,           Location = 232 : 0xE8(r13),                 Length = 4

                         * * * * *   E N D    O F    S T O R A G E    O F F S E T    L I S T I N G    * * * * *
:
```

Figure 144. Example of moving a value outside an array range (Enterprise PL/I)

Figure 145 on page 304 shows sections of the dump generated by a call to PLIDUMP.

```
CEE3DMP V1 R9.0: Plidump called from error On-unit                                01/31/07 3:59:39 PM                  Page:    1
ASID: 010E   Job ID: J0009410   Job name: LEDGSMP1   Step name: GO         UserID: BARBARA

CEE3845I CEEDUMP Processing started.
PLIDUMP was called from statement number 9 at offset +000000D2 from _ON_Begin_7_Blk_2 with entry address 11200240

Information for enclave EXAMPLE

  Information for thread 8000000000000000

  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     IBMPDUMP    +000002AE              IBMPEV11                                            PQ78306  Call
    2     _ON_Begin_7_Blk_2
                      +000000D2  9           EXAMPLE              _Begin_12_Blk_3                         Call
    3     IBMPEONR    +000002A2              IBMPEV11                                            PQ76426  Call
    4     IBMPEBOP    +000004DC              IBMPEV11                                            LE19BAS  Call
    5     CEEEV011    +00000132              IBMPEV11             CEEEV011                                Call
    6     CEEHDSP     +000017D0              CEEPLPKA             CEEHDSP                        D1908    Call
    7     IBMBERRI    +000000AA              IBMPEV11                                            LE19BAS  Exception
    8     ERR_RAISE_COND
                      +00000090              IBMPEV11                                            LE19BAS  Call
    9     IBMPERSU    +00000082              IBMPEV11                                            LE19BAS  Call
    10    _Begin_12_Blk_3
                      +00000100  16          EXAMPLE              _Begin_12_Blk_3                         Call
    11    EXAMPLE     +000000B0  12          EXAMPLE              _Begin_12_Blk_3                         Call
    12    IBMPMINV    +000004DE              IBMPEV11             IBMPMINV                                Call
    13    CEEEV011    +00000202              IBMPEV11             CEEEV011                                Call
    14    CEEBBEXT    +000001B6              CEEPLPKA             CEEBBEXT                       D1908    Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     11A3DE50   114A4E38   114A4E38   +000002AE  20061214   LIBRARY   EBCDIC  HFP
    2     11A3DD70   11200240   112000D0   +00000242  20070131   ENT PL/I EBCDIC  HFP
    3     11A3DBD8   114A7B98   114A7B98   +000002A2  20061214   LIBRARY   EBCDIC  HFP
    4     11A3DA08   114AF390   114AF390   +000004DC  20061214   LIBRARY   EBCDIC  HFP
    5     11A3D978   114062E8   114062E8   +00000132  20061214   LIBRARY
    6     11A3A858   112C3238   112C3238   +000017D0  20061215   CEL
    7     11A3A6B8   114AAA18   114AAA18   +000000AA  20061214   LIBRARY   EBCDIC  HFP
    8     11A3A618   114A9FA8   114A9FA8   +00000090  20061214   LIBRARY   EBCDIC  HFP
    9     11A3A570   114AB120   114AB120   +00000082  20061214   LIBRARY   EBCDIC  HFP
    10    11A3A4A8   112000D0   112000D0   +00000100  20070131   ENT PL/I EBCDIC  HFP
    11    11A3A3B8   11200340   112000D0   +00000320  20070131   ENT PL/I EBCDIC  HFP
    12    11A3A180   114DD990   114DD990   +000004DE  20061214   LIBRARY
    13    11A3A0F0   114062E8   114062E8   +00000202  20061214   LIBRARY
    14    11A3A030   11291208   11291208   +000001B6  20061215   CEL

  Condition Information for Active Routines
    Condition Information for  (DSA address 11A3A6B8)
      CIB Address: 11A3B178
      Current Condition:
        IBM0281S A prior condition was promoted to the ERROR condition.
      Original Condition:
        IBM0421S  ONCODE=520  The SUBSCRIPTRANGE condition was raised.
      Location:
        Program Unit:  Entry: IBMBERRI Statement:  Offset: +000000AA

    Storage dump near condition, beginning at location: 114AAAB2
      +000000 114AAAB2  4110D098 5050D098 5040D09C 5040D0A0  05EF1F00 43002016 A7010080 A7840009  |...q&&.q& ..& ..........x...xd..|


CEE3DMP V1 R9.0: Plidump called from error On-unit                                01/31/07 3:59:39 PM                  Page:    2
ASID: 010E   Job ID: J0009410   Job name: LEDGSMP1   Step name: GO         UserID: BARBARA

  Control Blocks for Active Routines:
    DSA for IBMPDUMP: 11A3DE50
      +000000  FLAGS.... 1000      member... 0000      BKC...... 11A3DD70  FWC...... 11A3E150  R14...... 914A50E8
      +000010  R15...... 912EF898  R0....... 00000000  R1....... 11A3DEE8  R2....... 00000002  R3....... 114A5104
      +000024  R4....... 11A3DEFC  R5....... 11A3E04C  R6....... 11200800  R7....... 11200438  R8....... 11A3B264
      +000038  R9....... 00000014  R10...... 00000098  R11...... 11A3A468  R12...... 112129B0  reserved. 00000000
      +00004C  NAB...... 11A3E150  PNAB..... 00000000  reserved. 00000000  11A3DB34
      +000064  reserved. 926DF340  reserved. 81A340A2  MODE..... A381A385  reserved. 948595A3
      +000078  reserved. 81A34083  reserved. C6C5D5E4
    Dynamic save area (IBMPDUMP): 11A3DE50
      +000000 11A3DE50  10000000 11A3DD70 11A3E150 914A50E8  912EF898 00000000 11A3DEE8 00000002  |.....t...t.&j.&Yj.8q.....t.Y....|
      +000020 11A3DE70  114A5104 11A3DEFC 11A3E04C 11200800  11200438 11A3B264 00000014 00000098  |.....t...t.<.........t.........q|
      +000040 11A3DE90  11A3A468 112129B0 00000000 11A3E150  00000000 00000000 11A37B2E 11A3DB34  |.tu..........t.&.........t#..t..|
⋮
```

Figure 145. Sections of the Language Environment dump (Part 1 of 2)

Figure 146 on page 305 shows more sections of the dump generated by a call to PLIDUMP.

```
DSA for _Begin_12_Blk_3: 11A3A4A8
  +000000  FLAGS.... 1000      member... 0000      BKC...... 11A3A3B8  FWC...... 11A3A7D8  R14...... 912001D2
  +000010  R15...... 914AB120  R0....... 0000000A  R1....... 11A3A478  R2....... 0000000B  R3....... 1120010A
  +000024  R4....... 11A3A0D8  R5....... 11A3A3B8  R6....... 11200800  R7....... 00000000  R8....... 11211648
  +000038  R9....... 00000008  R10...... 11A3A0B0  R11...... 11200ACC  R12...... 112129B0  reserved. 00000000
  +00004C  NAB...... 11A3A570  PNAB..... 00000000  reserved. 00000000  00000000
  +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 00000000
  +000078  reserved. 00000000  reserved. 00000000
Dynamic save area (_Begin_12_Blk_3): 11A3A4A8
  +000000 11A3A4A8  10000000 11A3A3B8 11A3A7D8 912001D2  914AB120 0000000A 11A3A478 0000000B  |.....tt..txQj..Kj........tu.....|
  +000020 11A3A4C8  1120010A 11A3A0D8 11A3A3B8 11200800  00000000 11211648 00000008 11A3A0B0  |.....t.Q.tt.................t..|
  +000040 11A3A4E8  11200ACC 112129B0 00000000 11A3A570  00000000 00000000 00000000 00000000  |............tv.................|
  +000060 11A3A508  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...............................|
  +000080 11A3A528  11A3A120 9129B186 11A3A0F0 00000000  10A3A0F0 11A3A4A8 00000000 00000000  |.t..j..f.t.0.....t.0.tuy........|
  +0000A0 11A3A548  00180280 11A3A4A8 11A3A450 11200A00  00000014 11A3A3B8 0000000A 0000000B  |.....tuy.tu&.........tt.........|
  +0000C0 11A3A568  11A3A478 11200340 10A3A4A8 11A3A4A8  11200650 914AB1A4 114A9FA8 00000020  |.tu.... .tuy.tuy...&j..u...y....|
DSA for EXAMPLE: 11A3A3B8
  +000000  FLAGS.... 10A3      member... A12C      BKC...... 11A3A180  FWC...... 11A3A138  R14...... 912003F2
  +000010  R15...... 112000D0  R0....... 11A3A3B8  R1....... 11200240  R2....... 11211768  R3....... 1120037A
  +000024  R4....... 11A3A0D8  R5....... 11A3A3B8  R6....... 11200800  R7....... 00000000  R8....... 11211648
  +000038  R9....... 00000008  R10...... 11A3A0B0  R11...... 11200ACC  R12...... 112129B0  reserved. 00000000
  +00004C  NAB...... 11A3A4A8  PNAB..... 00000000  reserved. 00000000  00000000
  +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 00000000
  +000078  reserved. 00000000  reserved. 00000000
Dynamic save area (EXAMPLE): 11A3A3B8
  +000000 11A3A3B8  10A3A12C 11A3A180 11A3A138 912003F2  112000D0 11A3A3B8 11200240 11211768  |.t...t...t..j..2.....tt.... ....|
  +000020 11A3A3D8  1120037A 11A3A0D8 11A3A3B8 11200800  00000000 11211648 00000008 11A3A0B0  |...:.t.Q.tt.................t..|
  +000040 11A3A3F8  11200ACC 112129B0 00000000 11A3A4A8  00000000 00000000 00000000 00000000  |.............tuy...............|
  +000060 11A3A418  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |...............................|
  +000080 11A3A438  00000000 00000000 00000000 00000000  00000000 00000000 00100000 00000000  |...............................|
  +0000A0 11A3A458  00180180 11A3A3B8 00000000 11200980  0B300000 11200240 11A3A3B8 00000000  |.....tt............... .tt.....|
  +0000C0 11A3A478  00000002 00000002 00000002 00000002  00000002 00000002 00000002 00000002  |...............................|
  +0000E0 11A3A498  00000002 00000002 0000000B 00000014  10000000 11A3A3B8 11A3A7D8 912001D2  |....................tt..txQj..K|
ENTERPRISE PL/I OPTIONS:
 AFP, ARCH( 5), BACKREG(5), BIFPREC(15), CHECK(NOCONFORMANCE, NOSTORAGE), CMPAT(V2), CODEPAGE( 1140), COMMON,
 NOCOMPACT, CSECT, CSECTCUT( 4) CURRENCY( $), NODBCS, DECIMAL( FOFLONASGN, NOFORCEDSIGN), DEFAULT( IBM, ASSIGNABLE,
 NOINITFILL, NONCONNECTED, DESCRIPTOR, DESCLOCATOR, DUMMY(ALIGNED), ORDINAL(MIN), BYADDR, RETURNS(BYADDR),
 LINKAGE(OPTLINK), NORETCODE, NOINLINE, ORDER, NOOVERLAP, NONRECURSIVE, ALIGNED, NULL370, EVENDEC, SHORT(HEXADEC),
 EBCDIC, HEXADEC, NATIVE, NATIVEADDR, E(HEXADEC) ), DISPLAY(WTO), NODLLINIT, EXTRN(FULL), NOGRAPHIC, NOINITAUTO,
 NOINITBASED, NOINITCTL, NOINITSTATIC, NOINTERRUPT, LIMITS( EXTNAME( 7), FIXEDBIN( 31, 31), FIXEDDEC( 15, 15), NAME( 100
 )), OPTIMIZE( 0), PREFIX( CONVERSION, FIXEDOVERFLOW, INVALIDOP, OVERFLOW, PRECTYPE(ANS), NOSIZE, NOSTRINGRANGE,
 NOSTRINGSIZE, NOSUBSCRIPTRANGE, UNDERFLOW, ZERODIVIDE), REDUCE, NORENT, RESEXP, RESPECT(), RULES(IBM), NOSTDSYS,
 NOSCHEDULER, STRINGOFGRAPHIC(GRAPHIC), SYSTEM(MVS), TEST(ALL ,SYM ,HOOK ,NOSEPARATE), TUNE( 5), USAGE( ROUND(IBM),
 UNSPEC(IBM)), WIDECHAR(BIGENDIAN), WINDOW( 1950), WRITABLE, XINFO(NODEF, NOXML)
Static for procedure EXAMPLE    Timestamp: 2007.01.31 15:59:36 V03.R06.M00: 11200800
  +000000 11200800  02020240 00000005 02020240 00000021  00000000 11200898 00000000 11200830  |... ....... ..........q........|
  +000020 11200820  00000000 11200898 00000000 11200830  00000000 11200838 00000000 00000000  |.......q.......................|
  +000040 11200840  31010001 00000000 00000000 00000000  00000010 00000000 00000000 00000000  |...............................|
  +000060 11200860  112008B0 00000000 00000000 00000000  00000004 00000004 0000000A 00000001  |...............................|
  +000080 11200880  0000001B 00000024 0000002D 00000032  00000000 00000000 112008D0 112008F0  |..............................0|
  +0000A0 112008A0  11200910 11200930 00000000 11200860  02002200 11200340 00000000 00000000  |..............-....... ........|
  +0000C0 112008C0  11200840 11200438 00090107 00000000  42002201 000000A2 00000000 00000000  |... ..................s........|
  +0000E0 112008E0  30000000 11200444 00090105 00000000  48012401 D00000C0 11200870 00000000  |...............................|
  +000100 11200900  00001F80 1120044C 00010105 00000000  40002401 D00000E8 00000000 00000000  |.......<........ ......Y........|
  +000120 11200920  00001F80 11200454 00010101 00000000  40002401 D00000EC 00000000 00000000  |............... ...............|
  +000140 11200940  00001F80 11200458 00010109 00000000  00000003 00000010 00000002 0000002D  |...............................|
  +000160 11200960  00000024 0000000F 00000002 0000002D  00000032 0000000E 00000001 00000032  |...............................|
  +000180 11200980  D0000098 00100000 6E3BFFE0 00000000  11200898 11200A80 11200830 90010000  |...q....>..........q...........|
  +0001A0 112009A0  11200340 00000000 00000000 00000004  11200880 00000000 112009C0 00000000  |... ...........................|
  +0001C0 112009C0  D00000A8 00100000 6E3BFFE0 00000000  11200820 11200A80 11200828 83010000  |...y....>...................c...|
  +0001E0 112009E0  11200240 11200980 11200A00 00000000  00000000 00000000 00000000 00000000  |... ...........................|
  +000200 11200A00  D0000098 00000000 6E7BFFE0 00000000  11200810 11200A80 11200818 01000000  |...q....>#.....................|
  +000220 11200A20  112000D0 11200980 00000000 00000000  00000000 11200950 00000000 00000000  |......................&........|
  +000240 11200A40  00000000 00000000 00000000 00000000  00010007 C5E7C1D4 D7D3C500 010005D3  |...................EXAMPLE....L|
  +000260 11200A60  C1C2D3F1 00010005 C1D9D9C1 E8000100  01C90001 0009C1D9 D9C1E86D C5D5C400  |ABL1....ARRAY....I....ARRAY_END.|
  +000280 11200A80  00000000 11200464 E1100FF2 F0F0F7F0  F1F3F1F1 F5F5F9F3 F6F0F0F0 0000003F  |..........20070131155936000....|
  +0002A0 11200AA0  11200A40 11200860 11200838 00000001  11200850 00220000 00000000 11200980  |... ...-...........&...........|
  +0002C0 11200AC0  11200438 00000000 01000001 11200340  11200FC0 00000000 18AF47F0 A016C3C5  |.............. ...........0..CE|
⋮
```

Figure 146. Sections of the Language Environment dump (Part 2 of 2)

To debug this routine, use the following steps:

1. In the dump, PLIDUMP was called by the ERROR ON-unit in statement 9. The traceback information in the dump shows that the exception occurred following statement 16.

   Note: In the Language Environment dumps, the columns and messages refer to "statements", but the numbers are actually (for Enterprise PL/I) the line numbers from the source file.

2. Locate the Original Condition message in the Condition Information for Active Routines section of the dump. The message is

   `IBM0421S ONCODE=520 The SUBSCRIPTRANGE condition was raised.`

   It indicates that the exception occurred when an array element value exceeded the subscript range value (in this case, 10). For more information about this message, see PL/I runtime messages in *z/OS Language Environment Runtime Messages*.

3. Locate statement 14 in the routine in Figure 144 on page 303. The instruction is `Array_End = 20`. This statement assigns a 20 value to the variable `Array_End`.

4. Statement 15 begins the DO-loop instruction `Do I = 1 to Array_End`. Since the previous instruction (statement 14) specified that `Array_End = 20`, the loop in statement 10 should run until `I` reaches a 20 value.

   The instruction in statement 4, however, declared a 10 value for the array range. Therefore, when the I value reached 11, the SUBSCRIPTRANGE condition was raised.

The following steps provide another method for finding the value that raised the SUBSCRIPTRANGE condition.

1. Locate the offset of variable I in the storage offset listing in Figure 144 on page 303. Use this offset to find the I value at the time of the dump. In this example, the offset is X'E8'.

2. Now find offset X'E8' from the start of the stack frame for the entry EXAMPLE in Figure 145 on page 304.

The block located at this offset contains the value that exceeded the array range, X'B' or 11.

Calling a nonexistent subroutine

Figure 147 on page 306 demonstrates the error of calling a nonexistent subroutine. This routine was compiled with the LIST, MAP, and GONUMBER compiler options. It was run with the TERMTHDACT(DUMP) runtime option to generate a traceback.

```
5655-H31  IBM(R) Enterprise PL/I for z/OS      V3.R6.M0 (Built:20070119)                      2007.01.31 16:02:29   Page
1
                     Options
Specified

Install:


Command:

  Line.File Process
Statements
     1.0    *PROCESS  GONUMBER LIST S STG TEST
MAP;

Install:

5655-H31  IBM(R) Enterprise PL/I for z/OS      EXAMPLE1:  PROC  OPTIONS(                      2007.01.31 16:02:29   Page
2
 Compiler
Source

Line.File
       2.0      EXAMPLE1:  PROC
OPTIONS(MAIN);

3.0
       4.0          DCL Prog01 entry
external;

5.0
       6.0          On
error
       7.0
Begin;
       8.0              On error
system;
       9.0              Call plidump('tbnfs','Plidump called from error On-
unit');
      10.0
End;

11.0
      12.0          Call prog01;        /* Call enternal program PROG01
*/

13.0
      14.0       End
Example1;
5655-H31  IBM(R) Enterprise PL/I for z/OS      EXAMPLE1:  PROC  OPTIONS(                      2007.01.31 16:02:29   Page
3
                     Block Name
List
    Number
Name
         1
EXAMPLE1
         2
_ON_Begin_7_Blk_2
5655-H31  IBM(R) Enterprise PL/I for z/OS      EXAMPLE1:  PROC  OPTIONS(                      2007.01.31 16:02:29   Page
4


OFFSET OBJECT CODE        LINE#  FILE#    P S E U D O   A S S E M B L Y
L I S T I N G
⋮
```

Figure 147. Example of calling a nonexistent subroutine (Enterprise PL/I)

The following examples show the traceback and condition information sections from the dump.

```
CEE3DMP V1 R12.0: Plidump called from error On-unit                             01/26/10 4:02:32 PM           Page:    1
ASID: 0065   Job ID: J0009417   Job name: LEDGSMP2   Step name: GO         UserID: BARBARA

CEE3845I CEEDUMP Processing started.
PLIDUMP was called from statement number 9 at offset +000000D2 from _ON_Begin_7_Blk_2 with entry address 0B9008A8

Information for enclave EXAMPLE1

  Information for thread 8000000000000000

  Traceback:
```

```
   DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
   1     IBMPDUMP    +000002AE              IBMPEV11                                            PQ78306  Call
   2     _ON_Begin_7_Blk_2
                     +000000D2  9           EXAMPLE1             _ON_Begin_7_Blk_2                       Call
   3     IBMPEONR    +000002A2              IBMPEV11                                            PQ76426  Call
   4     IBMPEBOP    +000004DC              IBMPEV11                                            LE19BAS  Call
   5     CEEEV011    +00000132              IBMPEV11             CEEEV011                                Call
   6     CEEHDSP     +000017D0              CEEPLPKA             CEEHDSP                        D1908    Call
   7     EXAMPLE1    -0B9009A8              EXAMPLE1             _ON_Begin_7_Blk_2                       Exception
   8     IBMPMINV    +000004DE              IBMPEV11             IBMPMINV                                Call
   9     CEEEV011    +00000202              IBMPEV11             CEEEV011                                Call
   10    CEEBBEXT    +000001B6              CEEPLPKA             CEEBBEXT                       D1908    Call

   DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
   1     0C13DA70   0BBA4E38   0BBA4E38   +000002AE  20061214   LIBRARY   EBCDIC  HFP
   2     0C13D990   0B9008A8   0B9008A8   +000000D2  20070131   ENT PL/I EBCDIC  HFP
   3     0C13D7F8   0BBA7B98   0BBA7B98   +000002A2  20061214   LIBRARY   EBCDIC  HFP
   4     0C13D628   0BBAF390   0BBAF390   +000004DC  20061214   LIBRARY   EBCDIC  HFP
   5     0C13D598   0BB062E8   0BB062E8   +00000132  20061214   LIBRARY
   6     0C13A478   0B9C3238   0B9C3238   +000017D0  20061215   CEL
   7     0C13A3B8   0B9009A8   0B9008A8   -0B9009A8  20070131   ENT PL/I EBCDIC  HFP
   8     0C13A180   0BBDD990   0BBDD990   +000004DE  20061214   LIBRARY
   9     0C13A0F0   0BB062E8   0BB062E8   +00000202  20061214   LIBRARY
   10    0C13A030   0B991208   0B991208   +000001B6  20061215   CEL

 Condition Information for Active Routines
   Condition Information for _ON_Begin_7_Blk_2 (DSA address 0C13A3B8)
     CIB Address: 0C13AD98
     Current Condition:
       CEE3201S The system detected an operation exception (System Completion Code=0C1).
     Location:
       Program Unit: _ON_Begin_7_Blk_2
       Entry:        EXAMPLE1 Statement:  Offset: -0B9009A8
       Possible Bad Branch:  Statement: 12  Offset: +000001AE
     Machine State:
       ILC..... 0002    Interruption Code..... 0001
       PSW..... 078D0600 80000002
       GPR0..... 00000000_0C13A3B8  GPR1..... 00000000_0B9008A8  GPR2..... 00000000_0B911768  GPR3..... 00000000_0B9009E2
       GPR4..... 00000000_0C13A0D8  GPR5..... 00000000_00000000  GPR6..... 00000000_0B900DA0  GPR7..... 00000000_00000000
       GPR8..... 00000000_0B911648  GPR9..... 00000000_00000008  GPR10.... 00000000_0C13A0B0  GPR11.... 00000000_0B900F1C
       GPR12.... 00000000_0B9129B0  GPR13.... 00000000_0C13A3B8  GPR14.... 00000000_8B900A58  GPR15.... 00000000_00000000
       FPC...... F0000000
       FPR0..... 26100000  00000000            FPR1..... 00000000  00000000
       FPR2..... 18000000  00000000            FPR3..... 00000000  00000000
       FPR4..... 00000000  00000000            FPR5..... 00000000  00000000
       FPR6..... 00000000  00000000            FPR7..... 00000000  00000000
       FPR8..... 00000000  00000000            FPR9..... 00000000  00000000
       FPR10.... 00000000  00000000            FPR11.... 00000000  00000000
       FPR12.... 00000000  00000000            FPR13.... 00000000  00000000
       FPR14.... 00000000  00000000            FPR15.... 00000000  00000000

   Storage dump near condition, beginning at location: 00000000
     +000000 00000000  Inaccessible storage.
   GPREG STORAGE:
     Storage around GPR0 (0C13A3B8)
      -0020 0C13A398  00000000 00000000 00000000 00000000  00000000 00000000 0C13A124 0C13A128 |................................|
      +0000 0C13A3B8  1013A12C 0C13A180 0C13A138 8B900A30  8BBA4490 0B000000 0C13A3B8 0B911768 |..........................t..j..|
      +0020 0C13A3D8  0B9009E2 0C13A0D8 00000000 0B900DA0  00000000 0B911648 00000000 00000000 |...S...Q.............j..........|
     Storage around GPR1 (0B9008A8)
      -0020 0B900888  36000301 0FCC0000 00240008 C5E7C1D4  D7D3C5F1 0B900DA0 0000016C 00000000 |............EXAMPLE1.......%....|
      +0000 0B9008A8  47F0F022 01C3C5C5 000000E0 00000330  47F0F001 58F0C31C 184E05EF 00000000 |.00..CEE.........00..0C..+......|
      +0020 0B9008C8  07F390E7 D00C58E0 D04C4100 E0E05500  C3144130 F03A4720 F01458F0 C28090F0 |.3.X.....<......C...0...0..0B..0|
     Storage around GPR2 (0B911768)
      -0020 0B911748  00000000 00000000 0B9095A8 0B909500  0B909450 00000000 00000106 00000000 |..........ny..n...m&............|
      +0000 0B911768  8B910E58 00000000 00000000 0B901410  00000000 8B9094C8 00030000 0003000B |.j....................mH........|
      +0020 0B911788  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000 |................................|
```

To understand the traceback and debug this example routine, use the following steps:

1. Find the Current Condition message in the Condition Information for Active Routines section of the dump. The message is `CEE3201S The system detected an Operation exception.` For more information about this message, see *z/OS Language Environment Runtime Messages*.

   This section of the dump also provides such information as the name of the active routine and the current statement number at the time of the dump. The Location section indicates that the exception occurred at offset X'-0B9009A8' within entry EXAMPLE1 and that there may have been a bad branch from offset X'+000001AE' statement 12 within entry EXAMPLE1 .

2. Locate statement 12 in the routine (Figure 147 on page 306). This statement calls subroutine Prog01. The message CEE3201S, which indicates an operations exception, was generated because of an unresolved external reference.

3. Check the linkage editor output for error messages.

Divide-by-zero error

Figure 148 on page 308 demonstrates a divide-by-zero error. In this example, the main Enterprise PL/I routine passed bad data to an Enterprise PL/I subroutine. The bad data in this example is 0, and the error occurred when the subroutine SUB1 attempted to use this data as a divisor.

```
5655-H31  IBM(R) Enterprise PL/I for z/OS       V3.R6.M0 (Built:20070119)              2007.01.31 16:02:31   Page     1
                     Options
Specified

Install:


Command:

  Line.File Process
Statements
     1.0    *PROCESS  GONUMBER LIST S STG TEST
MAP;

Install:

5655-H31  IBM(R) Enterprise PL/I for z/OS       SAMPLE: PROC  OPTIONS(MAI              2007.01.31 16:02:31   Page     2
 Compiler
Source

Line.File
       2.0      SAMPLE: PROC
OPTIONS(MAIN) ;
       3.0           On
error
       4.0
begin;
       5.0               On error system;        /* prevent nested error conditions
*/
       6.0               Call PLIDUMP('TBC','PLIDUMP called from error ON-
unit');
       7.0               Put Data;               /* Display variables
*/
       8.0
End;

9.0
      10.0
DECLARE
      11.0             A_number    Fixed
Bin(31),
      12.0             My_Name
Char(13),
      13.0             An_Array(3) Fixed Bin(31)
init(1,3,5);

14.0
      15.0           Put skip list('Sample
Starting');
      16.0           A_number =
0;
      17.0           My_Name = 'Tery
Gillaspy';

18.0
      19.0           Call Sub1(a_number, my_name,
an_array);

20.0
      21.0       SUB1:  PROC(divisor, name1,
Array1);
      22.0
Declare
      23.0              Divisor   Fixed
Bin(31),
      24.0              Name1
Char(13),
      25.0              Array1(3) Fixed
Bin(31);
      26.0              Put skip list('Sub1
Starting');
      27.0              Array1(1) = Array1(2) /
Divisor;
      28.0              Put skip list('Sub1
Ending');
      29.0       End
SUB1;

30.0
      31.0          Put skip list('Sample
Ending');

32.0
      33.0
End;
⋮
```

Figure 148. Enterprise PL/I routine with a divide-by-zero error

Because variables are not usually displayed in a PLIDUMP dump, this routine included a PUT DATA statement, which generated a listing of arguments and variables used in the routine. Figure 149 on page 309 shows this output.

```
1Sample Starting
 Sub1 Starting        A_NUMBER=             0 MY_NAME='Tery Gillaspy' AN_ARRAY(1)=  1
 AN_ARRAY(2)=          3                      AN_ARRAY(3)=             5;
```

Figure 149. Variables from routine SAMPLE (Enterprise PL/I)

The routine in Figure 148 on page 308 was compiled with the LIST compiler option, which generated the object code listing shown in Figure 150 on page 309.

```
:
5655-H31  IBM(R) Enterprise PL/I for z/OS    SAMPLE: PROC  OPTIONS(MAI  : SUB1       2007.01.31 16:02:31   Page     5

OFFSET OBJECT CODE       LINE#  FILE#    P S E U D O   A S S E M B L Y   L I S T I N G

000000                   000021 |        SUB1     DS    0D
000000  47F0  F022       000021 |                 B     34(,r15)
000004  01C3C5C5                                        CEE eyecatcher
000008  00000160                                        DSA size
00000C  00000848                                        =A(PPA1-SUB1)
:
000136  5820  D14C       000027 |                 L     r2,#SR_PARM_3(,r13,332)
00013A  5820  2008       000027 |                 L     r2,_addrARRAY1(,r2,8)
00013E  5840  2000       000027 |                 L     r4,_shadow1(,r2,0)
000142  5820  D14C       000027 |                 L     r2,#SR_PARM_3(,r13,332)
000146  5820  2008       000027 |                 L     r2,_addrARRAY1(,r2,8)
00014A  5820  2004       000027 |                 L     r2,_shadow1(,r2,4)
00014E  5040  D150       000027 |                 ST    r4,#wtemp_1(,r13,336)
000152  5020  D144       000027 |                 ST    r2,_temp15(,r13,324)
000156  5820  D144       000027 |                 L     r2,_temp15(,r13,324)
00015A  5850  2004       000027 |                 L     r5,_shadow2(,r2,4)
00015E  5840  D150       000027 |                 L     r4,#wtemp_1(,r13,336)
000162  5820  D144       000027 |                 L     r2,_temp15(,r13,324)
000166  5820  2000       000027 |                 L     r2,_shadow2(,r2,0)
00016A  1382             000027 |                 LCR   r8,r2
00016C  5820  D14C       000027 |                 L     r2,#SR_PARM_3(,r13,332)
000170  5820  2008       000027 |                 L     r2,_addrARRAY1(,r2,8)
000174  5890  2000       000027 |                 L     r9,_shadow1(,r2,0)
000178  5820  D14C       000027 |                 L     r2,#SR_PARM_3(,r13,332)
00017C  5820  2008       000027 |                 L     r2,_addrARRAY1(,r2,8)
000180  5820  2004       000027 |                 L     r2,_shadow1(,r2,4)
000184  5090  D154       000027 |                 ST    r9,#wtemp_2(,r13,340)
000188  1E58             000027 |                 ALR   r5,r8
00018A  4145  4000       000027 |                 LA    r4,#AddressShadow(r5,r4,0)
00018E  5040  D158       000027 |                 ST    r4,#wtemp_3(,r13,344)
000192  5020  D140       000027 |                 ST    r2,_temp14(,r13,320)
000196  5820  D140       000027 |                 L     r2,_temp14(,r13,320)
00019A  5840  2004       000027 |                 L     r4,_shadow2(,r2,4)
00019E  8940  0001       000027 |                 SLL   r4,1
0001A2  5820  D154       000027 |                 L     r2,#wtemp_2(,r13,340)
0001A6  5850  D140       000027 |                 L     r5,_temp14(,r13,320)
0001AA  5850  5000       000027 |                 L     r5,_shadow2(,r5,0)
0001AE  1355             000027 |                 LCR   r5,r5
0001B0  1E45             000027 |                 ALR   r4,r5
0001B2  5884  2000       000027 |                 L     r8,_shadow2(r4,r2,0)
0001B6  5820  D14C       000027 |                 L     r2,#SR_PARM_3(,r13,332)
0001BA  5820  2000       000027 |                 L     r2,_addrDIVISOR(,r2,0)
0001BE  5820  2000       000027 |                 L     r2,_shadow2(,r2,0)
0001C2  8E80  0020       000027 |                 SRDA  r8,32
0001C6  1D82             000027 |                 DR    r8,r2
0001C8  1849             000027 |                 LR    r4,r9
0001CA  5820  D158       000027 |                 L     r2,#wtemp_3(,r13,344)
0001CE  5040  2000       000027 |                 ST    r4,_shadow2(,r2,0)
:
```

Figure 150. Object code listing from example Enterprise PL/I routine

Figure 151 on page 310 shows the Language Environment dump for routine SAMPLE.

```
CEE3DMP V1 R12.0: PLIDUMP called from error ON-unit                                 03/13/10 4:02:34 PM                  Page:    1
ASID: 0142   Job ID: J0009418   Job name: LEDGSMP3   Step name: GO        UserID: BARBARA

CEE3845I CEEDUMP Processing started.
PLIDUMP was called from statement number 6 at offset +000000D4 from _ON_Begin_4_Blk_2 with entry address 11200340

Information for enclave SAMPLE

  Information for thread 8000000000000000

  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     IBMPDUMP    +000002AE              IBMPEV11                                            PQ78306  Call
    2     _ON_Begin_4_Blk_2
                      +000000D4  6           SAMPLE               SUB1                                    Call
    3     IBMPEONR    +000002A2              IBMPEV11                                            PQ76426  Call
    4     IBMPEBOP    +000004DC              IBMPEV11                                            LE19BAS  Call
    5     CEEEV011    +00000132              IBMPEV11             CEEEV011                                Call
    6     CEEHDSP     +000017D0              CEEPLPKA             CEEHDSP                        D1908    Call
    7     SUB1        +000001C6  27          SAMPLE               SUB1                                    Exception
    8     SAMPLE      +000001CA  19          SAMPLE               SUB1                                    Call
    9     IBMPMINV    +000004DE              IBMPEV11             IBMPMINV                                Call
    10    CEEEV011    +00000202              IBMPEV11             CEEEV011                                Call
    11    CEEBBEXT    +000001B6              CEEPLPKA             CEEBBEXT                       D1908    Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     11A3ED08   114A5E38   114A5E38   +000002AE  20061214   LIBRARY   EBCDIC  HFP
    2     11A3EBB0   11200340   112000D0   +00000344  20070131   ENT PL/I EBCDIC  HFP
    3     11A3EA18   114A8B98   114A8B98   +000002A2  20061214   LIBRARY   EBCDIC  HFP
    4     11A3E848   114B0390   114B0390   +000004DC  20061214   LIBRARY   EBCDIC  HFP
    5     11A3E7B8   114072E8   114072E8   +00000132  20061214   LIBRARY
    6     11A3B698   112C4238   112C4238   +000017D0  20061215   CEL
    7     11A3B538   112000D0   112000D0   +000001C6  20070131   ENT PL/I EBCDIC  HFP
    8     11A3B3B8   112004B8   112000D0   +000005B2  20070131   ENT PL/I EBCDIC  HFP
    9     11A3B180   114DE990   114DE990   +000004DE  20061214   LIBRARY
    10    11A3B0F0   114072E8   114072E8   +00000202  20061214   LIBRARY
    11    11A3B030   11292208   11292208   +000001B6  20061215   CEL

  Condition Information for Active Routines
    Condition Information for SUB1 (DSA address 11A3B538)
      CIB Address: 11A3BFB8
      Current Condition:
        IBM0281S A prior condition was promoted to the ERROR condition.
      Original Condition:
        CEE3209S The system detected a fixed-point divide exception (System Completion Code=0C9).
      Location:
        Program Unit: SUB1 Entry: SUB1 Statement: 27 Offset: +000001C6
      Machine State:
        ILC..... 0002    Interruption Code..... 0009
        PSW..... 078D2600 91200298
        GPR0..... 0000000_00000001  GPR1..... 0000000_00004A48  GPR2..... 0000000_00000000  GPR3..... 0000000_1120010A
        GPR4..... 0000000_00000004  GPR5..... 0000000_FFFFFFFC  GPR6..... 0000000_11200BA8  GPR7..... 0000000_11200748
        GPR8..... 0000000_00000000  GPR9..... 0000000_00000003  GPR10.... 0000000_11A3B0B0  GPR11.... 0000000_11200FE4
        GPR12.... 0000000_112139B0  GPR13.... 0000000_11A3B538  GPR14.... 0000000_912001FE  GPR15.... 0000000_1153CF40
        FPC...... F0000000
        FPR0..... 26100000  00000000           FPR1..... 00000000  00000000
        FPR2..... 18000000  00000000           FPR3..... 00000000  00000000
        FPR4..... 00000000  00000000           FPR5..... 00000000  00000000
        FPR6..... 00000000  00000000           FPR7..... 00000000  00000000
        FPR8..... 00000000  00000000           FPR9..... 00000000  00000000
        FPR10.... 00000000  00000000           FPR11.... 00000000  00000000
        FPR12.... 00000000  00000000           FPR13.... 00000000  00000000
        FPR14.... 00000000  00000000           FPR15.... 00000000  00000000
        VR0...... 26100000 00000000 00000000 00000000       VR1...... 00000000 00000000 00000000 00000000
        VR2...... 18000000 00000000 00000000 00000000       VR3...... 00000000 00000000 00000000 00000000
        VR4...... 00000000 00000000 00000000 00000000       VR5...... 00000000 00000000 00000000 00000000
        VR6...... 00000000 00000000 00000000 00000000       VR7...... 00000000 00000000 00000000 00000000
        VR8...... 00000000 00000000 00000000 00000000       VR9...... 00000000 00000000 00000000 00000000
        VR10..... 00000000 00000000 00000000 00000000       VR11..... 00000000 00000000 00000000 00000000
        VR12..... 00000000 00000000 00000000 00000000       VR13..... 00000000 00000000 00000000 00000000
        VR14..... 00000000 00000000 00000000 00000000       VR15..... 00000000 00000000 00000000 00000000
        VR16..... 00000000 00000000 00000000 00000000       VR17..... 00000000 00000000 00000000 00000000
        VR18..... 00000000 00000000 00000000 00000000       VR19..... 00000000 00000000 00000000 00000000
        VR20..... 00000000 00000000 00000000 00000000       VR21..... 00000000 00000000 00000000 00000000
        VR22..... 00000000 00000000 00000000 00000000       VR23..... 00000000 00000000 00000000 00000000
        VR24..... 00000000 00000000 00000000 00000000       VR25..... 00000000 00000000 00000000 00000000
        VR26..... 00000000 00000000 00000000 00000000       VR27..... 00000000 00000000 00000000 00000000
        VR28..... 00000000 00000000 00000000 00000000       VR29..... 00000000 00000000 00000000 00000000
        VR30..... 00000000 00000000 00000000 00000000       VR31..... 00000000 00000000 00000000
00000000
    Storage dump near condition, beginning at location: 11200286
      +000000 11200286  5820D14C 58202000 58202000 8E800020  1D821849 5820D158 50402000 4400C1AC  |..J<............b....J.& ....A.|
:
```

Figure 151. Language Environment dump from example Enterprise PL/I routine (Part 1 of 2)

```
  Control Blocks for Active Routines:
 :
    DSA for CEEHDSP: 11A3B698
      +000000  FLAGS.... 0808      member... CEE1      BKC...... 11A3B538  FWC...... 11A3E7B8  R14...... 912C5A0A
      +000010  R15...... 914072E8  R0....... 00000010  R1....... 1120C2E8  R2....... 11A3BFB8  R3....... 11A3B3B8
      +000024  R4....... 112C8E64  R5....... FFFFFF30  R6....... 00000001  R7....... 00000007  R8....... 912C5712
      +000038  R9....... 11A3D696  R10...... 11A3C697  R11...... 112C4238  R12...... 112139B0  reserved. 00000000
      +00004C  NAB...... 11A3E7B8  PNAB..... 11A3B874  reserved. 11A3B9D8  00000000
      +000064  reserved. 11A3BE58  reserved. 00000000  MODE..... 00000000  reserved. 00000000
      +000078  reserved. 00000000  reserved. 00000000

    DSA for SUB1: 11A3B538
      +000000  FLAGS.... 10A3      member... B0F0      BKC...... 11A3B3B8  FWC...... 11A3B5F8  R14...... 912001FE
      +000010  R15...... 11537648  R0....... 11A3B668  R1....... 11A3B5D0  R2....... 00000001  R3....... 1120010A
      +000024  R4....... 00004A48  R5....... 11A3B3B8  R6....... 11200BA8  R7....... 11200748  R8....... 11A3B528
      +000038  R9....... 11A3B484  R10...... 11A3B0B0  R11...... 11200FE4  R12...... 112139B0  reserved. 00000000
      +00004C  NAB...... 11A3B698  PNAB..... 00000000  reserved. 00000000  00000000
      +000064  reserved. 00000000  reserved. 00000002  MODE..... 1120ADB0  reserved. 00000000
      +000078  reserved. 00000000  reserved. 112D96E0
    CIB for SUB1: 11A3BFB8
      +000000 11A3BFB8  C3C9C240 00000000 00000000 010C0004  00000001 00000000 00030119 59C9C2D4  |CIB ........................IBM|
      +000020 11A3BFD8  00000000 11A3C0C8 00030C89 59C3C5C5  00000001 00000005 11A3B3B8 914072E8  |.....t.H...i.CEE.........t..j .Y|
      +000040 11A3BFF8  00000000 11A3B538 11200298 1120C6F0  0000000B 11A3B538 00000000 00000000  |.....t.....q..F0.....t..........|
      +000060 11A3C018  00000000 00000000 11A64240 00000015  00000011 00000001 117537B0 00000011  |.........w. ....................|
      +000080 11A3C038  11200FE4 112139B0 00000000 11A3C0B0  114F9EBA 11A3C138 114F4338 00000007  |...U.........t...|...tA..|......|
      +0000A0 11A3C058  00000000 11A3C0F8 11A3C104 004F4327  44230000 940C9000 00000009 00000000  |.....t.8.tA..|......m...........|
      +0000C0 11A3C078  00000000 11200918 11A3B538 11A3B538  11200296 00000000 0000000A 00000001  |.........t...t.....o............|
      +0000E0 11A3C098  11A3B3B8 0000000B 00000064 00000014  00000003 00000000 10000000 00000000  |.t..............................|
      +000100 11A3C0B8  00000000 1120C908 11A3C104 11A3C0F8  E9D4C3C8 02000001 00000001 00004A48  |......I..tA..t.8ZMCH............|
    Dynamic save area (SUB1): 11A3B538
      +000000 11A3B538  10A3B0F0 11A3B3B8 11A3B5F8 912001FE  11537648 11A3B668 11A3B5D0 00000001  |.t.0.t...t.8j........t...t......|
      +000020 11A3B558  1120010A 00004A48 11A3B3B8 11200BA8  11200748 11A3B528 11A3B484 11A3B0B0  |.........t.....y.....t...t.d.t..|
      +000040 11A3B578  11200FE4 112139B0 00000000 11A3B698  00000000 00000000 00000000 00000000  |...U.........t.q................|
      +000060 11A3B598  00000000 00000000 00000002 1120ADB0  00000000 80010000 00000000 112D96E0  |..............................o.|
      +000080 11A3B5B8  00000000 00000000 00000000 00000000  00000000 00000000 11A3B668 00000000  |........................t.......|
      +0000A0 11A3B5D8  00000000 00000000 00180280 11A3B538  11A3B460 11200EE8 11A3B520 11A3B528  |.............t...t.-...Y.t...t..|
      +0000C0 11A3B5F8  11A3B484 00000001 00000000 00000000  00000000 000005D8 112008D8 112008A4  |.t.d...................Q...Q...u|
      +0000E0 11A3B618  11200BC8 9153CE54 115476F8 00004A48  4A480100 01A30000 11A5CB38 00000001  |...Hj......8.........t...v......|
      +000100 11A3B638  11A5CB38 00000000 11200748 11212648  00000008 11A3B0B0 11200FE4 40404040  |.v....................t.....U   |
      +000120 11A3B658  00000000 11A3B7E0 40404040 40404040  40404040 11200CBC 11A3B5FC 40404040  |.....t..            .....t..    |
      +000140 11A3B678  11200C50 11200C50 11A3B3B8 11A3B450  11A3B498 11A3B498 11A3B498 00000010  |...&...&.t...t.&.t.q.t.q.t.q....|
    DSA for SAMPLE: 11A3B3B8
      +000000  FLAGS.... 10A3      member... B12C      BKC...... 11A3B180  FWC...... 11A3B138  R14...... 91200684
      +000010  R15...... 112000D0  R0....... 11A3B520  R1....... 11A3B450  R2....... 00000001  R3....... 112004F2
      +000024  R4....... 00004A48  R5....... 11A3B3B8  R6....... 11200BA8  R7....... 11200748  R8....... 11A3B528
      +000038  R9....... 11A3B484  R10...... 11A3B0B0  R11...... 11200FE4  R12...... 112139B0  reserved. 00000000
      +00004C  NAB...... 11A3B538  PNAB..... 00000000  reserved. 00000000  00000000
      +000064  reserved. 00000000  reserved. 00000000  MODE..... 00000000  reserved. 00000000
      +000078  reserved. 00000000  reserved. 00000000
    Dynamic save area (SAMPLE): 11A3B3B8
      +000000 11A3B3B8  10A3B12C 11A3B180 11A3B138 91200684  112000D0 11A3B520 11A3B450 00000001  |.t...t...t..j..d.....t...t.&....|
      +000020 11A3B3D8  112004F2 00004A48 11A3B3B8 11200BA8  11200748 11A3B528 11A3B484 11A3B0B0  |...2.....t.....y.....t...t.d.t..|
      +000040 11A3B3F8  11200FE4 112139B0 00000000 11A3B538  00000000 00000000 00000000 00000000  |...U.........t..................|
      +000060 11A3B418  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
      +000080 11A3B438  00000000 00000000 00000000 00000000  00000000 00000000 11A3B484 11A3B528  |........................t.d.t..|
      +0000A0 11A3B458  11A3B520 00000000 00100000 00000000  00180180 11A3B3B8 00000000 11200E68  |.t...................t..........|
      +0000C0 11A3B478  0B300000 11200340 11A3B3B8 00000000  E38599A8 40C78993 9381A297 A8000000  |....... .t......Tery Gillaspy...|
      +0000E0 11A3B498  00000001 00000003 00000005 00000001  88000000 11A3B030 11A3B7D8 9140755E  |................h....t...t.Qj .;|
      +000100 11A3B4B8  112008A8 112008A4 11200BD0 11A3B0F0  914072E8 112014D8 4A480100 01000000  |...y...u.....t.0j .Y...Q........|
      +000120 11A3B4D8  11A5CB38 00000001 112014D8 00000000  11A3B308 112139B0 00000000 11A3B538  |.v.........Q.....t...........t..|
      +000140 11A3B4F8  00000000 00000000 00000000 00000000  00000000 00000000 00000000 11200CBC  |................................|
      +000160 11A3B518  11A3B4A4 00000000 11A3B498 11200C50  11A3B488 000D0002 11A3B4A0 00000000  |.t.u.....t.q...&.t.h.....t......|
    ENTERPRISE PL/I OPTIONS:
     AFP, ARCH( 5), BACKREG(5), BIFPREC(15), CHECK(NOCONFORMANCE, NOSTORAGE), CMPAT(V2), CODEPAGE( 1140), COMMON,
     NOCOMPACT, CSECT, CSECTCUT( 4) CURRENCY( $), NODBCS, DECIMAL( FOFLONASGN, NOFORCEDSIGN), DEFAULT( IBM, ASSIGNABLE,
     NOINITFILL, NONCONNECTED, DESCRIPTOR, DESCLOCATOR, DUMMY(ALIGNED), ORDINAL(MIN), BYADDR, RETURNS(BYADDR),
     LINKAGE(OPTLINK), NORETCODE, NOINLINE, ORDER, NOOVERLAP, NONRECURSIVE, ALIGNED, NULL370, EVENDEC, SHORT(HEXADEC),
     EBCDIC, HEXADEC, NATIVE, NATIVEADDR, E(HEXADEC) ), DISPLAY(WTO), NODLLINIT, EXTRN(FULL), NOGRAPHIC, NOINITAUTO,
     NOINITBASED, NOINITCTL, NOINITSTATIC, NOINTERRUPT, LIMITS( EXTNAME( 7), FIXEDBIN( 31, 31), FIXEDDEC( 15, 15), NAME( 100
     )), OPTIMIZE( 0), PREFIX( CONVERSION, FIXEDOVERFLOW, INVALIDOP, OVERFLOW, PRECTYPE(ANS), NOSIZE, NOSTRINGRANGE,
     NOSTRINGSIZE, NOSUBSCRIPTRANGE, UNDERFLOW, ZERODIVIDE), REDUCE, NORENT, RESEXP, RESPECT(), RULES(IBM), NOSTDSYS,
     NOSCHEDULER, STRINGOFGRAPHIC(GRAPHIC), SYSTEM(MVS), TEST(ALL ,SYM ,HOOK ,NOSEPARATE), TUNE( 5), USAGE( ROUND(IBM),
     UNSPEC(IBM)), WIDECHAR(BIGENDIAN), WINDOW( 1950), WRITABLE, XINFO(NODEF, NOXML)
    Static for procedure SAMPLE    Timestamp: 2007.01.31 16:02:31 V03.R06.M00: 11200BA8
      +000000 11200BA8  11201750 11200CBC 000D0002 00000000  02020240 00000003 02020240 0000000B  |...&............... ....... ....|
      +000020 11200BC8  02020240 0000000D 02020240 0000000F  02020240 00000021 00000000 11200C00  |... ....... ....... ............|
      +000040 11200BE8  00000000 11200CA8 00000000 11200E18  00000000 11200C00 00000000 11200C08  |.......y........................|
      +000060 11200C08  00000000 00000000 31010001 00000000  00000000 00000000 31000001 00000000  |................................|
 :
```

Figure 152. Language Environment dump from example Enterprise PL/I routine (Part 2 of 2)

To understand the dump information and debug this routine, use the following steps:

1. Notice the title of the dump: `PLIDUMP called from error ON-unit`. This was the title specified when PLIDUMP was invoked, and it indicates that the ERROR condition was raised and PLIDUMP was called from within the ERROR ON-unit.
2. Locate the messages in the Condition Information section of the dump.

   There are two messages. The current condition message indicates that a prior condition was promoted to the ERROR condition. The promotion of a condition occurs when the original condition is left unhandled (no Enterprise PL/I ON-units are assigned to gain control). The original condition message is `CEE3209S The system detected a fixed-point divide exception`. The original condition usually indicates the actual problem. For more information about this message, see *z/OS Language Environment Runtime Messages*.
3. In the traceback section, note the sequence of calls in the call chain. SAMPLE called SUB1 at statement 19, and SUB1 raised an exception at statement 27, PU offset X'1C6'.
4. Find the statement in the listing for SUB1 that raised the ZERODIVIDE condition. If SUB1 was compiled with GOSTMT and SOURCE, find statement 27 in the source listing.

   Since the object listing was generated in this example, you can also locate the actual assembler instruction causing the exception at offset X'1C6' in the object listing for this routine, shown in Figure 150 on page 309. Either method shows that *divisor* was loaded into register 2 (r2) and used as the divisor in a divide operation.
5. You can see from the declaration of SUB1 that *divisor* is a parameter passed from SAMPLE. Because of linkage conventions, you can infer that register 1 in the SAMPLE save area points to a parameter list that was passed to SUB1. *divisor* is the first parameter in the list.

6. In the SAMPLE DSA, the R1 value is X'11A3B450'. This is the address of the parameter list, which is located in static storage.
7. Find the parameter list in the stack frame; the address of the first parameter is X'11A3B484' and the value of the first parameter is X'00000000'. Thus, the exception occurred when SAMPLE passed a 0 value used as a divisor in subroutine SUB1.

Chapter 9. Debugging under CICS

This section provides information for debugging under the Customer Information Control System (CICS). The following sections explain how to access debugging information under CICS, and describe features unique to debugging under CICS.

Use the following list as a quick reference for debugging information:

- Language Environment runtime messages (CESE transient data queue)
- Language Environment traceback (CESE transient data queue)
- Language Environment dump output (CESE transient data queue)
- CICS Transaction Dump (CICS DFHDMPA or DFHDMPB data set)
- Language Environment abend and reason codes (system console)
- Language Environment return codes to CICS (system console)

If the EXEC CICS HANDLE ABEND command is active and the application, or CICS, initiates an abend or application interrupt, then Language Environment does not produce any runtime messages, tracebacks, or dumps.

If EXEC CICS ABEND NODUMP is issued, then no Language Environment dumps or CICS transaction dumps are produced.

Accessing debugging information

The following sections list the debugging information available to CICS users, and describe where you can find this information.

Under CICS, the Language Environment runtime messages, Language Environment traceback, and Language Environment dump output are written to the CESE transient data queue. The transaction identifier, terminal identifier, date, and time precede the data in the queue. For more information about the format of records written to the transient data queue, see Runtime output under CICS in *z/OS Language Environment Programming Guide*.

The CESE transient data queue is defined in the CICS destination control table (DCT). The CICS macro DFHDCT is used to define entries in the DCT. See *CICS Resource Definition Guide* for a detailed explanation of how to define a transient data queue in the DCT. If you are not sure how to define the CESE transient data queue, see your system programmer.

Locating Language Environment runtime messages

Under CICS, Language Environment runtime messages are written to the CESE transient data queue. The following example shows a Language Environment message that appears when an application abends due to an unhandled condition from an EXEC CICS command.

```
P039UTV9 19910916145313 CEE3250C The System or User ABEND AEI0 was issued.
P039UTV9 19910916145313           From program unit UT9CVERI at entry point UT9CVERIT
                                  +0000011E at P039UTV9 19910916145313
                                  at offset address 0006051E.
```

Locating the Language Environment traceback

Under CICS, the Language Environment traceback is written to the CESE transient data queue. Because Language Environment invokes your application routine, the Language Environment routines that invoked your routine appear in the traceback. Figure 153 on page 314 shows an example Language Environment traceback written to the CESE transient data queue. Data unnecessary for this example has been replaced by ellipses.


```
CEE3211S The system detected a decimal-divide exception (System Completion Code=0CB).
         From compile unit DIVZERO2 at entry point DIVZERO2 at compile unit offset +0000039A at entry offset +0000039A at address
         271FC39A.
CEE3DMP V1 R12.0: Condition processing resulted in the unhandled condition.        04/13/10 8:41:40 AM                 Page:    1
Task Number: 1116   Transaction ID: TD02

CEE3845I CEEDUMP Processing started.

Information for enclave DIVZERO2

  Information for thread 8000000000000000

  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                  Service  Status
    1     CEEHDSP     +000041FA                                   CEEHDSP                       HLE7770  Call
    2     CEECGEX     +000001F0                                   CEECGEX                       HLE7770  Call
    3     DIVZERO2    +0000039A                                   DIVZERO2                               Exception
    4     IGZCEV5     +0000066A                                   IGZCEV5                                Call
    5     CEECRINV    +00000480                                   CEECRINV                      HLE7770  Call
    6     CEECRINI    +00000AFE                                   CEECRINI                      HLE7770  Call

    DSA   DSA Addr   E  Addr    PU Addr    PU Offset  Comp Date  Compile Attributes
    1     2753D160   27AB3180   27AB3180   +000041FA  20100319   CEL
    2     27538F48   27AA9350   27AA9350   +000001F0  20100319   CEL
    3     27539F60   271FC000   271FC000   +0000039A  ********   COBOL
    4     27538D70   26AD2000   26AD2000   +0000066A  20100316   LIBRARY
    5     27538BC8   27AAC568   27AAC568   +00000480  20100319   CEL
    6     27538B48   27AAB8D0   27AAB8D0   +00000AFE  20100319   CEL

  Condition Information for Active Routines
    Condition Information for DIVZERO2 (DSA address 27539F60)
      CIB Address: 2753DA58
      Current Condition:
        CEE0198S The termination of a thread was signaled due to an unhandled condition.
      Original Condition:
        CEE3211S The system detected a decimal-divide exception (System Completion Code=0CB).
      Location:
        Program Unit: DIVZERO2 Entry: DIVZERO2 Statement:  Offset: +0000039A
      Machine State:
        ILC..... 0006    Interruption Code..... 000B
        PSW..... 079D0000 A71FC3A0
        GPR0..... 00000000_00000000  GPR1..... 00000000_271FC1E1  GPR2..... 00000000_000707FC  GPR3..... 00000000_A71FC366
        GPR4..... 00000000_271FC054  GPR5..... 00000000_00000000  GPR6..... 00000000_275359F8  GPR7..... 00000000_26AD2FFF
        GPR8..... 00000000_275332C0  GPR9..... 00000000_2753A168  GPR10.... 00000000_271FC088  GPR11.... 00000000_271FC262
        GPR12.... 00000000_271FC080  GPR13.... 00000000_27539F60  GPR14.... 00000000_A71FC374  GPR15.... 00000000_A7745688
        AR0...... A54885D6  AR1...... 00000002  AR2...... 00000000  AR3...... 00000000
        AR4...... 00000000  AR5...... 00000000  AR6...... 00000000  AR7...... 00000000
        AR8...... 00000000  AR9...... 00000000  AR10..... 00000000  AR11..... 00000000
        AR12..... 00000000  AR13..... 00000000  AR14..... 00000000  AR15..... 00000000

    Storage dump near condition, beginning at location: 271FC38A
      +000000 271FC38A  92409169 D2CC916A 9169D201 D180A155  FD10D180 A157F300 9090D180 96F09090  |k j.K.j.j.K.J.....J...3...J.o0.
    GPREG STORAGE:
      Storage around GPR0 (00000000)
        +0000 00000000    Inaccessible storage.
        +0020 00000020    Inaccessible storage.
        +0040 00000040    Inaccessible storage.
:
```

Figure 153. Language Environment traceback written to the CESE transient data queue

Locating the Language Environment dump

Under CICS, the Language Environment dump output is written to the CESE transient data queue. For active routines, the Language Environment dump contains the traceback, condition information, variables, storage, and control block information for the thread, enclave, and process levels. Use the Language Environment dump with the CICS transaction dump to locate problems when operating under CICS. For a sample Language Environment dump, see "Understanding the Language Environment dump" on page 40.

Using CICS transaction dump

The CICS transaction dump is generated to the DFHDMPA or DFHDMPB data set. The offline CICS dump utility routine converts the transaction dump into formatted, understandable output.

The CICS transaction dump contains information for the storage areas and resources associated with the current transaction. This information includes the Communication Area (COMMAREA), Transaction Work Area (TWA), Exec Interface Block (EIB), and any storage obtained by the CICS EXEC commands. This information does not appear in the Language Environment dump. It can be helpful to use the CICS transaction dump with the Language Environment dump to locate problems when operating under CICS.

When the location of an error is uncertain, it can be helpful to insert EXEC CICS DUMP statements in and around the code suspected of causing the problem. This generates CICS transaction dumps close to the error for debugging reference.

For information about interpreting CICS dumps, see *CICS Problem Determination Guide*.

Using CICS register and program status word contents

When a routine interrupt occurs (code = ASRA) and a CICS dump is generated, CICS formats the contents of the program status word (PSW) and the registers at the time of the interrupt. This information is also contained in the CICS trace table entry marked SSRP `* EXEC* — ABEND DETECTED`. For the format of the information contained in this trace entry, see *CICS Data Areas*, KERRD - KERNEL ERROR DATA.

The address of the interrupt can be found from the second word of the PSW, giving the address of the instruction following the point of interrupt. The address of the entry point of the function can be subtracted from this address. The offset compared to this listing gives the statement that causes the interrupt.

For C routines, you can find the address of the entry point in register 3.

If register 15 is corrupted, the contents of the first load module of the active enclave appear in the program storage section of the CICS transaction dump.

Using Language Environment abend and reason codes

An application can end with an abend in two ways:

- User-specified abend (that is, an abend requested by the assembler user exit or the ABTERMENC runtime option).
- Language Environment-detected unrecoverable error (in which case there is no Language Environment condition handling).

When Language Environment detects an unrecoverable error under CICS, Language Environment terminates the transaction with an EXEC CICS abend. The abend code has a number between 4000 and 4095. A write-to-operator (WTO) is performed to write a CEE1000S message to the system console. This message contains the abend code and its associated reason code. The WTO is performed only for unrecoverable errors detected by Language Environment. No WTO occurs for user-requested abends.

Although this type of abend is performed only for unrecoverable error conditions, an abend code of 4000–4095 does not necessarily indicate an internal error within Language Environment. For example, an application routine can write a variable outside its storage and corrupt the Language Environment control blocks.

Possible causes of a 4000–4095 abend are corrupted Language Environment control blocks and internal Language Environment errors. For more information about abend codes 4000–4095, see Language Environment abend codes in *z/OS Language Environment Runtime Messages*. Following is a sample Language Environment abend and reason code. Abend codes appear in decimal, and reason codes appear in hexadecimal.

```
12.34.27 JOB05585  IEF450I XCEPII03 GO CEPII03 - ABEND=S000 U4094 REASON=0000002C
```

Using Language Environment return codes to CICS

When the Language Environment condition handler encounters a severe condition that is specific to CICS, the condition handler generates a CICS-specific return code. This return code is written to the system console. Possible causes of a Language Environment return code to CICS are:

- Incorrect region size
- Incorrect DCT
- Incorrect CSD definitions

For a list of the return codes written only to CICS, see Return codes to CICS in *z/OS Language Environment Runtime Messages*. The following example shows a sample of a return code that was returned to CICS.

```
 +DFHAP1200I
LE03CC01 A CICS request to Language Environment has failed.  Reason
code '0012030'.
```

Activating Language Environment feature trace records under CICS

Activating Language Environment feature trace records under CICS will allow users to monitor and determine the activity of a transaction. By activating the feature trace records, Level 2 trace points are added insideLanguage Environment at these significant points:

- Event Handle
- Set anchor

- Gives R13 and parameters before call

These trace points are useful for any support personnel that needs to know what happpened inside Language Environment from a CICS call.

The function will be enabled by the existing CICS transactions. A user must enable the AP domain level 2 in order to include the Language Environment trace points. For more information on activating the CICS trace, see *CICS Diagnosis Reference*.

Every time CICS calls Language Environment, the feature trace is activated under the Extended Runtime Library Interface (ERTLI). The trace can bee seen in CICS transaction dumps. Feature trace entries are formatted in a similar way to CICS trace items. There are three formats: ABBREV, SHORT & FULL. The ABBREV version (Figure 154 on page 316) just formats the heading line for each trace point and is laid out in a similar way to CICS trace entries.

```
00036 1 AP 1940 APLI  ENTRY START_PROGRAM         NAMETEST,CEDF,FULLAPI,EXEC,NO,0678FABC,00000000 , 00000000,1,NO
=000334=
00036 1 AP 1948 APLI  EVENT CALL-TO-LE/370        Thread_Initialization NAMETEST
=000339=
00036 1 AP 1949 APLI  EVENT RETURN-FROM-LE/370    Thread_Initialization OK NAMETEST
=000340=
00036 1 AP 1948 APLI  EVENT CALL-TO-LE/370        Rununit_Initialization NAMETEST
=000343=
00036 1 FT 1014 Lang.Env. CEEZCREN EVENT CEEEVNT-ID(PRCINIT)   R13(06C00E10), 00000000
=000344=
00036 1 FT 1013 Lang.Env. CEEZCREN EVENT CEEEVNT-ID(OPTP)      R13(06C00E10), 06C049B0, 07500F28, 06C0403C, 06C010B4
=000345=
00036 1 FT 1101 Lang.Env. CEECRINI EVENT SET_ANCHOR            R13(06C009B8), 06C06180, 00000002
=000346=
00036 1 FT 1018 Lang.Env. CEEZINV  EVENT CEEEVNT-ID(ENCINIT)   R13(06C06D80), 00000000, 06C0403C, 00000000, 06C041B4, 00000
=000347=
00036 1 FT 1008 Lang.Env. CEECRINV EVENT CEEEVNT-ID(MAININV)   R13(06C06D80), 87500020, 00000001, 00000000, 00140050, 87500
=000348=
00036 1 AP 1948 APLI  EVENT CALL-TO-LE/370        Rununit_End_Invocation NAMETEST
=000386=
00036 1 AP 1949 APLI  EVENT RETURN-FROM-LE/370    Rununit_End_Invocation OK NAMETEST
=000387=
00036 1 AP 1948 APLI  EVENT CALL-TO-LE/370        Rununit_Termination NAMETEST
=000388=
00036 1 FT 1012 Lang.Env. CEEZDSEX EVENT CEEEVNT-ID(ENCTERM)   R13(06C06D80), 06C0403C, 00000000
=000389=
00036 1 FT 1102 Lang.Env. CEECRTRM EVENT SET_ANCHOR            R13(06C009B8), 00000000
=000390=
00036 1 AP 1949 APLI  EVENT RETURN-FROM-LE/370    Rununit_Termination OK NAMETEST
=000391=
00036 1 AP 1948 APLI  EVENT CALL-TO-LE/370        Thread_Termination
=000392=
00036 1 FT 1009 Lang.Env. CEEZDSPR EVENT CEEEVNT-ID(PRCTERM)   R13(06C00A80), 00000000
=000393=
00036 1 AP 1949 APLI  EVENT RETURN-FROM-LE/370    Thread_Termination OK
=000394=
00036 1 AP 1941 APLI  EXIT  START_PROGRAM/OK      ....,NO,NAMETEST
=000395=
```

Figure 154. CICS trace output in the ABBREV format.

The Domain Name field is replaced with a "Feature" short name (for example, Lang.Env.) and module name (for example, CEE.....) which are coded into the "Feature Trace" initialization (short name) and header formatting call (module name). See the following macro example.

The FULL version includes the heading from the ABBREV version and then dumps each captured block in Hex and Character formats. For an example, see Figure 155 on page 317.

```
AP 1948 APLI EVENT CALL-TO-LE/370 - Rununit_Initialization    Program_name(NAMETEST)

             TASK-00036 KE_NUM-0026 TCB-006FA1D0 RET-868218FE TIME-05:58:55.2643333923 INTERVAL-00.0000020781    =000343=
               1-0000  0000001E                                                             *....                             *
               2-0000  06878DE0 00140148 0005848C 0014014C  00045A4C 00140130 0014001C 067F3CE8  *.g.\......d....<..!<.........".Y*
                 0020  0678FAD8 06878F37 867F3DD0                                          *...Q.g..f".}                     *
               3-0000  D5C1D4C5 E3C5E2E3                                                    *NAMETEST                         *
               4-0000  00000030 20000000 07500000 00001B00  87500020 00000000 06C03800 00000000  *.........&......g&.......{......*
                 0020  00140050 00000000 00000000 0678FABC                                 *...&...........                  *

FT Lang.Env.  1014 CEEZCREN EVENT - CEEEVNT-ID(PRCINIT)   R13(06C00E10), PARMS(00000000)

             TASK-00036 KE_NUM-0026 TCB-006FA1D0 RET-06F092A0 TIME-05:58:55.2643970329 INTERVAL-00.0000636406    =000344=
                 0000  0000C9C2 D4404040 40404040 40404040  40404040 40404040 40404040 40404040  *..IBM                            *
                 0020  D3819587 A4818785 40C595A5 89999695  948595A3 40404040 40404040 4040F0F0  *Language Environment           00*
                 0040  F0F0F0F0 F0F0F0F1 C3C5C5C3 E3C6D4E3  D3819587 4BC595A5 4B000000          *00000001CEECTFMTLang.Env....    *
               1-0000  06C00E10 00000011 00000000                                          *.{..........                     *

FT Lang.Env.  1013 CEEZCREN EVENT - CEEEVNT-ID(OPTP)      R13(06C00E10), PARMS(06C049B0, 07500F28, 06C0403C, 06C010B4)

             TASK-00036 KE_NUM-0026 TCB-006FA1D0 RET-06F0A23A TIME-05:58:55.2644148454 INTERVAL-00.0000178125    =000345=
                 0000  0000C9C2 D4404040 40404040 40404040  40404040 40404040 40404040 40404040  *..IBM                            *
                 0020  D3819587 A4818785 40C595A5 89999695  948595A3 40404040 40404040 4040F0F0  *Language Environment           00*
                 0040  F0F0F0F0 F0F0F0F1 C3C5C5C3 E3C6D4E3  D3819587 4BC595A5 4B000000          *00000001CEECTFMTLang.Env....    *
               1-0000  06C00E10 00000004 06C049B0 07500F28  06C0403C 06C010B4                   *.{.......{...&...{ ..{..        *

FT Lang.Env.  1101 CEECRINI EVENT - SET_ANCHOR R13(06C009B8), PARMS(06C06180, 00000002)

             TASK-00036 KE_NUM-0026 TCB-006FA1D0 RET-06F02F90 TIME-05:58:55.2644493767 INTERVAL-00.0000345312    =000346=
                 0000  0000C9C2 D4404040 40404040 40404040  40404040 40404040 40404040 40404040  *..IBM                            *
                 0020  D3819587 A4818785 40C595A5 89999695  948595A3 40404040 40404040 4040F0F0  *Language Environment           00*
                 0040  F0F0F0F0 F0F0F0F1 C3C5C5C3 E3C6D4E3  D3819587 4BC595A5 4B0092B4          *00000001CEECTFMTLang.Env..k.    *
               1-0000  06C009B8 06C06180 00000002                                          *.{...{/.....                     *

FT Lang.Env.  1018 CEEZINV  EVENT - CEEEVNT-ID(ENCINIT)   R13(06C06D80), PARMS(00000000, 06C0403C, 00000000, 06C041B4, 00000000,
                                  01000000, 00000000, 00000000)

             TASK-00036 KE_NUM-0026 TCB-006FA1D0 RET-06F0C9B4 TIME-05:58:55.2644710798 INTERVAL-00.0000217031    =000347=
                 0000  000AC9C2 D4404040 40404040 40404040  40404040 40404040 40404040 40404040  *..IBM                            *
                 0020  D3819587 A4818785 40C595A5 89999695  948595A3 40404040 40404040 4040F0F0  *Language Environment           00*
                 0040  F0F0F0F0 F0F0F0F1 C3C5C5C3 E3C6D4E3  D3819587 4BC595A5 4B0072B4          *00000001CEECTFMTLang.Env....    *
               1-0000  06C06D80 00000012 00000000 06C0403C  00000000 06C041B4 00000000 01000000  *.{_..........{ ......{..........*
                 0020  00000000 00000000                                                    *........                         *
               2-0000  D8C3C5E2 C9000000 00000000 00000000  D8C3C5E2 D6000000 00000000 00000000  *QCESI...........QCESO...........*
                 0020  D8C3C5E2 C5000000 00000000 00000000                                 *QCESE...........                 *

FT Lang.Env.  1008 CEECRINV EVENT - CEEEVNT-ID(MAININV)   R13(06C06D80), PARMS(87500020, 00000001, 00000000, 00140050, 87500020)

             TASK-00036 KE_NUM-0026 TCB-006FA1D0 RET-06F038D2 TIME-05:58:55.2645123298 INTERVAL-00.0000412500    =000348=
                 0000  0000C9C2 D4404040 40404040 40404040  40404040 40404040 40404040 40404040  *..IBM                            *
                 0020  D3819587 A4818785 40C595A5 89999695  948595A3 40404040 40404040 4040F0F0  *Language Environment           00*
                 0040  F0F0F0F0 F0F0F0F1 C3C5C5C3 E3C6D4E3  D3819587 4BC595A5 4B000000          *00000001CEECTFMTLang.Env....    *
               1-0000  06C06D80 0000000E 87500020 00000001  00000000 00140050 87500020          *.{_.....g&.............&g&..    *

AP 1948 APLI EVENT CALL-TO-LE/370 - Rununit_End_Invocation    Program_name(NAMETEST)

             TASK-00036 KE_NUM-0026 TCB-006FA1D0 RET-868218FE TIME-05:58:55.2670554079 INTERVAL-00.0000107187    =000386=
               1-0000  00000021                                                             *....                             *
               2-0000  06878DEC 00140148 0005848C 0014014C  00045A4C 00140130 0014001C 067F3CE8  *.g........d....<..!<.........".Y*
                 0020  0678FAD8 80140390                                                    *...Q....                         *
               3-0000  D5C1D4C5 E3C5E2E3                                                    *NAMETEST                         *
               4-0000  40000000 00000000 D5C1D4C5 0000036C  D3F3F2F1 00000005 00000000 00000000  * .......NAME...%L321............*
                 0020  00000000 001402FC 00000000 00000000  00000000 00000000 00000000 00000000  *................................*
```

Figure 155. CICS trace output in the FULL format.

The first block is used for the feature trace information. It contains the name of the off-line formatting module and the short name used in the formatted heading line. The other 6 blocks are available for user data.

The SHORT version is a cross between the ABBREV and FULL versions.

Ensuring transaction rollback

If your application does not run to normal completion and there is no CICS transaction abend, take steps to ensure that transaction rollback (the backing out of any updates made by the malfunctioning application) takes place.

There are two ways to ensure that a transaction rollback occurs when an unhandled condition of severity 2 or greater is detected:

- Use the ABTERMENC runtime option with the ABEND suboption (ABTERMENC(ABEND)).
- Use an assembler user exit that requests an abend for unhandled conditions of severity 2 or greater.

The IBM-supplied assembler user exit for CICS (CEECXITA), available in the Language Environment SCEESAMP sample library, ensures that a transaction abend and rollback occur for all unhandled conditions of severity 2 or greater. For more information about the assembler user exit, see "Invoking the assembler user exit" on page 22.

Finding data when Language Environment returns a nonzero return code

Language Environment does not write any messages to the CESE transient data queue. Table 48 on page 318 shows the output generated when Language Environment returns a nonzero reason code to CICS and the location where the output appears.

Table 48. Finding data when Language Environment returns a nonzero return code

Output Message	Location	Issued By
DFHAC2206 14:43:54 LE03CC01 Transaction UTV2 has failed with abend AEC7. Resource backout was successful.	User's terminal	CICS
DFHAP1200I LE03CC01 A CICS request to the Language Environment has failed. Reason code '0012030'.	System console	CICS
DFHAC2236 06/05/91 14:43:48 LE03CC01 Transaction UTV2 abend AEC7 in routine UT2CVERI term P021 backout successful.	Transient data queue CSMT	CICS

Finding data when Language Environment abends internally

Language Environment does not write any messages to the CESE transient data queue. Table 49 on page 318 shows the output generated when Language Environment abends internally and the location where the output appears:

Table 49. Finding data when Language Environment abends internally

Output Message	Location	Issued By
DFHAC2206 14:35:24 LE03CC01 Transaction UTV8 has failed with abend 4095. Resource backout was successful.	User's terminal	CICS
CEE1000S LE INTERNAL abend. ABCODE = 00000FFF REASON = 00001234	System console	Language Environment
DFHAC2236 06/05/91 14:35:24 LE03CC01 Transaction UTV8 abend 4095 in routine UT8CVERI term P021 backout successful.	Transient data queue CSMT	CICS

Finding data when Language Environment abends from an EXEC CICS command

This section shows the output generated when an application abends from an EXEC CICS command and the location where the output appears. This error assumes the use of Language Environment runtime option TERMTHDACT(MSG).

Table 50. Finding data when Language Environment abends from an EXEC CICS command

Output Message	Location	Issued By
DFHAC2206 14:35:34 LE03CC01 Transaction UTV8 has failed with abend AEI. Resource backout was successful.	User's terminal	CICS
No message.	System console	CICS
DFHAC2236 06/05/91 14:35:17 LE03CC01 Transaction UTV9 abend AEI0 in routine UT9CVERI term P021 backout successful.	Transient data queue CSMT	CICS
P021UTV9 091156 143516 CEE3250C The System or User Abend AEI0 was issued.	Transient data queue CESE	Language Environment

Displaying and modifying runtime options with the CLER transaction

The CICS transaction CLER allows you to display all the current Language Environment runtime options for a region, and to modify a subset of these options. The CLER transaction can be used to:

- Display the current runtime options in effect for the region.
- Modify the following subset of the region runtime options:
  - ALL31(ON|OFF)
  - CBLPSHPOP(ON|OFF)
  - CHECK(ON|OFF)
  - HEAPZONES(0-1024,QUIET|MSG|TRACE|ABEND)
  - INFOMSGFILTER(ON|OFF)
  - RPTOPTS(ON|OFF)
  - RPTSTG(ON|OFF)
  - TERMTHDACT(QUIET|MSG|TRACE|DUMP|UAONLY|UATRACE| UADUMP|UAIMM)
  - TRAP(ON|OFF)
- Write the current region runtime options to the CESE queue for printing.

The CLER transaction is conversational; it presents the user with commands for the terminal display. The runtime options that can be modified with this transaction are only in effect for the duration of the running region.

The CLER transaction must be defined in the CICS CSD (CICS System Definition file). The following definitions are required, and are in the Language Environment CEECCSD job in the SCEESAMP data set. Use the CEECCSD job to activate these definitions, or you must define them dynamically with the CICS CEDA transaction.

```
DEFINE PROGRAM(CEL4RTO) GROUP(CEE) LANGUAGE(ASSEMBLER) EXECKEY(CICS)
DEFINE MAPSET(CELCLEM) GROUP(CEE)
DEFINE MAPSET(CELCLRH) GROUP(CEE)
DEFINE TRANS(CLER) PROG(CEL4RTO) GROUP(CEE)
```

Note: If the runtime option ALL31 is modified to OFF, the stack is forced to BELOW. A warning message, asking if you want to continue, is presented on the panel if the runtime option ALL31 is set to OFF or CBLPSHPOP, RPTOPTS, and RPTSTG are set to ON.

To send the runtime option report to the CESE queue for output display or printing, press PF10 on the panel which displays the runtime option report.

For detailed information on the use of CLER, select PF1 from the main menu that is displayed when the CLER transaction is invoked.

Part 3. Debugging Language Environment AMODE 64 applications

This part provides specific information for debugging applications written to make use of the memory address space above the 2 GB bar.

Chapter 10. Preparing your AMODE 64 application for debugging

This chapter describes options and features that you can use to prepare your AMODE 64 application for debugging. The following topics are covered:

- Compiler options for C and C++
- Language Environment runtime options
- Use of storage in routines
- Options for modifying exception handling
- Assembler user exits
- Enclave termination behavior
- Language Environment feedback codes and condition tokens

Setting compiler options

The following sections discuss language-specific compiler options important to debugging routines in Language Environment. These sections cover only the compiler options that are important to debugging. For a complete list of compiler options, see the appropriate HLL publications.

The use of some compiler options (such as DEBUG) can affect the performance of your routine. You must set these options before you compile. In some cases, you might need to remove the option and recompile your routine before delivering your application.

XL C and XL C++ compiler options for AMODE 64 applications

When compiling an application using the LP64 compiler option, you cannot use the TEST compiler option. You must instead use the DEBUG(FORMAT(DWARF)) compiler option.

When the GONUMBER compiler option is used with LP64, it will produce executables with additional debug information. This is used by Language Environment to produce statement numbers in the Language Environment dump (CEEDUMP). Statement numbers in the CEEDUMP are also produced if the DEBUG compiler option or the c89 -g option is used.

For more information about Interprocedural Analysis (IPA), see Using the IPA in *z/OS XL C/C++ Programming Guide*.

Using Language Environment runtime options

Several runtime options affect debugging in Language Environment. The TEST runtime option, for example, can be used with a debugging tool to specify the level of control in effect for the debugging tool when the routine being initialized is started. The DYNDUMP, HEAPCHK, TERMTHDACT, TRACE, and TRAP options affect exception handling. The following Language Environment runtime options affect debugging. For a more detailed discussion of these runtime options, see *z/OS Language Environment Programming Reference*.

Runtime option	Description of runtime option
CEEDUMP	Specifies options to control the processing of the Language Environment dump report.
DYNDUMP	Provides a way to obtain IPCS readable dumps of user applications that would ordinarily be lost due to the absence of a SYSMDUMP, SYSUDUMP, or SYSABEND DD statement
HEAPCHK	Determines whether additional heap check tests are performed.
HEAPZONES	Activates user heap overlay toleration and checking.

Runtime option	Description of runtime option
INFOMSGFILTER	Filters user specified informational messages from stderr. **Note:** Affects only those messages generated by Language Environment and any routine that calls `__le_msg_get_and_write()`. Other routines that write to stderr, such as `__le_msg_write()`, do not have a filtering option.
PROFILE	Controls the use of an optional profiler tool, which collects performance data for the running application. When this option is in effect, the profiler is loaded and the debugger cannot be loaded. If the TEST option is in effect when PROFILE is specified, the profiler tool will not be loaded.
RPTOPTS	Causes a report to be produced which contains the runtime options in effect. See "Determining the runtime options in effect for AMODE 64 applications" on page 324 below.
RPTSTG	Generates a report of the storage used by an enclave. See "Controlling storage allocation for AMODE 64 applications" on page 326.
STORAGE	Specifies that Language Environment initializes all heap and stack storage to a user-specified value.
TERMTHDACT	Controls response when an enclave terminates due to an unhandled condition of severity 2 or greater.
TEST	Specifies the conditions under which a debugging tool assumes control.
TRACE	Activates Language Environment runtime library tracing and controls the size of the trace table, the type of trace, and whether the trace table should be dumped unconditionally upon termination of the application.
TRAP	When TRAP is set to ON, Language Environment traps routine interrupts and abends, and optionally prints trace information or invokes a user-written exception handling routine. With TRAP set to OFF, the operating system handles all interrupts and abends. You should generally set TRAP to ON, or your runtime results can be unpredictable.

Determining the runtime options in effect for AMODE 64 applications

The runtime options in effect at the time the routine is run can affect routine behavior. Use RPTOPTS(ON) to generate an options report in the Language Environment message file when your routine terminates. The options report lists runtime options, and indicates where they were set. Figure 156 on page 325 shows a sample options report.

```
Options Report for Enclave main Tue Sep 14 09:18:49 2021
Language Environment V02 R05.00

LAST WHERE SET                 OPTION
-----------------------------------------------------------------------------
IBM-supplied default             CEEDUMP(60,SYSOUT=*,FREE=END,SPIN=UNALLOC)
IBM-supplied default             DYNDUMP(*USERID,NODYNAMIC,TDUMP)
IBM-supplied default             ENVAR("")
IBM-supplied default             FILETAG(NOAUTOCVT,NOAUTOTAG)
PARMLIB(CEEPRMML)                HEAPCHK(OFF,1,0,0,0,1024,0,1024,0)
IBM-supplied default             HEAPPOOLS(OFF,8,10,32,10,128,10,
                                 256,10,1024,10,2048,10,0,10,0,10,
                                 0,10,0,10,0,10,0,10)
IBM-supplied default             HEAPPOOLS64(OFF,8,4000,32,2000,128,700,
                                 256,350,1024,100,2048,50,3072,50,4096,50,
                                 8192,25,16384,10,32768,5,65536,5)
IBM-supplied default             HEAPZONES(0,ABEND,0,ABEND)
PARMLIB(CEEPRMML)                HEAP64(6M,1M,KEEP,32768,32768,KEEP,
                                 4096,4096,FREE)
IBM-supplied default             INFOMSGFILTER(OFF,,,,)
IBM-supplied default             IOHEAP64(1M,1M,FREE,12288,8192,FREE,
                                 4096,4096,FREE)
IBM-supplied default             LIBHEAP64(1M,1M,FREE,16384,8192,FREE,
                                 8192,4096,FREE)
IBM-supplied default             NATLANG(ENU)
IBM-supplied default             PAGEFRAMESIZE64(4K,4K,4K,4K,4K,4K,4K)
Invocation command               POSIX(ON)
IBM-supplied default             PROFILE(OFF,"")
DD:CEEOPTS                       RPTOPTS(ON)
SETCEE command                   RPTSTG(ON)
IBM-supplied default             STACK64(1M,1M,128M)
IBM-supplied default             STORAGE(NONE,NONE,NONE,)
IBM-supplied default             TERMTHDACT(TRACE,,96)
IBM-supplied default           NOTEST(ALL,"*","PROMPT","INSPPREF")
IBM-supplied default             THREADSTACK64(OFF,1M,1M,128M)
IBM-supplied default             TRACE(OFF,4096,DUMP,LE=0)
IBM-supplied default             TRAP(ON,SPIE)
```

Figure 156. Sample 64-bit options report

Understanding the HEAPZONES and HEAPCHK runtime options

The HEAPZONES and HEAPCHK runtime options are useful for debugging overlay damage problems that occur in the user heap. Though similar in that both options can be used for debugging purposes, the runtime options activate very different behavior in the runtime when specified.

HEAPZONES is a lightweight mechanism that detects heap overlay damage only during the freeing of an element. It looks for damage in the heap check zone of the freed element only.

Selecting a non-quiet output option causes HEAPZONES to display information about the damaged heap element. When messaging is requested, the address of the damaged element along with information specific to the heap check zone are included in the message. Depending on the type of damage, the value of the heap check zone is displayed. The data area of the damaged location is displayed following any issued informational messages. This runtime option can also be used as a mechanism to tolerate heap overlay damage by simply requesting no output (QUIET).

Depending on the size of the heap check zone and the number of allocation requests, the user may notice a significant amount of extra storage being used by the application. Performance may be affected due to the overhead of examining each heap check zone.

HEAPCHK investigates the entire user heap for damage during heap related calls at a frequency based on the specified settings in the option. Because HEAPCHK will traverse the entire user heap, a slow down in application performance will occur. Information about HEAPCHK diagnostic output is discussed in Chapter 3, “Using Language Environment debugging facilities,” on page 33.

When deciding which runtime option is better suited to use with your application, consider the differences between HEAPZONES and HEAPCHK relating to performance, storage usage, and time of damage detection. Although both runtime options affect performance, an application that chooses HEAPCHK will perform slower than an application that chooses HEAPZONES. If storage usage is a concern, HEAPCHK will not consume extra amounts of storage in the manner that HEAPZONES will. Determining when heap damage has occurred may be simpler to accomplish if HEAPCHK is chosen because of the frequency and scope of its analysis.

For more information about the HEAPZONES runtime option, see HEAPZONES in *z/OS Language Environment Programming Reference*.

For more information about the HEAPCHK runtime option, see HEAPCHK in *z/OS Language Environment Programming Reference*.

Controlling storage allocation for AMODE 64 applications

The following runtime options control storage allocation:

- HEAP64
- HEAPPOOLS
- HEAPPOOLS64
- IOHEAP64
- LIBHEAP64
- STACK64
- THREADSTACK64

To generate a report of the storage a routine (or more specifically, an enclave) used during its run, specify the RPTSTG(ON) runtime option. The storage report, generated during enclave termination provides statistics that can help you understand how space is being consumed as the enclave runs. If storage management tuning is desired, the statistics can help you set the corresponding storage-related runtime options for future runs. Figure 157 on page 327 shows a sample storage report.

```
 Storage Report for Enclave main Tue Sep 14 09:26:22 2021
Language Environment V02 R05.00

    STACK64 statistics:
      Initial size:                                              1M
      Increment size:                                            1M
      Maximum used by all concurrent threads:                    1M
      Largest used by any thread:                                1M
      Number of increments allocated:                            0
    THREADSTACK64 statistics:
      Initial size:                                              1M
      Increment size:                                            1M
      Maximum used by all concurrent threads:                    0M
      Largest used by any thread:                                0M
      Number of increments allocated:                            0
    64bit User HEAP statistics:
      Initial size:                                              1M
      Increment size:                                            1M
      Total heap storage used:                              983808
      Suggested initial size:                                    1M
      Successful Get Heap requests:                             11
      Successful Free Heap requests:                             0
      Number of segments allocated:                              0
      Number of segments freed:                                  0
    31bit User HEAP statistics:
      Initial size:                                          32768
      Increment size:                                        32768
      Total heap storage used (sugg. initial size):         243352
      Successful Get Heap requests:                             58
      Successful Free Heap requests:                             0
      Number of segments allocated:                              9
      Number of segments freed:                                  0
    24bit User HEAP statistics:
      Initial size:                                           4096
      Increment size:                                         4096
      Total heap storage used (sugg. initial size):              0
      Successful Get Heap requests:                              0
      Successful Free Heap requests:                             0
      Number of segments allocated:                              0
      Number of segments freed:                                  0
    64bit Library HEAP statistics:
      Initial size:                                              1M
      Increment size:                                            1M
      Total heap storage used:                             3795584
      Suggested initial size:                                    4M
      Successful Get Heap requests:                            384
      Successful Free Heap requests:                           337
      Number of segments allocated:                              2
      Number of segments freed:                                  0
    31bit Library HEAP statistics:
      Initial size:                                          16384
      Increment size:                                         8192
      Total heap storage used (sugg. initial size):              0
      Successful Get Heap requests:                              0
      Successful Free Heap requests:                             0
      Number of segments allocated:                              0
      Number of segments freed:                                  0
```

Figure 157. 64-bit storage report (Part 1 of 4)

Figure 158 on page 328 shows a sample storage report.

```
     24bit Library HEAP statistics:
       Initial size:                                          8192
       Increment size:                                        4096
       Total heap storage used (sugg. initial size):             0
       Successful Get Heap requests:                             0
       Successful Free Heap requests:                            0
       Number of segments allocated:                             0
       Number of segments freed:                                 0
    64bit I/O HEAP statistics:
       Initial size:                                             1M
       Increment size:                                           1M
       Total heap storage used:                                  0
       Suggested initial size:                                   1M
       Successful Get Heap requests:                             0
       Successful Free Heap requests:                            0
       Number of segments allocated:                             0
       Number of segments freed:                                 0
     31bit I/O HEAP statistics:
       Initial size:                                         12288
       Increment size:                                        8192
       Total heap storage used (sugg. initial size):          9616
       Successful Get Heap requests:                            27
       Successful Free Heap requests:                           19
       Number of segments allocated:                             1
       Number of segments freed:                                 0
     24bit I/O HEAP statistics:
       Initial size:                                          4096
       Increment size:                                        4096
       Total heap storage used (sugg. initial size):          3032
       Successful Get Heap requests:                            14
       Successful Free Heap requests:                            6
       Number of segments allocated:                             1
       Number of segments freed:                                 0
     HEAPPOOLS Statistics:
       Pool  1     size:     8 Get Requests:               0
       Pool  2     size:    32 Get Requests:               1
         Successful Get Heap requests:    17-   24                    1
       Pool  3     size:   128 Get Requests:               0
       Pool  4     size:   256 Get Requests:               0
       Pool  5.1   size:  1024 Get Requests:             225
       Pool  5.2   size:  1024 Get Requests:               0
       Pool  5.3   size:  1024 Get Requests:               0
         Successful Get Heap requests:   273-  280                  225
       Pool  6     size:  2048 Get Requests:               0
       Requests greater than the largest cell size:              0
     HEAPPOOLS Summary:
       Specified  Element  Extent   Cells Per  Extents    Maximum      Cells In
       Cell Size  Size     Percent  Extent     Allocated  Cells Used   Use
       ------------------------------------------------------------------------
              8       16     10        409          0          0          0
             32       40     10        163          1          1          1
            128      136     10         48          0          0          0
            256      264     10         24          0          0          0
           1024     1032     10          4         57        225        225
           1024     1032     10          4          0          0          0
           1024     1032     10          4          0          0          0
           2048     2056     10          4          0          0          0
       ------------------------------------------------------------------------
       Suggested Percentages for current Cell Sizes:
         HEAPP(ON,8,1,32,1,128,1,256,1,(1024,3),90,2048,1,0)
       Suggested Cell Sizes:
         HEAPP(ON,24,,280,,2048,,0)
```

Figure 158. 64-bit storage report (Part 2 of 4)

Figure 159 on page 329 shows a sample storage report.

```
    HEAPPOOLS64 Statistics:
      Pool  1     size:     8 Get Requests:               2
        Successful Get Heap requests:     1-    8                    2
      Pool  2     size:    32 Get Requests:             240
        Successful Get Heap requests:     9-   16                   12
        Successful Get Heap requests:    17-   24                  227
        Successful Get Heap requests:    25-   32                    1
      Pool  3     size:   128 Get Requests:             125
        Successful Get Heap requests:    33-   40                    4
        Successful Get Heap requests:    41-   48                    1
        Successful Get Heap requests:    49-   56                    1
        Successful Get Heap requests:    57-   64                    4
        Successful Get Heap requests:    65-   72                    3
        Successful Get Heap requests:    73-   80                    7
        Successful Get Heap requests:    81-   88                    2
        Successful Get Heap requests:    89-   96                   88
        Successful Get Heap requests:   105-  112                    3
        Successful Get Heap requests:   113-  120                    8
        Successful Get Heap requests:   121-  128                    4
      Pool  4     size:   256 Get Requests:              53
        Successful Get Heap requests:   129-  136                    2
        Successful Get Heap requests:   137-  144                    2
        Successful Get Heap requests:   145-  152                    2
        Successful Get Heap requests:   153-  160                    8
        Successful Get Heap requests:   161-  168                    1
        Successful Get Heap requests:   169-  176                    2
        Successful Get Heap requests:   177-  184                    3
        Successful Get Heap requests:   185-  192                    6
        Successful Get Heap requests:   193-  200                    5
        Successful Get Heap requests:   201-  208                    5
        Successful Get Heap requests:   209-  216                    2
        Successful Get Heap requests:   217-  224                    1
        Successful Get Heap requests:   225-  232                    5
        Successful Get Heap requests:   233-  240                    6
        Successful Get Heap requests:   249-  256                    3
      Pool  5.1   size:  1024 Get Requests:               2
      Pool  5.2   size:  1024 Get Requests:               2
      Pool  5.3   size:  1024 Get Requests:               0
        Successful Get Heap requests:   281-  288                    2
        Successful Get Heap requests:   521-  528                    1
        Successful Get Heap requests:   713-  720                    1
      Pool  6     size:  2048 Get Requests:               2
        Successful Get Heap requests:  1505- 1512                    1
        Successful Get Heap requests:  1641- 1648                    1
      Pool  7     size:  3072 Get Requests:               2
        Successful Get Heap requests:  2073- 2080                    1
        Successful Get Heap requests:  2105- 2112                    1
      Pool  8     size:  4096 Get Requests:               1
        Successful Get Heap requests:  3681- 3688                    1
      Pool  9     size:  8192 Get Requests:               0
      Pool 10     size: 16384 Get Requests:               0
      Pool 11     size: 32768 Get Requests:               0
      Pool 12     size: 65536 Get Requests:               0
      Requests greater than the largest cell size:                 0
```

Figure 159. 64-bit storage report (Part 3 of 4)

Figure 160 on page 329 shows a sample storage report.

```
    HEAPPOOLS64 Summary:
      Specified  Element    Cells Per   Extents    Maximum       Cells In
      Cell Size  Size       Extent      Allocated  Cells Used    Use
      -----------------------------------------------------------------
            8        32        4000          1          1           0
           32        48        2000          1        226         225
          128       144         700          1         83          77
          256       272         350          1          1           0
         1024      1040          34          1          2           2
         1024      1040          34          1          2           0
         1024      1040          34          0          0           0
         2048      2064          50          1          2           2
         3072      3088          50          1          2           2
         4096      4112          50          1          1           0
         8192      8208          25          0          0           0
        16384     16400          10          0          0           0
        32768     32784           5          0          0           0
        65536     65552           5          0          0           0
      -----------------------------------------------------------------
      Suggested Cell Sizes:
        HP64(ON,
             40,,80,,96,,128,,168,,224,,
             288,,528,,720,,1648,,2112,,3688,)
    Largest number of threads concurrently active:                 6
  End of Storage Report
```

Figure 160. 64-bit storage report (Part 4 of 4)

Storage statistics for AMODE 64 applications

The statistics for initial and incremental allocations of storage types that have a corresponding runtime option differ from the runtime option settings when their values have been rounded up by the implementation, or when allocations larger than the amounts specified were required during execution.

See Storage statistics for AMODE 64 applications in *z/OS Language Environment Programming Reference* for information about rounding.

Stack storage statistics for AMODE 64 applications

Language Environment stack storage is managed at the thread level—each thread has its own stack-type resources.

STACK64 and THREADSTACK64 statistics

- Initial size—the actual size of the initial stack area assigned to each thread. If a pthread-attributes-table is provided on the invocation of pthread-create, the stack size specified in the pthread-attributes-table takes precedence over the stack runtime options.
- Increment size—the size of each incremental stack area made available, as determined by the increment portion of the corresponding runtime option.
- Maximum used by all concurrent threads—the maximum amount allocated in total at any one time by all concurrently executing threads.
- Largest used by any thread—the largest amount allocated ever by any single thread.
- Number of increments allocated—the number of incremental segments allocated by all threads.

Determining the applicable threads

If the application is not a multithreading application, the STACK64 statistics are for the one and only thread that executed, and the THREADSTACK64 statistics are all zero.

If the application is a multithreading application, and THREADSTACK64 was not suppressed, the STACK64 statistics are for the initial thread (IPT), and the THREADSTACK64 statistics are for the other threads. However, if THREADSTACK64 was suppressed, the STACK64 statistics are for all of the threads, initial and other.

Allocating stack storage

The allocation of the stack for each thread, including the initial processing thread (IPT), is part of a storage request to the system when the thread is first created. Other storage, not part of the stack, is also acquired at this time. These storage allocations are not shown in the storage report. The size of the stack portion of this storage is the stack maximum size plus a one megabyte (1M) guard area. After allocation, the guard area follows the stack initial size and runs through the end of the stack maximum size plus the 1M guard area. Increments to the stack for each thread do not result in additional storage requests to the system. They result in the movement of the beginning of the guard area no further than the maximum size of the stack. The stack initial, increment, and maximum sizes are controlled through the STACK64 and THREADSTACK64 runtime options.

Heap storage statistics

Language Environment heap storage is managed at the enclave level. Each enclave has its own heap type resources, which are shared by the threads that execute within the enclave. The heap resources have 64-bit, 31-bit, and 24-bit addressable areas, each of which can be tuned separately.

HEAP64, LIBHEAP64, and IOHEAP64 statistics

- Initial size—the default initial allocation, as specified by the corresponding runtime option.
- Increment size—the minimum incremental allocation, as specified by the corresponding runtime option.
- Total heap storage used—the largest total amount used by the enclave at any one time.
- Successful Get Heap requests—the number of get heap requests.
- Successful Free Heap requests—the number of free heap requests.
- Number of segments allocated—the number of incremental segments allocated.
- Number of segments freed—the number of incremental segments individually freed.

The number of Free Heap requests could be less than the number of Get Heap requests if the pieces of heap storage acquired by individual Get Heap requests were not explicitly freed, but were freed implicitly during enclave termination. The number of incremental segments individually freed could be less than the number allocated if the segments were not explicitly freed, but were freed implicitly during enclave termination. The initial segment is included in *Number of segments allocated* for each 31-bit and 24-bit addressable heap resource, and for the 64-bit addressable IOHEAP64 resource. A disposition of KEEP always causes 0 to be reported for the *Number of segments freed*. These statistics, in all cases, specify totals for the entire enclave.

Heap pools storage statistics

The HEAPPOOLS and HEAPPOOLS64 runtime options for C/C++ applications only controls usage of the heap pools storage algorithm at the enclave level. The heap pools algorithm allows for the definition of one to twelve heap pools, each consisting of a number of storage cells of a specified length. For further details regarding heap pools storage statistics in the storage report, see "Language Environment storage report with heap pools statistics" on page 463.

Modifying exception handling behavior

Setting the exception handling behavior of your routine affects the response that occurs when the routine encounters an error. You can modify exception handling behavior in the following ways:

- Application program interfaces (API)
- User-written exception handlers
- POSIX functions (used to specifically set signal actions and signal masks)

Language Environment application program interfaces (API)

You can use the following APIs to modify exception handling:

Function name	API description
`__cabend()`	Terminates an enclave using an abend.
`__le_cib_get()`	Returns a pointer to a condition information block (CIB) associated with a given condition token. The CIB contains detailed information about the condition.
`__set_exception_handler()`	Activates a routine to handle an exception.
`__reset_exception_handler()`	Removes handling of an exception by any routine.

Language Environment runtime options

The following Language Environment runtime options can affect your routine's exception handling behavior:

Runtime option	Description of runtime option
TERMTHDACT	Sets the level of information that is produced when a condition of severity 2 or greater remains unhandled within the enclave. The possible parameter settings for different levels of information are: • QUIET for no information • MSG for message only • TRACE for message and a traceback • DUMP for message, traceback, and Language Environment dump • UAONLY for message and a system dump of the user address space • UATRACE for message, Language Environment dump with traceback information only, and a system dump of the user address space • UADUMP for message, traceback, Language Environment dump, and system dump • UAIMM for a system dump of the user address space of the original abend or program interrupt prior to the Language Environment condition manager processing the condition.
TRAP(ON)	Fully enables the Language Environment exception handler. This causes the Language Environment exception handler to intercept error conditions and routine interrupts. When TRAP(ON, NOSPIE) is specified, Language Environment handles all program interrupts and abends through an ESTAE. Use this feature when you do not want Language Environment to issue an ESPIE macro. During normal operation, you should use TRAP(ON) when running your applications.
TRAP(OFF)	Disables the Language Environment condition handler from handling abends and program checks/interrupts. ESPIE is not issued with TRAP(OFF). Specify TRAP(OFF) when you do not want Language Environment to issue an ESPIE. When TRAP(OFF), TRAP(OFF,SPIE), or TRAP(OFF,NOSPIE) is specified and either a program interrupt or abend occurs, the user exit for termination is ignored. TRAP(OFF) can cause several unexpected side effects. It is not supported in AMODE 64 production execution. For more information about the TRAP option, see TRAP in *z/OS Language Environment Programming Reference*.

Customizing exception handlers

User-written exception handlers permit you to customize exception handling for certain conditions. You can register a user-written exception handler for the current stack frame by using the `__set_exception_handler()` API. For more information about user-written exception handlers and the Language Environment condition manager, see __set_exception_handler() — Register an exception handler routine in *z/OS XL C/C++ Runtime Library Reference*.

Using condition information

If a condition that might require attention occurs while an application is running, Language Environment builds a condition token. The condition token contains 16 bytes (128 bits) of information about the condition that Language Environment or your routines can use to respond appropriately. Each condition is associated with a single Language Environment runtime message. You can use this condition information in two ways:

- To specify the feedback code parameter when calling Language Environment services (see "Using the feedback code parameter" on page 333).
- To code a symbolic feedback code in a user-written exception handler (see "Using the symbolic feedback code" on page 334).

Using the feedback code parameter

The feedback code is an optional parameter of the Language Environment APIs. For C/C++ applications, this parameter is optional. For more information about feedback codes and condition tokens, see Using symbolic feedback codes and Using condition tokens in *z/OS Language Environment Programming Guide for 64-bit Virtual Addressing Mode*.

When you provide the feedback code (`fc`) parameter, the API in which the condition occurs sets the feedback code to a specific value called a condition token.

The condition token does not apply to asynchronous signals. For a discussion of the distinctions between synchronous signals and asynchronous signals with POSIX(ON), see Language Environment and POSIX signal handling interactions in *z/OS Language Environment Programming Guide*.

When you do not provide the `fc` parameter, any nonzero condition is signaled and processed by Language Environment exception handling routines. If you have registered a user-written exception handler, Language Environment passes control to the handler, which determines the next action to take. If the condition remains unhandled, Language Environment writes a message to stderr. The message is the translation of the condition token into English (or another supported national language).

Language Environment provides APIs that can be used to convert condition tokens to routine variables, messages, or signaled conditions. The following table lists these Language Environment APIs and their functions. For more information about these APIs, see Library functions in *z/OS XL C/C++ Runtime Library Reference*.

API name	API description
`__le_msg_write()`	Writes a message string to stderr
`__le_msg_get_and_write()`	Takes a message associated with a condition and writes it to stderr
`__le_msg_get()`	Retrieves, formats, and stores message data for a condition
`__le_msg_add_insert()`	Creates a message insert

There are two types of condition tokens. Case 1 condition tokens contain condition information, including the Language Environment message number. All Language Environment APIs and most application routines use case 1 condition tokens. Case 2 condition tokens contain condition information and a user-specified class and cause code. Application routines, user-written exception handlers, assembler user exits, and some operating systems can use case 2 condition tokens.

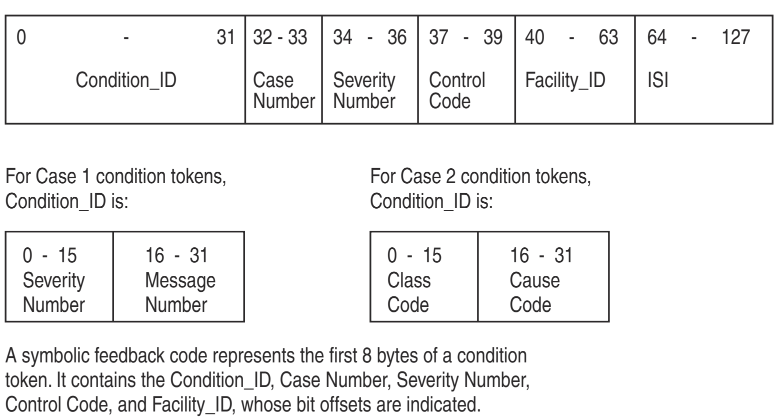


Figure 161. Language Environment condition token

For example, in the condition token: X'0003032D 59C3C5C5 00000000 00000000'

- X'0003' is severity.
- X'032D' is message number 813.

- X'59' are hexadecimal flags for case, severity, and control.
- X'C3C5C5' is the CEE facility ID.
- X'00000000 00000000' is the instance specific information (ISI). (In this case, no ISI was provided.)

If a Language Environment traceback or dump is generated while a condition token is being processed or when a condition exists, Language Environment writes the runtime message to the condition section of the traceback or dump. If a condition is detected when a Language Environment API is invoked without a feedback code, the condition token is passed to the Language Environment condition manager. If a condition is severity 0 or 1, Language Environment resumes without issuing a message. For conditions of severity 2 or greater, Language Environment issues a message and terminates. For a list of Language Environment runtime messages and corrective information, see Language Environment errno2 values in *z/OS Language Environment Runtime Messages*.

If a second condition is raised while Language Environment is attempting to handle a condition, the message `CEE0374C CONDITION = <message no.>` is displayed using a write-to-operator (WTO). The message number in the CEE0374C message indicates the original condition that was being handled when the second condition was raised. This can happen when a critical error is signaled (for example, when internal control blocks are damaged).

If the output for this error message appears several times in sequence, the conditions appear in order of occurrence. Correcting the earliest condition can cause your application to run successfully.

Using the symbolic feedback code

The symbolic feedback code represents the first 8 bytes of a 16-byte condition token. You can think of the symbolic feedback code as the nickname for a condition. As such, the symbolic feedback code can be used in user-written exception handlers to screen for a given condition, even if it occurs at different locations in an application. For more details on symbolic feedback codes, see Using symbolic feedback codes in *z/OS Language Environment Programming Guide for 64-bit Virtual Addressing Mode*.

Chapter 11. Classifying AMODE 64 application errors

This chapter describes errors that commonly occur in Language Environment AMODE 64 applications. It also explains how to use runtime messages and abend codes to obtain information about errors in your application.

Identifying problems in routines

The following sections describe how you can identify errors in Language Environment routines. Included are common error symptoms and solutions.

Language Environment module names

You can identify Language Environment-supplied module elements by any of the following three-character prefixes:

- CEE (Language Environment)
- CEL (Language Environment)
- EDC (C/C++)

Module elements or text files with other prefixes are not part of the Language Environment product for AMODE 64 applications.

Common errors in routines

These common errors have simple solutions:

- If you receive abend U4093, reason X'224' (548 decimal), then make sure you use MEMLIMIT to allow access to above the 2 GB bar.
- If you do not have enough virtual storage, increase your region size or decrease your storage usage (stack size) by using the storage-related runtime options and callable services. (See "Controlling storage allocation for AMODE 64 applications" on page 326 for information about using storage in routines.)
- If you do not have enough disk space, increase your disk allocation.
- If executable files are not available, check your executable library to ensure that they are defined. For example, check your STEPLIB or JOBLIB definitions.

If your error is not caused by any of the items listed above, examine your routine or routines for changes since the last successful run. If there have been changes, review these changes for errors that might be causing the problem. One way to isolate the problem is to branch around or comment out recent changes and rerun the routine. If the run is successful, the error can be narrowed to the scope of the changes.

Changes in optimization levels, addressing modes, and input/output file formats can also cause unanticipated problems in your routine.

In most cases, generated condition tokens or runtime messages point to the nature of the error. The runtime messages offer the most efficient corrective action. To help you analyze errors and determine the most useful method to fix the problem, Table 51 on page 335 lists common error symptoms, possible causes, and programmer responses.

Table 51. Common error symptoms, possible causes, and programmer responses

Error Symptom	Possible Cause	Programmer Response
Numbered runtime message appears	Condition raised in routine	For any messages you receive, read the Programmer Response. For information about message structure, see "Interpreting runtime messages" on page 336.

Table 51. Common error symptoms, possible causes, and programmer responses (continued)

Error Symptom	Possible Cause	Programmer Response
User abend code < 4000	• A non-Language Environment abend occurred • The assembler user exit requested an abend for an unhandled condition of severity ≥2	Check for a subsystem-generated abend or a user-specified abend in Language Environment abend codes in *z/OS Language Environment Runtime Messages*.
User abend code ≥ 4000	• Language Environment detected an error and could not proceed • An unhandled software-raised condition occurred • The assembler user exit requested an abend for an unhandled condition of severity 4	For any abends you receive, read the appropriate explanation in Language Environment abend codes in *z/OS Language Environment Runtime Messages*.
System abend with TRAP(OFF)	Cause depends on type of malfunction	Respond appropriately. See the messages and codes book of the operating system.
System abend with TRAP(ON)	System-detected error	See the messages and codes book of the operating system.
No response (wait/ loop)	Application logic failure	Check routine logic.
Unexpected message (message received was not from most recent service)	Condition caused by something related to current service	Generate a traceback using `cdump()` or `ctrace()`.
Incorrect output	Incorrect file definitions, storage overlay, incorrect routine mask setting, references to uninitialized variables, data input errors, or application routine logic error	Correct the appropriate parameters.
No output	Incorrect ddname or file definitions	Correct the appropriate parameters.
Nonzero return code from enclave	The return code was issued by the application routine	Check the application for the meaning of the return code.

Interpreting runtime messages

The first step in debugging your routine is to look up any runtime messages. runtime messages are written to the C stderr stream. runtime messages provide users with additional information about a condition, and possible solutions for any errors that occurred. They can be issued by Language Environment common routines or language-specific runtime routines and contain a message prefix, message number, severity code, and descriptive text.

In the following example Language Environment message:

```
CEE3206S The system detected a specification exception (System Completion Code=0C6).
```

- The message prefix is CEE.
- The message number is 3206.
- The severity code is S.

- The message text is "The system detected a specification exception (System Completion Code=0C6)".

Language Environment messages can appear even though you made no explicit calls to Language Environment services. C/C++ runtime library routines commonly use the Language Environment services. This is why you can see Language Environment messages even when the application routine does not directly call common runtime services.

Message prefix

The message prefix indicates the Language Environment component that generated the message. The message prefix is the first three characters of the message number and is also the facility ID in the condition token. The messages for the various components can be found in *z/OS Language Environment Runtime Messages*.

Message Prefix	Language Environment Component
CEE	Common run time
EDC	C/C++ run time

Message number

The message number is the 4-digit number following the message prefix. Leading zeros are inserted, if the message number is less than four digits. It identifies the condition raised and references additional condition and programmer response information.

Severity code

The severity code is the letter following the message number and indicates the level of attention called for by the condition. Messages with severity "I" are informational messages and do not usually require any corrective action. In general, if more than one runtime message appears, the first noninformational message indicates the problem. For a complete list of severity codes, severity values, condition information, and default actions, see Interpreting runtime messages in *z/OS Language Environment Programming Guide for 64-bit Virtual Addressing Mode*.

Message text

The message text provides a brief explanation of the condition.

Understanding abend codes

Under Language Environment, abnormal terminations generate abend codes. There are two types of abend codes: 1) user abends (Language Environment and user-specified) and 2) system abends. User abends follow the format of U*dddd*, where *dddd* is a decimal user abend code. System abends follow the format of S*hhh*, where *hhh* is a hexadecimal abend code. Language Environment abend codes are usually in the range of 4000 to 4095. However, some subsystem abend codes can also fall in this range. User-specified abends use the range of 0 to 3999.

Example abend codes are:

```
User (Language Environment) abend code:U4041
User-specified abend code:U0005
System abend code:S80A
```

The Language Environment API `__cabend()` terminates your application with an abend. You can set the `clean_up` parameter value to determine how the abend is processed and how Language Environment handles the raised condition. For more information about `__cabend()` and `clean_up`, see *z/OS XL C/C++ Runtime Library Reference*.

User abends

If you receive a Language Environment abend code, see Language Environment abend codes in *z/OS Language Environment Runtime Messages* for a list of abend codes, error descriptions, and programmer responses.

System abends

If you receive a system abend code, look up the code and the corresponding information in the publications for the system you are using. When a system abend occurs, the operating system can generate a system dump. System dumps are written to ddname SYSMDUMP, SYSABEND, or SYSUDUMP. If the DYNDUMP runtime option is used in combination with the TERMTHDACT runtime option, the system dump can be written without the ddname specified. System dumps show the memory state at the time of the condition. See "Generating a system dump" on page 356 for more information about system dumps.

Chapter 12. Using Language Environment AMODE 64 debugging facilities

This section describes methods of debugging AMODE 64 routines in Language Environment. Currently, most problems in Language Environment and member language routines can be determined through the use of a debugging tool or through information provided in the Language Environment dump.

Debugging tools

You can use **dbx** to debug Language Environment applications. For more information, see dbx - Use the debugger in *z/OS UNIX System Services Command Reference*. For more information on usage, see Developing for the dbx Plugin Framework in *z/OS UNIX System Services Programming Tools*.

Language Environment dumps

The following sections provide information about using the Language Environment dump service, and describe the contents of the Language Environment dump.

Generating a Language Environment dump with TERMTHDACT

The TERMTHDACT runtime option produces a dump during program checks or abnormal terminations. You must use TERMTHDACT(DUMP) in conjunction with TRAP(ON) to generate a Language Environment dump. You can use TERMTHDACT to produce a traceback, Language Environment dump, or user address space dump when a thread ends abnormally because of an unhandled condition of severity 2 or greater. If this is the last thread in the process, the enclave goes away. A thread terminating in a non-POSIX environment is analogous to an enclave terminating. For information about enclave termination, see Enclave termination in *z/OS Language Environment Programming Guide for 64-bit Virtual Addressing Mode*.

The TERMTHDACT suboptions QUIET, MSG, TRACE, DUMP, UAONLY, UATRACE, UADUMP, and UAIMM control the level of information available. Following are the suboptions, the levels of information produced, and the destination of each.

Table 52. TERMTHDACT suboptions, level of information, and destinations

Suboption	Level of information	Destination
QUIET	No information	No destination.
MSG	Message	Stderr
TRACE	Message and Language Environment dump containing only a traceback	Message goes to stderr. Traceback goes to CEEDUMP file.
DUMP	Message and complete Language Environment dump	Message goes to stderr. Language Environment dump goes to CEEDUMP file.
UAONLY	SYSMDUMP, SYSABEND dump, or SYSUDUMP depending on the DD card used in the JCL in z/OS. You will get a system dump of your user address space if the appropriate DD statement is used. **Note:** A Language Environment dump is not generated.	Language Environment generates a U4039 abend which allows a system dump of the user address space to be generated. For z/OS, the system dump is written to the ddname specified.
UATRACE	Message, Language Environment dump containing only a traceback, and a system dump of the user address space	Message goes to stderr. Traceback goes to CEEDUMP file. Language Environment generates a U4039 abend which allows a system dump of the user address space to be generated. For z/OS, the system dump is written to the ddname specified.

Table 52. TERMTHDACT suboptions, level of information, and destinations (continued)		
Suboption	**Level of information**	**Destination**
UADUMP	Message, Language Environment dump, and SYSMDUMP, SYSABEND dump, or SYSUDUMP depending on the DD card used in the JCL in z/OS.	Message goes to stderr. Language Environment dump goes to CEEDUMP file. Language Environment generates a U4039 abend which allows a system dump of the user address space to be generated. For z/OS, the system dump is written to the ddname specified.
UAIMM	Language Environment generates a system dump of the original abend/program interrupt of the user address space. You will get a system dump of your user address space if the appropriate DD statement is used. After the dump is taken by the operating system, Language Environment condition manager continues processing.	Message goes to stderr. User address space dump goes to ddname specified for z/OS.

The TRACE and UATRACE suboptions of TERMTHDACT use these dump options:

- CONDITION
- ENCLAVE(ALL)
- FILES
- FNAME(CEEDUMP)
- GENOPTS
- NOBLOCKS
- NOENTRY
- NOSTORAGE
- STACKFRAME(ALL)
- THREAD(ALL)
- TRACEBACK
- VARIABLES

The DUMP and UADUMP suboptions of TERMTHDACT use these dump options:

- BLOCKS
- CONDITION
- ENCLAVE(ALL)
- FILES
- FNAME(CEEDUMP)
- GENOPTS
- NOENTRY
- STACKFRAME(ALL)
- STORAGE
- THREAD(ALL)
- TRACEBACK
- VARIABLES

Considerations for setting TERMTHDACT options

Review the following considerations before setting TERMTHDACT runtime options. For more information about TERMTHDACT, see TERMTHDACT in *z/OS Language Environment Programming Reference*.

- z/OS UNIX Considerations

- The TERMTHDACT option applies when a thread terminates abnormally. Abnormal termination of a single thread causes termination of the entire enclave. If an unhandled condition of severity 2 or higher percolates beyond the first routine's stack frame, the enclave terminates abnormally.
- If an enclave terminates due to a POSIX default signal action, then TERMTHDACT applies to conditions that result from software signals, program checks, or abends.
- If running under a shell and Language Environment generates a system dump, then a core dump is generated to a file based on the kernel environment variable, _BPXK_MDUMP.

• Preinitialized Environments for Authorized Programs Considerations

- The TERMTHDACT suboptions TRACE, DUMP, UADUMP, UATRACE are overridden to UAONLY.
- For UAONLY, a U4039 abend is generated and an SVC dump of the U4039 abend with the following title is taken:

```
COMPON=CEL,COMPID=568819801,ISSUER=CELAFRR ,MODULE=CELAEICT+????,
ABEND=U4039,REASON=00000000
```

- For UAIMM, an SVC dump of the original abend/program interrupt with the following title is taken (the ABEND and REASON values are those of the original abend/program interrupt):

```
COMPON=CEL,COMPID=568819801,ISSUER=CELAFRR ,MODULE=CELAEICT+????,
ABEND=S00C9,REASON=00000009
```

Generating a Language Environment dump with language-specific functions

C/C++ routines can use the functions `cdump()`, `csnap()`, and `ctrace()` to produce a Language Environment dump. For more information on these functions, see "Generating a Language Environment dump of a C/C++ routine" on page 442.

Understanding the Language Environment dump

The Language Environment dump service generates output of data and storage from the Language Environment runtime environment on an enclave basis. This output contains the information needed to debug most basic routine errors.

Figure 165 on page 344 illustrates a dump for enclave main. The example shows full use of the TERMTHDACT dump options. Ellipses are used to summarize some sections of the dump and information regarding unhandled conditions may not be present at all. Sections of the dump are numbered to correspond with the descriptions given in Figure 162 on page 342.

The CEE3DMP was generated by the C program CELQSAMP shown in Figure 162 on page 342. CELQSAMP uses the DLL CELQDLL shown in Figure 164 on page 343.

```
#pragma options(SERVICE("1.8"),NOOPT,GONUM)
#pragma runopts(TERMTHDACT(UADUMP),POSIX(ON))
#pragma runopts(TRACE(ON,1M,NODUMP,LE=1),HEAPCHK(ON))
#pragma runopts(RPTSTG(ON))
#define _OPEN_THREADS
#include <pthread.h>
#include <stdio.h>
#include <stdlib.h>
#include <dll.h>

typedef void* FUNC(void *);

pthread_mutex_t      mut;
pthread_t            thread[2];
int                  threads_joined = 0;
char *               t1 = "Thread 1";
char *               t2 = "Thread 2";
/*******************************************************************/
/*  thread_func: Invoked via pthread_create.                       */
/*******************************************************************/
void *thread_func(void *parm)
{
  printf(">>> Thread_func: %s locking mutex\n",parm);
  pthread_mutex_lock(&mut);
  pthread_mutex_unlock(&mut);
  printf(">>> Thread_func: %s exitting\n",parm);
  pthread_exit(NULL);
}
/*******************************************************************/
/*  Start of Main function.                                        */
/*******************************************************************/
main()
{
  dllhandle *          handle;
  FUNC *               fp;
  FILE*                fp1;
  FILE*                fp2;

  printf("Load DLL...\n");
  handle = dllload("CELQDLL");
  if (handle == NULL) {
    perror("Could not load DLL CELQDLL");
    exit(106);
  }

  printf("Query DLL...\n");
  fp = (FUNC *)dllqueryfn(handle,"div_zero");
  if (fp == NULL) {
    perror("Could not find thread_func");
    exit(107);
  }

  printf("Init MUTEX...\n");
  if (pthread_mutex_init(&mut, NULL) == -1) {
    perror("Init of mut failed");
    exit(101);
  }  printf("Lock Mutex Lock...\n");
  if (pthread_mutex_lock(&mut) == -1) {
    perror("Lock of mut failed");
    exit(102);
  }
```

Figure 162. The C program CELQSAMP (AMODE 64) (Part 1 of 2)

The second part of the C program CELQSAMP is shown in Figure 163 on page 343.

```
  printf("Create 1st thread...\n");
  if (pthread_create(&thread[0],NULL,thread_func,(void *)t1) == -1) {
    perror("Could not create thread #1");
    exit(103);
  }

  printf("Create 2nd thread...\n");
  if (pthread_create(&thread[1],NULL,thread_func,(void *)t2) == -1) {
    perror("Could not create thread #2");
    exit(104);
  }
  printf("Write to some files...\n");
  fp1 = fopen("myfile.data", "w");
  if (!fp1) {
    perror("Could not open myfile.data for write");
    exit(109);
  }

  fprintf(fp1, "record 1\n");
  fprintf(fp1, "record 2\n");
  fprintf(fp1, "record 3\n");

  fp2 = fopen("memory.data", "wb,type=memory");
  if (!fp2) {
    perror("Could not open memory.data for write");
    exit(112);
  }

  fprintf(fp2, "some data");
  fprintf(fp2, "some more data");
  fprintf(fp2, "even more data");

  printf("Call div_zero...\n");
  fp(NULL);

  printf("Error -- Should not get here\n");
  exit(110);
}
```

Figure 163. The C program CELQSAMP (AMODE 64) (Part 2 of 2)

The DLL CELQDLL is shown in Figure 164 on page 343.

```
/* DLL containing div_zero */
#pragma options(SERVICE("1.4.f.0001"),NOOPT,GONUM)
#pragma export(div_zero)
#include <stdio.h>
#include <stdlib.h>
char wsa_array[11] = { 'C','E','L','Q','D','L','L',' ','W','S','A'};
/*********************************************************************/
/*  div_zero: Cause divide by zero exception                         */
/*********************************************************************/
void *div_zero(void *parm)
{
  int                  i = 0;

  printf("Divide by zero...\n");
  i = 1/i;
  printf("Error -- Should not get here. i=%d\n",i);
  exit(110);
}
```

Figure 164. The C DLL CELQDLL (AMODE 64)

For easy reference, the sections of the following dump are numbered to correspond with the descriptions in “Sections of the Language Environment dump” on page 352.

```
[1] CEE3DMP V1 R9.0: Condition processing resulted in the unhandled condition.         Wed Jan 17 21:19:59 2007             Page:    1
    ASID: 0028   Job ID: JOB00051   Job name: CELQSAMP   Step name: STEP1      PID: 67108872   Parent PID: 1   User name: IBMUSER

[2] CEE3845I CEEDUMP Processing started.

[3] Information for enclave main

[4]   Information for thread 253E019000000000

[5]   Traceback:
        DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
        1     CEEHDSP     +00000000              CELQLIB              CEEHDSP                        D1908    Call
        2     CEEOSIGJ    +0000094E              CELQLIB              CEEOSIGJ                       D1908    Call
        3     CELQHROD    +0000024E              CELQLIB              CELQHROD                       D1908    Call
        4     CEEOSIGG    +1B032E48              CELQLIB              CEEOSIGG                       D1908    Call
        5     CELQHROD    +0000024E              CELQLIB              CELQHROD                       D1908    Call
        6     div_zero    +0000004E  15          CELQDLL              CELQDLL                        1.4.f.0  Exception
        7     main        +00000468  98          CELQSAMP             CELQSAMP                       1.2.d    Call
        8     CELQINIT    +0000134C              CELQLIB              CELQINIT                       D1908    Call

        DSA   DSA Addr          E  Addr             PU Addr           PU Offset   Comp Date Compile Attributes
        1     00000001082FAAC0  00000000251B6060    00000000251B6060  00000000    20061215  CEL       POSIX  XPLINK  EBCDIC  HFP
        2     00000001082FD3E0  000000002504AAB0    000000002504AAB0  0000094E    20070109  CEL       POSIX  XPLINK  EBCDIC  HFP
        3     00000001082FDDE0  00000000251C9480    00000000251C9480  0000024E    20061215  CEL       POSIX  XPLINK  EBCDIC  HFP
        4     00000001082FE020  00000000253D11F8    00000000253D11F8  1B032E48    20061215  CEL       POSIX  XPLINK  EBCDIC  HFP
        5     00000001082FEE40  00000000251C9480    00000000251C9480  0000024E    20061215  CEL       POSIX  XPLINK  EBCDIC  HFP
        6     00000001082FF080  000000002575B5A0    0000000000000000  ********    20070117  C/C++     POSIX  XPLINK  EBCDIC  IEEE
        7     00000001082FF180  00000000250000D8    0000000000000000  ********    20070117  C/C++     POSIX  XPLINK  EBCDIC  IEEE
        8     00000001082FF280  0000000025005010    0000000025005010  0000134C    20061215  CEL       POSIX  XPLINK  EBCDIC  HFP

        Fully Qualified Names
        DSA   Entry       Program Unit                                        Load Module
        6     div_zero    PLPSC://'POSIX.CRTL.C(CELQDLL)'                     CELQDLL
        7     main        PLPSC://'POSIX.CRTL.C(CELQSAMP)'                    CELQSAMP

        Full Service Level
        DSA   Entry       Service
        6     div_zero    1.4.f.0001

[6]   Condition Information for Active Routines
        Condition Information for PLPSC://'POSIX.CRTL.C(CELQDLL)' (DSA address 00000001082FF080)
          CIB Address: 00000001082FBE00
          Current Condition:
            CEE0198S The termination of a thread was signaled due to an unhandled condition.
          Original Condition:
            CEE3209S The system detected a fixed-point divide exception (System Completion Code=0C9).
          Location:
            Program Unit: PLPSC://'POSIX.CRTL.C(CELQDLL)'
            Entry:        div_zero Statement: 15 Offset: +0000004E
          Machine State:
            ILC..... 0002    Interruption Code..... 0009
            PSW..... 0785240180000000 000000002575B5F0
            GPR0..... 0000000000000000  GPR1..... 0000000100009DF0  GPR2..... 00000001082FF278  GPR3..... 0000000000000012
            GPR4..... 00000001082FF080  GPR5..... 00000000000000C0  GPR6..... 0000000000000000  GPR7..... 0000000000000001
            GPR8..... 000000002575B5AC  GPR9..... 000000002575B638  GPR10.... 00000000250014B0  GPR11.... 0000000108FC5E70
            GPR12.... 0000000100005340  GPR13.... 0000000000006F58  GPR14.... 0000000025250098  GPR15.... 000000000000001F
```

Figure 165. Example dump using CEE3DMP (AMODE 64) (Part 1 of 9)

The following is the sceond part of the example dump using CEE3DMP (AMODE 64) .

```
        Storage dump near condition, beginning at location(000000002575B5DE)
          +0000 000000002575B5DE  0700E300 48C00014 A7690001 8E600020  |..T.....x....-..|
          +0010 000000002575B5EE  1D60B904 00075000 48C0E320 48C00014  |.-....&...T.....|
        GPREG STORAGE:
          Storage around GPR0 (0000000000000000)
            +0000 0000000000000000  Inaccessible storage.
            +0010 0000000000000010  Inaccessible storage.
            +0020 0000000000000020  Inaccessible storage.
            +0030 0000000000000030  Inaccessible storage.
            +0040 0000000000000040  Inaccessible storage.
            +0050 0000000000000050  Inaccessible storage.
          Storage around GPR1 (0000000100009DF0)
            -0020 0000000100009DD0  00000000 00000000 00000000 00000000  |................|
            -0010 0000000100009DE0 - +FFFFFF 0000000100009DEF             same as above
⋮
          Storage around GPR15(000000000000001F)
            -001F 0000000000000000  Inaccessible storage.
            -000F 0000000000000010  Inaccessible storage.
            +0001 0000000000000020  Inaccessible storage.
            +0011 0000000000000030  Inaccessible storage.
            +0021 0000000000000040  Inaccessible storage.
            +0031 0000000000000050  Inaccessible storage.

[7]   Parameters, Registers, and Variables for Active Routines:
        div_zero (DSA address 00000001082FF080):
          DOWNSTACK DSA
          Saved Registers:
            GPR0..... ****************  GPR1..... ****************  GPR2..... ****************  GPR3..... ****************
            GPR4..... 00000001082FF080  GPR5..... BBBBBBBBBBBBBBBB  GPR6..... 00000000251C9480  GPR7..... 0000000000000001
            GPR8..... 000000002575B5AC  GPR9..... 000000002575B638  GPR10.... 00000000250014B0  GPR11.... 0000000108FC5E70
            GPR12.... 4040404040404040  GPR13.... 4040404040404040  GPR14.... 4040404040404040  GPR15.... 4040404040404040
        GPREG STORAGE:
          Storage around GPR0  is invalid.
          Storage around GPR1  is invalid.
          Storage around GPR2  is invalid.
          Storage around GPR3  is invalid.
          Storage around GPR4 (00000001082FF080)
            +0800 00000001082FF880  00000001 082FF180 00000001 083710A0  |......1.........|
            +0810 00000001082FF890  00000000 2575B5A0 00000000 25000542  |................|
            +0820 00000001082FF8A0  00000000 250000E4 00000000 25000658  |.......U........|
            +0830 00000001082FF8B0  00000000 250014B0 00000001 08FC5E70  |..............;.|
            +0840 00000001082FF8C0  00000001 00005340 00000000 00006F58  |....... ......?.|
            +0850 00000001082FF8D0  00000000 25250098 00000000 0000001F  |.......q........|
⋮
          Storage around GPR15(4040404040404040)
            -0020 4040404040404020  Inaccessible storage.
            -0010 4040404040404030  Inaccessible storage.
            +0000 4040404040404040  Inaccessible storage.
            +0010 4040404040404050  Inaccessible storage.
            +0020 4040404040404060  Inaccessible storage.
            +0030 4040404040404070  Inaccessible storage.
         main (DSA address 00000001082FF180):
          DOWNSTACK DSA
          Saved Registers:
            GPR0..... ****************  GPR1..... ****************  GPR2..... ****************  GPR3..... ****************
            GPR4..... 00000001082FF180  GPR5..... 00000001083710A0  GPR6..... 000000002575B5A0  GPR7..... 0000000025000542
            GPR8..... 00000000250000E4  GPR9..... 0000000025000658  GPR10.... ****************  GPR11.... ****************
            GPR12.... ****************  GPR13.... ****************  GPR14.... ****************  GPR15.... ****************

       GPREG STORAGE:
          Storage around GPR0  is invalid.
          Storage around GPR1  is invalid.
⋮
        CELQINIT (DSA address 00000001082FF280):
          DOWNSTACK DSA
```

Figure 166. Example dump using CEE3DMP (AMODE 64) (Part 2 of 9)

The following is the third part of the example dump using CEE3DMP (AMODE 64) .

```
            Saved Registers:
             GPR0..... ****************  GPR1..... ****************  GPR2..... ****************  GPR3..... ****************
             GPR4..... 00000001082FF280  GPR5..... 0000000108300070  GPR6..... 00000000250000D8  GPR7..... 000000002500635E
             GPR8..... 0000000000006FF0  GPR9..... 0000000025002E98  GPR10.... ****************  GPR11.... ****************
             GPR12.... ****************  GPR13.... ****************  GPR14.... ****************  GPR15.... ****************
        GPREG STORAGE:
          Storage around GPR0  is invalid.
          Storage around GPR1  is invalid.
:
[8]   Control Blocks for Active Routines:
        DSA for CEEHDSP: 00000001082FB2C0
          +000000  R4....... 00000001082FD3E0            R5....... 00000000251BABA0            R6....... 00000000251B6060
          +000018  R7....... 000000002504B400            R8....... 00000001089135B0            R9....... 0000000000000005
          +000030  R10...... 00000001082FE3DF            R11...... 00000001082FE0C0            R12...... 00000001089135B0
          +000048  R13...... 00000001082FE680            R14...... 000000002504B300            R15...... 000000002530A300
          +000060  reserved. 0000000000000000            reserved. 0000000000000000            HPTRAN... 0000000000000000
          +000078  reserved. 0000000000000000
        DSA for CEEOSIGJ: 00000001082FDBE0
          +000000  R4....... 00000001082FDDE0            R5....... 000000002504C3EC            R6....... 000000002504AAB0
          +000018  R7....... 00000000251C96D0            R8....... 0000000025754AD8            R9....... 0000000025754BD0
          +000030  R10...... 0000000025754A30            R11...... 0000000000000020            R12...... 0000000100007B18
          +000048  R13...... 00000001082FE680            R14...... 00000000253D6504            R15...... 0000000000000003
          +000060  reserved. 082FE3C400000001            reserved. 082FDDB000000001            HPTRAN... 082FDDF000000001
          +000078  reserved. 082FE13C00000001
        DSA for CELQHROD: 00000001082FE5E0
          +000000  R4....... E3D9C1D5E3D9C1D5            R5....... CCCCCCCCCCCCCCCC            R6....... 00000000251C9480
          +000018  R7....... 0000000000000000            R8....... 0000000000000008            R9....... 000000000119B648
          +000030  R10...... 00000001082FF01F            R11...... 0000000119B00050            R12...... 0000000100007B18
          +000048  R13...... 00000001082FF6E0            R14...... 00000000253D3012            R15...... 00000000007FF050
          +000060  reserved. 0000000100007B18            reserved. 00000001082FF6E0            HPTRAN... 00000001082FE708
          +000078  reserved. 000000000284F9CA
        DSA for CELQHROD: 00000001082FE708
          +000000  EYE...... 64INTRPT  TRTYPE... 00000010  reserved. 40404040  reserved. 4040404040404040
          +000018  reserved. 4040404040404040            reserved. 4040404040404040            reserved. 4040404040404040
          +000030  TRANEP... 00000000251C9480            TR_R0.... 4040404040404040            TR_R1.... 4040404040404040
          +000048  TR_R2.... 4040404040404040            TR_R3.... 4040404040404040            TR_R4.... 00000001082FE020
          +000060  TR_R5.... 4040404040404040            TR_R6.... 4040404040404040            TR_R7.... 0000000000000003
          +000078  TR_R8.... 00000001082FEBD0            TR_R9.... 00000001082FEBD8            TR_R10... 00000001082FECB0
          +000090  TR_R11... 000000007F754910            TR_R12... 00000001082FEBD0            TR_R13... 00000001082FEBD8
          +0000A8  TR_R14... 00000001082FE7D8            TR_R15... 4040404040404040            reserved. 0000000000000000
          +0000C0  ROND_DSA. 00000001082FDDE0            ROND_R13. 00000000257549A0            ROND_R14. 00000000253D6504
        DSA for CEEOSIGG: 00000001082FE820
          +000000  R4....... 00000001082FEE40            R5....... 00000000253D4114            R6....... 00000000253D11F8
          +000018  R7....... 00000000251C96D0            R8....... 0000000025754190            R9....... 0000000025754198
          +000030  R10...... 0000000025754110            R11...... 0000000000000020            R12...... 0000000100007B18
          +000048  R13...... 00000001082FF6E0            R14...... 00000000251CCBF8            R15...... 0000000000000001
          +000060  reserved. 00000001082FEC28            reserved. 00000001082FEAA4            HPTRAN... 00000001082FEB30
          +000078  reserved. 00000001082FEB38
        DSA for CELQHROD: 00000001082FF640
          +000000  R4....... E3D9C1D5E3D9C1D5            R5....... CCCCCCCCCCCCCCCC            R6....... 00000000251C9480
          +000018  R7....... 0000000000000000            R8....... 000000002575B5AC            R9....... 000000002575B638
          +000030  R10...... 00000000250014B0            R11...... 0000000108FC5E70            R12...... 0000000100005340
          +000048  R13...... 0000000000006F58            R14...... 0000000025250098            R15...... 000000000000001F
          +000060  reserved. 00000001082FF080            reserved. 00000000000000C0            HPTRAN... 00000001082FF768
          +000078  reserved. 000000002575B5DE
        DSA for CELQHROD: 00000001082FF768
          +000000  EYE...... 64INTRPT  TRTYPE... 00000010  reserved. 00000000  reserved. 3C10000000000000
          +000018  reserved. 3410000000000000            reserved. 0000008000000000            reserved. 0000000000000048
          +000030  TRANEP... 00000000251C9480            TR_R0.... 00000001082FF180            TR_R1.... 00000000000000C0
          +000048  TR_R2.... 0000000025573FF0            TR_R3.... 000000002500052E            TR_R4.... 00000001082FF080
          +000060  TR_R5.... 0000000025000658            TR_R6.... 00000000250014B0            TR_R7.... 0000000000000001
          +000078  TR_R8.... 0000000100005340            TR_R9.... 0000000000006F58            TR_R10... 0000000025250098
          +000090  TR_R11... 000000000000001F            TR_R12... 000024D000000001            TR_R13... 1990036000000001
          +0000A8  TR_R14... 199013C800000001            TR_R15... 19901F3800000001            reserved. 0000000100009DF0
          +0000C0  ROND_DSA. 00000001082FEE40            ROND_R13. 0000000025754040            ROND_R14. 00000000251CCBF8
        DSA for div_zero: 00000001082FF880
          +000000  R4....... 00000001082FF180            R5....... 00000001083710A0            R6....... 000000002575B5A0
          +000018  R7....... 0000000025000542            R8....... 00000000250000E4            R9....... 0000000025000658
          +000030  R10...... 00000000250014B0            R11...... 0000000108FC5E70            R12...... 0000000100005340
          +000048  R13...... 0000000000006F58            R14...... 0000000025250098            R15...... 000000000000001F
          +000060  reserved. 00000001082FF918            reserved. 000000007F7547D8            HPTRAN... 0000000000000000
          +000078  reserved. 0000000000000000

        CIB for div_zero(00000001082FBE00)
          +0000 00000001082FBE00  C3C9C240 00000000 00000000 00000000  |CIB ............|
          +0010 00000001082FBE10  00000000 00000000 01900004 00000000  |................|
          +0020 00000001082FBE20  00000000 00000000 000300C6 59C3C5C5  |...........F.CEE|
          +0030 00000001082FBE30  00000000 00000000 00000001 082FBF90  |................|
          +0040 00000001082FBE40  00030C89 59C3C5C5 00000000 00000004  |...i.CEE........|
          +0050 00000001082FBE50  00000004 00000000 00000001 082FF180  |..............1.|
```

Figure 167. Example dump using CEE3DMP (AMODE 64) (Part 3 of 9)

The following is the fourth part of the example dump using CEE3DMP (AMODE 64) .

```
          +0060 00000001082FBE60  00000000 251BB1D0 00000000 00000000  |................|
          +0070 00000001082FBE70  00000001 082FF080 00000000 2575B5F0  |......0........0|
          +0080 00000001082FBE80  00000001 00007000 00000003 00000000  |................|
          +0090 00000001082FBE90  00000001 082FF080 01010000 00000000  |......0.........|
          +00A0 00000001082FBEA0  00000000 00000000 00000000 00000000  |................|
          +00B0 00000001082FBEB0 - +0000FF 00000001082FBEFF             same as above
          +0100 00000001082FBF00  48220400 00000000 940C9000 00000009  |........m.......|
          +0110 00000001082FBF10  00000000 00000000 00000000 250008C0  |................|
          +0120 00000001082FBF20  00000001 082FF080 00000001 082FF080  |......0.......0.|
          +0130 00000001082FBF30  00000000 2575B5EE 00000000 00000000  |................|
          +0140 00000001082FBF40  00000000 00000000 00000067 00000000  |................|
          +0150 00000001082FBF50  00000001 082FF180 00000003 00000008  |......1.........|
          +0160 00000001082FBF60  00000014 00000004 00000000 00000000  |................|
          +0170 00000001082FBF70  00000000 00000000 00000008 00000000  |................|
          +0180 00000001082FBF80  00000001 00007220 00000000 00000000  |................|
        DSA for main: 00000001082FF980
          +000000  R4....... 00000001082FF280            R5....... 0000000108300070            R6....... 00000000250000D8
          +000018  R7....... 000000002500635E            R8....... 0000000000006FF0            R9....... 0000000025002E98
          +000030  R10...... 00000000250014B0            R11...... 0000000108FC5E70            R12...... 0000000100005340
          +000048  R13...... 0000000000006F58            R14...... 0000000025250098            R15...... 000000000000001F
          +000060  reserved. 0000000000000000            reserved. 0000000000000000            HPTRAN... 0000000000000000
          +000078  reserved. 0000000000000000
        DSA for CELQINIT: 00000001082FFA80
          +000000  R4....... 00000001082FF760            R5....... 0000000000000000            R6....... 0000000025005010
          +000018  R7....... 00000000250064F8            R8....... 0000000000000000            R9....... 0000000000000000
          +000030  R10...... 0000000000000000            R11...... 0000000000000000            R12...... 0000000000000000
          +000048  R13...... 0000000000000000            R14...... 0000000000000000            R15...... 0000000000000000
          +000060  reserved. 0000000000000000            reserved. 0000000000000000            HPTRAN... 0000000000000000
          +000078  reserved. 0000000000000000
 [9]   Storage for Active Routines:
         DSA frame(00000001082FAAC0)
          +0800 00000001082FB2C0  00000001 082FD3E0 00000000 251BABA0  |......L.........|
          +0810 00000001082FB2D0  00000000 251B6060 00000000 2504B400  |......--........|
          +0820 00000001082FB2E0  00000001 089135B0 00000000 00000005  |.....j..........|
          +0830 00000001082FB2F0  00000001 082FE3DF 00000001 082FE0C0  |......T.........|
          +0840 00000001082FB300  00000001 089135B0 00000001 082FE680  |.....j........W.|
          +0850 00000001082FB310  00000000 2504B300 00000000 2530A300  |.............t.|
          +0860 00000001082FB320  00000000 00000000 00000000 00000000  |................|
          +0870 00000001082FB330 - +00087F 00000001082FB33F             same as above
 :
          +2540 00000001082FD000  00000000 00000000 00000000 00000000  |................|
          +2550 00000001082FD010 - +00311F 00000001082FDBDF             same as above

        DSA frame(00000001082FD3E0)
          +0800 00000001082FDBE0  00000001 082FDDE0 00000000 2504C3EC  |.............C.|
          +0810 00000001082FDBF0  00000000 2504AAB0 00000000 251C96D0  |.............o.|
          +0820 00000001082FDC00  00000000 25754AD8 00000000 25754BD0  |.......Q........|
          +0830 00000001082FDC10  00000000 25754A30 00000000 00000020  |................|
 :
          +1180 00000001082FE560 - +0011EF 00000001082FE5CF             same as above
          +11F0 00000001082FE5D0  00000000 00000000 00000001 082FEBD8  |..............Q|

        DSA frame(00000001082FDDE0)
          +0800 00000001082FE5E0  E3D9C1D5 E3D9C1D5 CCCCCCCC CCCCCCCC  |TRANTRAN........|

        DSA frame(00000001082FE020)
          +0800 00000001082FE820  00000001 082FEE40 00000000 253D4114  |....... ........|
          +0810 00000001082FE830  00000000 253D11F8 00000000 251C96D0  |.......8......o.|
          +0820 00000001082FE840  00000000 25754190 00000000 25754198  |..............q|
 :
          +1600 00000001082FF620  00000000 00000000 00000000 00000013  |................|
          +1610 00000001082FF630  00000000 252B27D0 00000000 252B2810  |................|

        DSA frame(00000001082FEE40)
          +0800 00000001082FF640  E3D9C1D5 E3D9C1D5 CCCCCCCC CCCCCCCC  |TRANTRAN........|

        DSA frame(00000001082FF080)
          +0800 00000001082FF880  00000001 082FF180 00000001 083710A0  |......1.........|
          +0810 00000001082FF890  00000000 2575B5A0 00000000 25000542  |................|
          +0820 00000001082FF8A0  00000000 250000E4 00000000 25000658  |.......U........|
          +0830 00000001082FF8B0  00000000 250014B0 00000001 08FC5E70  |.............;.|
          +0840 00000001082FF8C0  00000001 00005340 00000000 00006F58  |....... ......?.|
          +0850 00000001082FF8D0  00000000 25250098 00000000 0000001F  |.......q........|
 :
          +08E0 00000001082FF960  34100000 00000000 00000080 00000000  |................|
          +08F0 00000001082FF970  00000000 00000048 00000000 00000000  |................|
```

Figure 168. Example dump using CEE3DMP (AMODE 64) (Part 4 of 9)

The following is the fifth part of the example dump using CEE3DMP (AMODE 64) .

```
        DSA frame(00000001082FF180)
          +0800 00000001082FF980  00000001 082FF280 00000001 08300070  |......2.........|
          +0810 00000001082FF990  00000000 250000D8 00000000 2500635E  |.......Q.......;|
          +0820 00000001082FF9A0  00000000 00006FF0 00000000 25002E98  |......?0.......q|
          +0830 00000001082FF9B0  00000000 250014B0 00000001 08FC5E70  |..............;.|
⋮
          +08E0 00000001082FFA60  00000001 08300070 00000000 00000000  |................|
          +08F0 00000001082FFA70  00000000 00000000 00000000 00000000  |................|

        DSA frame(00000001082FF280)
          +0800 00000001082FFA80  00000001 082FF760 00000000 00000000  |......7-........|
          +0810 00000001082FFA90  00000000 25005010 00000000 250064F8  |......&........8|
          +0820 00000001082FFAA0  00000000 00000000 00000000 00000000  |................|
          +0830 00000001082FFAB0 - +00087F 00000001082FFAFF             same as above
⋮
          +0C00 00000001082FFE80  00000000 00000000 00000000 00000000  |................|
          +0C10 00000001082FFE90 - +000CDF 00000001082FFF5F             same as above

[4]   Information for thread 253E10A000000001


[5]   Traceback:
        DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
        1     CEEOPML2    +00000000              CELQLIB              CEEOPML2                       D1908    Call
        2     thread_func +0000005A  24          CELQSAMP             CELQSAMP                       1.2.d    Call
        3     CELQPCMM    +00000DEA              CELQLIB              CELQPCMM                       D1908    Call

        DSA  DSA Addr          E  Addr            PU Addr           PU Offset  Comp Date Compile Attributes
        1    00000001111FEF60  0000000025290D80  0000000025290D80  00000000   20061215  CEL     POSIX  XPLINK  EBCDIC  HFP
        2    00000001111FF2C0  00000000250005A8  0000000000000000  ********   20070117  C/C++   POSIX  XPLINK  EBCDIC  IEEE
        3    00000001111FF3C0  000000002526E6D0  000000002526E6D0  00000DEA   20061214  CEL     POSIX  XPLINK  EBCDIC  HFP

        Fully Qualified Names
        DSA   Entry       Program Unit                                        Load Module
        2     thread_func PLPSC://'POSIX.CRTL.C(CELQSAMP)'                    CELQSAMP

      GPR0..... 0000000000000001  GPR1..... 00000000257669A0  GPR2..... 0000000108910290  GPR3..... 00000000257669A0
      GPR4..... 00000001111FEF60  GPR5..... 0000000025292620  GPR6..... 0000000000000000  GPR7..... 0000000025292004
      GPR8..... 00000000DA899660  GPR9..... 00000001114013C8  GPR10.... 0000000100003CA0  GPR11.... 0000000108358750
      GPR12.... 00000001114013C8  GPR13.... 000000002576F000  GPR14.... 00000001114013C8  GPR15.... 00000001807D17D8
        GPREG STORAGE:
          Storage around GPR0 (0000000000000001)
            -0001 0000000000000000  Inaccessible storage.
            +000F 0000000000000010  Inaccessible storage.
⋮
[8]   Control Blocks for Active Routines:
        DSA for CEEOPML2: 00000001111FF760
          +000000  R4....... 00000001111FFB60           R5....... 000000002576F000           R6....... 0000000025290D80
          +000018  R7....... 0000000025000604           R8....... 00000000250005B4           R9....... 0000000025000658
          +000030  R10...... 00000001083001B8           R11...... 00000001111FFEE8           R12...... 000000007F64A75C
          +000048  R13...... 000000002576F000           R14...... 0000000111401F38           R15...... 0000000120000000
          +000060  reserved. 0000000000000000           reserved. 0000000000000000           HPTRAN... 0000000000000000
          +000078  reserved. 0000000000000000
        DSA for thread_func: 00000001111FFAC0
          +000000  R4....... 00000001111FF3C0           R5....... 0000000108300070           R6....... 00000000250005A8
          +000018  R7....... 000000002526F4BC           R8....... 0000000111401FA0           R9....... 000000002576F0D0
          +000030  R10...... 0000000000000080           R11...... 0000000000000000           R12...... 0000000000000000
          +000048  R13...... 0001004000000001           R14...... 00000000251D9FD4           R15...... 000000002505CF48
          +000060  reserved. 0000000108FE8C30           reserved. 0000000000000000           HPTRAN... 000000007F6C58C8
          +000078  reserved. 0000000000000000
        DSA for CELQPCMM: 00000001111FFBC0
          +000000  R4....... 00000001111FF760           R5....... 0000000000000000           R6....... 000000002526E6D0
          +000018  R7....... 000000002526FC8C           R8....... 0000000111401FA0           R9....... 000000002576F0D0
          +000030  R10...... 0000000000000080           R11...... 00000001111FFEE8           R12...... 000000007F64A75C
          +000048  R13...... 000000002576F000           R14...... 0000000111401F38           R15...... 0000000120000000
          +000060  reserved. 0000000000000000           reserved. 0000000000000000           HPTRAN... 0000000000000000
          +000078  reserved. 0000000000000000

  [9]   Storage for Active Routines:
         DSA frame(00000001111FEF60)
          +0800 00000001111FF760  00000001 111FFB60 00000000 2576F000  |.......-......0.|
          +0810 00000001111FF770  00000000 25290D80 00000000 25000604  |................|
          +0820 00000001111FF780  00000000 250005B4 00000000 25000658  |................|
          +0830 00000001111FF790  00000001 083001B8 00000001 111FFEE8  |...............Y|
⋮
```

Figure 169. Example dump using CEE3DMP (AMODE 64) (Part 5 of 9)

The following is the sixth part of the example dump using CEE3DMP (AMODE 64) .

```
[10]  Control Blocks Associated with the Thread:
        CAA(00000001114013C8)
          +0000 00000001114013C8  00000000 00000000 00000000 00000000  |................|
          +0010 00000001114013D8 - +0002AF 0000000111401677             same as above
          +02B0 0000000111401678  00008000 00000000 00000000 00000000  |................|
:
 [11]  Enclave Control Blocks:
        EDB(0000000100005340)
          +0000 0000000100005340  C3C5C5C5 C4C24040 00000000 00000000  |CEEEDB  ........|
          +0010 0000000100005350  00000000 00000000 00000000 00000000  |................|
          +0020 0000000100005360 - +0000FF 000000010000543F             same as above
          +0100 0000000100005440  97000100 00000000 00000001 000068F8  |p.............8|
:
          +01A0 00000001000054E0  00000000 00000000 00000000 00000000  |................|
          +01B0 00000001000054F0 - +0001FF 000000010000553F             same as above
        MEML(00000001000068F8)
          +0000 00000001000068F8  00000000 00000000 00000000 00000000  |................|
          +0010 0000000100006908  FFFFFFFF FFFFFFFF 00000000 00000000  |................|
          +0020 0000000100006918  00000000 00000000 00000000 00000000  |................|
          +0030 0000000100006928  FFFFFFFF FFFFFFFF 00000000 00000000  |................|
          +0040 0000000100006938  00000000 00000000 00000000 00000000  |................|
:
          +0190 0000000100006A88  FFFFFFFF FFFFFFFF 00000000 00000000  |................|
          +01A0 0000000100006A98  00000000 00000000 00000000 00000000  |................|
        Mutex and Condition Variable Blocks (MCVB+MHT+CHT)(00000001089100B8)
          +0000 00000001089100B8  00000000 00011E78 00000001 08910100  |............j..|
          +0010 00000001089100C8  000007F0 00007F00 00000000 00000000  |...0..".........|
          +0020 00000001089100D8  00000001 08FC7470 00000001 08910900  |............j..|
          +0030 00000001089100E8  000001F0 00001F00 00000000 00000000  |...0............|
          +0040 00000001089100F8  00000001 08FC74B0 00000000 00000000  |................|
          +0050 0000000108910108  00000000 00000000 00000000 00000000  |................|
          +0060 0000000108910118 - +00014F 0000000108910207             same as above
:
          +04B0 0000000108910568 - +00097F 0000000108910A37             same as above
          +0980 0000000108910A38  00000001 08FC74F0 00000000 00000000  |.......0........|
          +0990 0000000108910A48  00000000 00000000 00000000 00000000  |................|
          +09A0 0000000108910A58 - +000A2F 0000000108910AE7             same as above
          +0A30 0000000108910AE8  00000001 08FC73F0 00000000 00000000  |.......0........|
          +0A40 0000000108910AF8  00000001 08FC7430 00000000 00000000  |................|
        Thread Synchronization Enclave Latch Table (EPALT)(0000000108910B00)
          +0000 0000000108910B00  00000000 00000000 00000000 00000000  |................|
          +0010 0000000108910B10 - +00015F 0000000108910C5F             same as above
          +0160 0000000108910C60  00000000 00000000 DA8ADF60 00000000  |...........-....|
          +0170 0000000108910C70  00000000 257520A0 00000001 08911118  |............j..|
          +0180 0000000108910C80  00000000 00000000 00000000 00000000  |................|
          +0190 0000000108910C90 - +00022F 0000000108910D2F             same as above
:
          +0B00 0000000108911600 - +000C6F 000000010891176F             same as above
          +0C70 0000000108911770  00000000 2538B4E0 00000000 00000000  |................|
          +0C80 0000000108911780  00000000 00000000 00000000 00000000  |................|
          +0C90 0000000108911790 - +0013FF 0000000108911EFF             same as above

        DLL Information:
        WSA Addr          Module Addr          Thread ID         Use Count  Name
        0000000108300050                                         00000001   main
        0000000108371090  000000002575B000     253E019000000000  00000001   CELQDLL
        0000000108390510  0000000025777000     253E019000000000  00000002   CDAEQED
        0000000108396110  00000000257F5000     253E019000000000  00000001   CDAEQDPI
        00000001083A0430  00000000258C4000     253E019000000000  00000001   CELQDSNF

        HEAPCHK Option Control Block (HCOP)(00000001089234D0)
          +0000 00000001089234D0  C8C3D6D7 00000048 00000001 00000000  |HCOP............|
          +0010 00000001089234E0  00000000 0000000A 0000000A 00000000  |................|
          +0020 00000001089234F0  00000001 08FC0090 00000001 08923518  |.............k..|
          +0030 0000000108923500  00000001 08A00050 00000000 00000000  |.......&........|
          +0040 0000000108923510  00000000 00000000 C8C3C6E3 00004000  |........HCFT.. .|

              HEAPCHK Element Table (HCEL) for Heapid 0000000100100138 :
        Header(0000000108FC0090)
          +0000 0000000108FC0090  C8C3C5D3 00000000 00000000 00000000  |HCEL............|
          +0010 0000000108FC00A0  00000000 00000000 00000001 00100138  |................|
          +0020 0000000108FC00B0  000001F4 0000000F 00000010 00000000  |...4............|
                                  Address           Seg Address        Length
```

Figure 170. Example dump using CEE3DMP (AMODE 64) (Part 6 of 9)

The following is the seventh part of the example dump using CEE3DMP (AMODE 64) .

```
        Table(0000000108FC00C0)
         +0000 0000000108FC00C0  00000001 08300040 00000001 08300000  00000000 00000180 00000001 08FC3F50
         +0020 0000000108FC00E0  00000001 083001C0 00000001 08300000  00000000 00019660 00000001 08FC5B30
         +0040 0000000108FC0100  00000001 08319820 00000001 08300000  00000000 00025B40 00000001 08FC5C90
         +0060 0000000108FC0120  00000001 0833F360 00000001 08300000  00000000 00019340 00000001 08FC5EB0
         +0080 0000000108FC0140  00000001 083586A0 00000001 08300000  00000000 000189E0 00000001 08FC6010
         +00A0 0000000108FC0160  00000001 08371080 00000001 08300000  00000000 00000060 00000001 08FC7050
         +00C0 0000000108FC0180  00000001 083710E0 00000001 08300000  00000000 0001F420 00000001 08FC7530
         +00E0 0000000108FC01A0  00000001 08390500 00000001 08300000  00000000 00005C00 00000001 08FEC4F0
         +0100 0000000108FC01C0  00000001 08396100 00000001 08300000  00000000 0000A320 00000001 08FEE1D0
         +0120 0000000108FC01E0  00000001 083A0420 00000001 08300000  00000000 00000180 00000001 08FEE4F0
         +0140 0000000108FC0200  00000001 083A05A0 00000001 08300000  00000000 00017400 00000001 08FEE6F0
         +0160 0000000108FC0220  00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000
         +0180 0000000108FC0240  00000001 083B79A0 00000001 08300000  00000000 00017720 00000001 08FEEA50
         +01A0 0000000108FC0260  00000001 19D00040 00000001 19D00000  00000000 00032360 00000001 08FEEC10
         +01C0 0000000108FC0280  00000001 19D323A0 00000001 19D00000  00000000 000280C0 00000001 08FEEDB0
         +01E0 0000000108FC02A0  00000001 19D5A460 00000001 19D00000  00000000 000321A0 00000001 08FEEF70

   Language Environment Trace Table:

         Most recent trace entry is at displacement: 000680

             Displacement                        Trace Entry in Hexadecimal                                      Trace Entry in EBCDIC
             ------------ ------------------------------------------------------------------------    --------------------------------
               +000000    Time 21.19.55.717535    Date 2007.01.17    Thread ID... 253E019000000000
               +000010    Member ID.... 01    Flags..... 000000    Entry Type..... 00001000
               +000018    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
               +000038    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
               +000058    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
               +000078    40404040 40404040                                                         |                                |

               +000080    Time 21.19.55.717715    Date 2007.01.17    Thread ID... 253E019000000000
               +000090    Member ID.... 01    Flags..... 000000    Entry Type..... 00001010
               +000098    C3C5C5D7 C2D24040 00000070 00000000  00000000 257669A0 00001660 00000000  |CEEPBK  ...................-....|
               +0000B8    00000001 11400000 00000000 000024D0  00000001 11400360 00000001 114013C8  |..... ............... .-..... .H|
               +0000D8    00000001 11401F38 00000001 11402010  00000001 08300060 00000000 25000658  |..... ....... .........-........|
               +0000F8    24000000 00000000                                                         |........                        |

               +000100    Time 21.19.55.717821    Date 2007.01.17    Thread ID... 253E019000000000
               +000110    Member ID.... 01    Flags..... 000000    Entry Type..... 00001011
               +000118    253E10A0 00000001 00000000 7F7547D8  00000000 257669A0 00001660 00000000  |............"..Q...........-....|
               +000138    00000001 11400000 00000000 000024D0  00000001 11400360 00000001 114013C8  |..... ............... .-..... .H|
               +000158    00000001 11401F38 00000001 11402010  00000001 08300060 00000000 25000658  |..... ....... .........-........|
               +000178    24000000 00000000                                                         |........                        |

               +000180    Time 21.19.55.717823    Date 2007.01.17    Thread ID... 253E019000000000
               +000190    Member ID.... 01    Flags..... 000000    Entry Type..... 000010F0
               +000198    00000000 00000000 00000000 00000000  00000000 257669A0 00001660 00000000  |...........................-....|
               +0001B8    00000001 11400000 00000000 000024D0  00000001 11400360 00000001 114013C8  |..... ............... .-..... .H|
               +0001D8    00000001 11401F38 00000001 11402010  00000001 08300060 00000000 25000658  |..... ....... .........-........|
               +0001F8    24000000 00000000                                                         |........                        |

               +000200    Time 21.19.55.717845    Date 2007.01.17    Thread ID... 253E019000000000
               +000210    Member ID.... 01    Flags..... 000000    Entry Type..... 00001000
               +000218    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
               +000238    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
               +000258    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
               +000278    40404040 40404040                                                         |                                |


               +000280    Time 21.19.55.717974    Date 2007.01.17    Thread ID... 253E019000000000
               +000290    Member ID.... 01    Flags..... 000000    Entry Type..... 00001010
               +000298    C3C5C5D7 C2D24040 00000070 00000000  00000000 257689A0 00001660 00000000  |CEEPBK  ..............i....-....|
               +0002B8    00000001 19900000 00000000 000024D0  00000001 19900360 00000001 199013C8  |.......................-.......H|
               +0002D8    00000001 19901F38 00000001 19902010  00000001 08300060 00000000 25000664  |.......................-........|
               +0002F8    24000000 00000000                                                         |........                        |
               +000300    Time 21.19.55.718015    Date 2007.01.17    Thread ID... 253E019000000000
               +000310    Member ID.... 01    Flags..... 000000    Entry Type..... 00001011
               +000318    253E1FB0 00000002 00000000 7F7547D8  00000000 257689A0 00001660 00000000  |............"..Q......i....-....|
               +000338    00000001 19900000 00000000 000024D0  00000001 19900360 00000001 199013C8  |.......................-.......H|
               +000358    00000001 19901F38 00000001 19902010  00000001 08300060 00000000 25000664  |.......................-........|
               +000378    24000000 00000000                                                         |........                        |
```

Figure 171. Example dump using CEE3DMP (AMODE 64) (Part 7 of 9)

The following is the eigth part of the example dump using CEE3DMP (AMODE 64) .

```
            +000380    Time 21.19.55.718016    Date 2007.01.17    Thread ID... 253E019000000000
            +000390    Member ID.... 01    Flags..... 000000    Entry Type..... 000010F0
            +000398    00000000 00000000 00000000 00000000  00000000 257689A0 00001660 00000000  |.....................i....-....|
            +0003B8    00000001 19900000 00000000 000024D0  00000001 19900360 00000001 199013C8  |......................-.......H|
            +0003D8    00000001 19901F38 00000001 19902010  00000001 08300060 00000000 25000664  |......................-........|
            +0003F8    24000000 00000000                                                          |........                        |

            +000400    Time 21.19.55.719149    Date 2007.01.17    Thread ID... 253E1FB000000002
            +000410    Member ID.... 01    Flags..... 000000    Entry Type..... 00001910
            +000418    253E1FB0 00000002 00000001 19901FA0  00000001 19901F38 80000000 00000000  |................................|
            +000438    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
            +000458    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
            +000478    00000000 00000000                                                          |........                        |

            +000480    Time 21.19.55.719199    Date 2007.01.17    Thread ID... 253E1FB000000002
            +000490    Member ID.... 01    Flags..... 000000    Entry Type..... 00001930
            +000498    253E1FB0 00000002 00000001 19901FA0  00000001 19901F38 80000000 00000000  |................................|
            +0004B8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
            +0004D8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
            +0004F8    00000000 00000000                                                          |........                        |

            +000500    Time 21.19.55.719713    Date 2007.01.17    Thread ID... 253E10A000000001
            +000510    Member ID.... 01    Flags..... 000000    Entry Type..... 00001910
            +000518    253E10A0 00000001 00000001 11401FA0  00000001 11401F38 80000000 00000000  |............. ....... ..........|
            +000538    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
            +000558    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
            +000578    00000000 00000000                                                          |........                        |

            +000580    Time 21.19.55.719742    Date 2007.01.17    Thread ID... 253E10A000000001
            +000590    Member ID.... 01    Flags..... 000000    Entry Type..... 00001930
            +000598    253E10A0 00000001 00000001 11401FA0  00000001 11401F38 80000000 00000000  |............. ....... ..........|
            +0005B8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
            +0005D8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
            +0005F8    00000000 00000000                                                          |........                        |

            +000600    Time 21.19.55.719935    Date 2007.01.17    Thread ID... 253E019000000000
            +000610    Member ID.... 01    Flags..... 000000    Entry Type..... 00000700
            +000618    00000000 00000000 00000000 00000000  00000000 00000000 00000001 00005340  |............................... |
            +000638    00000008 00400579 00000000 00000001  00000001 082FE020 00000000 253D3012  |..... ..........................|
            +000658    001F2000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
            +000678    00000000 00000000                                                          |........                        |

            +000680    Time 21.19.55.719939    Date 2007.01.17    Thread ID... 253E019000000000
            +000690    Member ID.... 01    Flags..... 000000    Entry Type..... 00000701
            +000698    00000001 80000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
            +0006B8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
            +0006D8    00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000  |................................|
            +0006F8    00000000 00000000                                                          |........                        |

      Heap Storage Diagnostics
        All storage has been freed.
:

[12]  Runtime Options Report:

       LAST WHERE SET                 OPTION
       -------------------------------------------------------------------------------
       DD:CEEOPTS                       CEEDUMP(0,SYSOUT=*,FREE=END,SPIN=UNALLOC)
       IBM-supplied default             DYNDUMP(*USERID,NODYNAMIC,TDUMP)
       IBM-supplied default             ENVAR("")
       IBM-supplied default             FILETAG(NOAUTOCVT,NOAUTOTAG)
       DD:CEEOPTS                       HEAPCHK(ON,1,0,10,10)
       DD:CEEOPTS                       HEAPPOOLS(ON,8,10,32,10,128,10,256,10,1024,10,2048,10,0,10,0,10,0,10,0,10,0,10,0,10)
       DD:CEEOPTS                       HEAPPOOLS64(ON,8,4000,32,2000,128,700,256,350,1024,100,2048,50,3072,50,4096,50,8192,25,
                                          16384,10,32768,5,65536,5)
       IBM-supplied default             HEAPZONES(0,ABEND,0,ABEND)
```

Figure 172. Example dump using CEE3DMP (AMODE 64) (Part 8 of 9)

The following is the ninth part of the example dump using CEE3DMP (AMODE 64) .

```
       IBM-supplied default             HEAP64(1M,1M,KEEP,32768,32768,KEEP,4096,4096,FREE)
       IBM-supplied default             INFOMSGFILTER(OFF,,,,)
       IBM-supplied default             IOHEAP64(1M,1M,FREE,12288,8192,FREE,4096,4096,FREE)
       IBM-supplied default             LIBHEAP64(1M,1M,FREE,16384,8192,FREE,8192,4096,FREE)
       IBM-supplied default             NATLANG(ENU)
       IBM-supplied default             PAGEFRAMESIZE64(4K,4K,4K,4K,4K,4K,4K)
       Programmer default               POSIX(ON)
       IBM-supplied default             PROFILE(OFF,"")
       DD:CEEOPTS                       RPTOPTS(ON)
       DD:CEEOPTS                       RPTSTG(ON)
       IBM-supplied default             STACK64(1M,1M,128M)
       IBM-supplied default             STORAGE(NONE,NONE,NONE,)
       Programmer default               TERMTHDACT(UADUMP,,96)
       IBM-supplied default           NOTEST(ALL,"*","PROMPT","INSPPREF")
       IBM-supplied default             THREADSTACK64(OFF,1M,1M,128M)
       DD:CEEOPTS                       TRACE(ON,1048576,NODUMP,LE=8)
       IBM-supplied default             TRAP(ON,SPIE)
 [13]  Process Control Blocks:

        PCB(0000000100003CA0)
          +0000 0000000100003CA0  C3C5C5D7 C3C24040 00000000 00000000  |CEEPCB  ........|
          +0010 0000000100003CB0  00000000 00000000 00000000 00000000  |................|
          +0020 0000000100003CC0 - +0000FF 0000000100003D9F             same as above
          +0100 0000000100003DA0  03030208 00000000 00000000 00000000  |................|
          +0110 0000000100003DB0  00000001 00004048 00000000 00000000  |...... .........|
          +0120 0000000100003DC0  00000000 00000000 00000000 00000000  |................|
          +0130 0000000100003DD0  00000000 00000000 00000001 00003A10  |................|
          +0140 0000000100003DE0  7FC00000 00000000 00000000 00000000  |"...............|
          +0150 0000000100003DF0  00000000 00000000 00000000 00000000  |................|
          +0160 0000000100003E00  00000000 252A3F48 00000000 00000000  |................|
          +0170 0000000100003E10  00000000 00000000 00000000 00000000  |................|
          +0180 0000000100003E20 - +0001BF 0000000100003E5F             same as above
        MEML(0000000100004048)
          +0000 0000000100004048  00000000 00000000 00000000 00000000  |................|
          +0010 0000000100004058 - +00005F 00000001000040A7             same as above
          +0060 00000001000040A8  00000001 00008688 00000000 00000000  |......fh........|
          +0070 00000001000040B8  00000000 00000000 00000000 00000000  |................|
          +0080 00000001000040C8 - +0001AF 00000001000041F7             same as above
        Thread Synchronization Process Latch Table (PPALT)(0000000108911F00)
          +0000 0000000108911F00  DA8ADF60 00000000 00000000 257520A0  |...-............|
          +0010 0000000108911F10  00000001 08911050 00000000 00000000  |.....j.&........|
          +0020 0000000108911F20  00000000 00000000 00000000 00000000  |................|
          +0030 0000000108911F30 - +00009F 0000000108911F9F             same as above
          +00A0 0000000108911FA0  DA8ADF60 00000000 00000000 257520A0  |...-............|
          +00B0 0000000108911FB0  00000001 08911500 00000000 00000000  |.....j..........|
          +00C0 0000000108911FC0  00000000 00000000 00000000 00000000  |................|
          +00D0 0000000108911FD0 - +0013FF 00000001089132FF             same as above
[14]CEE3846I CEEDUMP Processing completed.
```

Figure 173. Example dump using CEE3DMP (AMODE 64) (Part 9 of 9)

Sections of the Language Environment dump

The sections of the dump listed in Table 53 on page 352 appear independently of the Language Environment-conforming languages used.

Table 53. Contents of the Language Environment dump - AMODE 64

Section number and heading	Contents
[1] Page Heading	The page heading section appears on the top of each page of the dump and contains: • CEE3DMP identifier • Title For dumps generated as a result of an unhandled condition, the title is "Condition processing resulted in the Unhandled condition." • Product abbreviation of Language Environment • Version number • Release number • Date • Time • Page number
[2] CEE3845I CEEDUMP Processing started.	Identifies the start of the Language Environment dump processing. Similarly, message CEE3846I identifies the end of the dump processing, Message number CEE3845I can be used to locate the start of the next CEEDUMP report when scanning forward in a data set that contains several CEEDUMP reports.
[3] Enclave Identifier	Names the enclave for which information in the dump is provided.
[4] - [10] Thread Information:	These sections show information that is specific to a thread. When multiple threads are dumped, these sections will appear for each thread.

Table 53. Contents of the Language Environment dump - AMODE 64 (continued)

Section number and heading	Contents
[4] Information for thread	Shows the system identifier for the thread. Each thread has a unique identifier.
[5] Traceback	For all active routines in a particular thread, the traceback section shows routine information in three parts. The first part contains: • DSA number: A number that is assigned to the information for this active routine by dump processing. The number is used to associate information from the first part of the traceback with information in the second and third parts of the traceback. • Entry: For C/C++ routines, this is the function name. If a function name or entry point was not specified for a particular routine, then the string `'** NoName **'` will appear. • Entry point offset • Statement number: Refers to the line number in the source code (program unit) in which a call was made or an exception took place. The statement number appears only if your routine was compiled with the options required to generate statement numbers. These options are described under "XL C and XL C++ compiler options for AMODE 64 applications" on page 323. • Load module: The load module name displayed can be a partitioned data set member or an UNIX executable file. The load module name is also displayed in the third part of the traceback (see below for details). • Program unit: The primary entry point of the external procedure. For C routines, this is the compile unit name. For Language Environment-conforming assemblers, this is the ENTNAME = value on the CELQPRLG macro. If your routine was compiled with the compile options to generate statement numbers then the program unit name displayed under this column will appear as follows: – If your compiled routine is in a partitioned data set then only the member will be output. – If your compiled routine is in a sequential data set then only the last qualifier will be shown. – If your compiled routine is in an UNIX filename then only what fits of the filename will be displayed in a line. Look for the complete name of the program unit in the Fully Qualified Names section of the traceback, if your routine was compiled using compile options to generate statement numbers. • Service level: The latest service level applied to the compile unit (for example, for IBM products, it would be the PTF number). – If the service level string is equal or less than 7 bytes, all of the string will be output. – If the service level string is longer than 7 bytes, the Service column will only show the first 7 bytes of the service string, and the full service string will be shown in section of Full Service Level with max length of 64 bytes. • Status: Routine status can be call or exception.

Table 53. Contents of the Language Environment dump - AMODE 64 (continued)

Section number and heading	Contents
[5] Traceback (continued)	The second part contains: • DSA number: A number assigned to the information for this active routine by dump processing. The number is used to associate information from the first part of the traceback with information in the second and third parts of the traceback. • Stack frame (DSA) address • Entry point address • Program unit address • Program unit offset: The offset of the last instruction to run in the routine. If the offset is a negative number, zero, or a very large positive number, the routine associated with the offset probably did not allocate a save area or the routine could have been called using SVC-assisted linkage. Adding the program unit address to the offset gives you the location of the current instruction in the routine. This offset is from the starting address of the routine. • Compile Date • Attributes: The attributes of the compile unit including whether character data is being treated as EBCDIC or ASCII and whether floating point data is being treated as IEEE or hexadecimal. The third part, which is also referred to as 'Fully Qualified Names' section, contains the following: • DSA number • Entry • Program unit: Similar to the Program Unit column in part 1 except that the server name and the complete program unit (PU) name will be displayed. A PU name will appear here only if it was compiled using compile options to produce statement numbers. • Load Module: The complete pathname of a load module name residing in an UNIX filename will be displayed here if available. The load module's full pathname will be displayed if the PATH environment variable is set such that the pathname of the load module's directory appears before the current directory (.). For load modules found in data sets, the same output shown in the traceback part 1 will also be displayed here. The fourth part of the traceback, which is also referred to as the "Full Service Level" section, contains the following: • DSA number • Entry • Service: The full service level string with max length of 64 bytes will be displayed here. The fifth part of the traceback, which is also referred to as the "AMODE 31 and AMODE 64 DSA Anchor" section, contains the following: • DSA number • Entry • Entry point address • Anchor

Table 53. Contents of the Language Environment dump - AMODE 64 (continued)

Section number and heading	Contents
[6] Condition Information for Active Routines	Displays the following information for all conditions currently active on the call chain: • Statement showing failing routine and stack frame address of routine • Condition information block (CIB) address • The current condition, in the form of a Language Environment message for the condition raised or a Language Environment abend code, if the condition was caused by an abend • Location: For the failing routine, this is the program unit, entry routine, statement number, and offset. • Machine state, which shows: – Instruction length counter (ILC) – Interruption code – Program status word (PSW) – Contents of GPRs 0–15. Contents of floating point content register (FPC) and floating point registers FPR 0-15. – Storage dump near condition (2 hex-bytes of storage near the PSW) – Storage pointed to by General Purpose Registers These values are the current values at the time the condition was raised.
[7] Parameters, Registers, and Variables for Active Routines	For each active routine, this section shows: • Routine name and stack frame address • Saved registers: This lists the contents of GPRs 0–15 at the time the routine received control. The saved registers are those saved by the DSA-owning routine on entry. Register 7 is the return address back to the caller of the DSA-owning routine. Register 6 may be the entry point of the DSA-owning routine. (This is not true when the Branch Relative and Save instruction is used to implement the call. The non-volatile floating-point registers that are saved in the stack frame. The registers are only displayed if the program owning the stack frame saved them. Dashes are displayed in the registers when the register values are not saved. • Storage pointed to by the saved registers: Treating the saved contents of each register as an address, 32 bytes before and 64 bytes after the address shown.
[8] Control Blocks for Active Routines	For each active routine controlled by the STACKFRAME option, this section lists contents of related control blocks. The Language Environment-conforming language determines which language-specific control blocks appear. The possible control blocks are: • Stack frame • Condition information block • Language-specific control blocks
[9] Storage for Active Routines	Displays local storage for each active routine. The storage is dumped in hexadecimal, with EBCDIC translations on the right side of the page. There can be other information, depending on the language used. For C/C++ routines, this is the stack frame storage.
[10] Control Blocks Associated with the Thread	Lists the contents of the Language Environment common anchor area (CAA), thread synchronization queue element (SQEL) and dummy stack frame. Other language-specific control blocks can appear in this section.

Section number and heading	Contents
[11] Enclave Control Blocks	Lists the contents of the Language Environment enclave data block (EDB) and enclave member list (MEML). The information presented may vary depending on which runtime options are set. • If the POSIX runtime option is set to ON, this section lists the contents of the mutex and condition variable control blocks, the enclave level latch table, and the thread synchronization trace block and trace table. • If DLLs have been loaded, this section shows information for each DLL including the DLL name, load address, use count, writeable static area (WSA) address, and the thread ID of the thread that loaded the DLL. • If the HEAPCHK runtime option is set to ON, this section shows the contents of the HEAPCHK options control block (HCOP) and the HEAPCHK element tables (HCEL). A HEAPCHK element table contains the location and length of all allocated storage elements for a heap in the order that they were allocated. • When the *call-level* suboption of the HEAPHCK runtime option is set, any unfreed storage, which would indicate a storage leak, would be displayed in this area. The traceback could then be used to identify the program which did not free the storage. • If the TRACE runtime option is set to ON, this section shows the contents of the Language Environment trace table. Other language-specific control blocks can appear in this section.
[12] Runtime Options Report	Lists the Language Environment runtime options in effect when the routine was executed.
[13] Process Control Blocks	Lists the contents for the Language Environment process control block (PCB), process member list (MEML), and if the POSIX runtime option is set to ON, the process level latch table. Other language-specific control blocks can appear in this section.
[14] CEE3846I CEEDUMP Processing completed.	Identifies the end of the Language Environment dump processing. Similarly, message CEE3845I identifies the start of the dump processing, Message number CEE3846I can be used to locate the end of the previous CEEDUMP report when scanning backward in a data set that contains several CEEDUMP reports.

Generating a system dump

A system dump contains the storage information needed to diagnose errors. You can use Language Environment to generate a system dump through any of the following methods:

DYNDUMP(*hlq*,DYNAMIC,TDUMP)
You can use the DYNDUMP runtime option to obtain IPCS readable dumps of user applications that would ordinarily be lost due to the absence of a SYSMDUMP, SYSUDUMP, or SYSABEND DD statement.

TERMTHDACT(UAONLY, UATRACE, or UADUMP)
You can use these runtime options, with TRAP(ON), to generate a system dump if an unhandled condition of severity 2 or greater occurs. For further details regarding the level of dump information produced by each of the TERMTHDACT suboptions, see “Generating a Language Environment dump with TERMTHDACT” on page 339.

TRAP(ON,NOSPIE) TERMTHDACT(UAIMM)
TRAP(ON,NOSPIE) TERMTHDACT(UAIMM) generates a system dump of the user address space of the original abend or program interrupt prior to the Language Environment condition manager processing the condition.

Abend Codes in Initialization Assembler User Exit
Abend codes listed in the initialization assembler user exit are passed to the operating system. The operating system can then generate a system dump.

__cabend()
You can use the `__cabend()` API to cause the operating system to handle an abend.

See system or subsystem documentation for detailed system dump information.

The method for generating a system dump varies for each of the Language Environment runtime environments. The following sections describe the recommended steps needed to generate a system dump in batch and z/OS UNIX shell runtime environments. Other methods may exist, but these are the recommended steps for generating a system dump. For details on setting Language Environment runtime options, see *z/OS Language Environment Programming Guide*.

Steps for generating a system dump in a batch runtime environment

Perform the following steps to generate a system dump in a batch runtime environment. When you are done, you have a generated system dump in a batch runtime environment.

1. Specify runtime options TERMTHDACT(UAONLY, UADUMP, UATRACE, or UAIMM), and TRAP(ON). If you specify the suboption UAIMM then you must set TRAP(ON,NOSPIE). The TERMTHDACT suboption determines the level of detail of the Language Environment formatted dump. For further details on the TERMTHDACT suboptions, see "Generating a Language Environment dump with TERMTHDACT" on page 339.
2. Decide whether to include a SYSMDUMP DD card or use the DYNDUMP runtime option.
   - Include a SYSMDUMP DD card with the desired data set name and DCB information:
     ```
     LRECL=4160, BLKSIZE=4160, and RECFM=FBS.
     ```
   - Specify the DYNDUMP runtime option with the following information:
     ```
     DYNDUMP (hlq,DYNAMIC,TDUMP)
     ```
3. Rerun the program.

Steps for generating a system dump in a z/OS UNIX shell

Perform the following steps to generate a system dump from a z/OS UNIX shell:

- Using _BPXK_MDUMP.
  1. Specify where to write the system dump.
     - To write the system dump to a z/OS data set, issue the `export _BPXK_MDUMP=`*`filename`* command, where *filename* is a fully qualified data set name with DCB information: LRECL=4160, BLKSIZE=4160, and RECFM=FBS. For example:
       ```
       export _BPXK_MDUMP=hlq.mydump
       ```
     - To write the system dump to a z/OS UNIX file, issue the `export _BPXK_MDUMP=`*`filename`* command, where *filename* is a fully qualified z/OS UNIX file name; For example:
       ```
       export _BPXK_MDUMP=/tmp/mydump.dmp
       ```
  2. Specify Language Environment runtime options, where *suboption* = UAONLY, UADUMP, UATRACE, or UAIMM. If UAIMM is set, TRAP(ON,NOSPIE) must also be set. The TERMTHDACT suboption determines the level of detail of the Language Environment formatted dump. For more details about the TERMTHDACT suboptions, see "Generating a Language Environment dump with TERMTHDACT" on page 339.
     ```
     export _CEE_RUNOPTS="termthdact(suboption)"
     ```
  3. Rerun the program.

  When you are done, the system dump is written to the data set name or z/OS UNIX file name specified. For more information about BPXK_MDUMP, see _BPXK environment variables in *z/OS UNIX System Services Planning*.
- Using DYNDUMP.

1. Specify Language Environment runtime options:

```
export _CEE_RUNOPTS="termthdact(suboption),DYNDUMP(hlq,DYNAMIC,TDUMP)"
```

suboption
is UAONLY, UADUMP, UATRACE, or UAIMM. If UAIMM is set, TRAP(ON,NOSPIE) must also be set. The TERMTHDACT suboption determines the level of detail of the Language Environment formatted dump. For further details regarding the TERMTHDACT suboptions, see "Generating a Language Environment dump with TERMTHDACT" on page 339

hlq
is the high level qualifier for the dump data set to be created.

2. Rerun the program.

When you are done, the system dump is written to the name generated by the DYNDUMP runtime option. For more information about DYNDUMP information, see DYNDUMP in *z/OS Language Environment Programming Reference*.

You can also specify the signal SIGDUMP on the **kill** command to generate a system dump of the user address space. For more information about the **kill** command and signals, see kill - End a process or job, or send it a signal in *z/OS UNIX System Services Command Reference*.

Formatting and analyzing system dumps

You can use the Interactive Problem Control System (IPCS) to format and analyze system dumps. Language Environment provides an IPCS VERBEXIT LEDATA that can be used to format Language Environment control blocks. For more information about using IPCS, see *z/OS MVS IPCS User's Guide*.

Preparing to use the Language Environment support for IPCS

Use the following guidelines before you use IPCS to format Language Environment control blocks:

- Ensure that your IPCS job can find the CEEIPCSP member.

  IPCS provides an exit control table with imbed statements to enable other products to supply exit control information. The IPCS default table, BLSCECT, normally in the SYS1.PARMLIB library, has the following entry for Language Environment:

  ```
  IMBED MEMBER(CEEIPCSP) ENVIRONMENT(IPCS)
  ```

  The Language Environment-supplied CEEIPCSP member, installed in the SYS1.PARMLIB library, contains the Language Environment-specific entries for the IPCS exit control table.
- Provide an IPCSPARM DD statement to specify the libraries containing the IPCS control tables; for example:

  ```
  //IPCSPARM  DD  DSN=SYS1.PARMLIB,DISP=SHR
  ```
- Ensure that your IPCS job can find the Language Environment-supplied ANALYZE exit routines installed in the SYS1.MIGLIB library.
- To aid in debugging system or address space hang situations, Language Environment mutexes, latches and condition variables can be displayed if the CEEIPCSP member you are using is updated to identify the Language Environment ANALYZE exit, by including the following statement:

  ```
  EXIT EP(CEEEANLZ) ANALYZE
  ```

Understanding Language Environment IPCS VERBEXIT – LEDATA

Purpose

Use the LEDATA verb exit to format data for Language Environment. This VERBEXIT provides information about the following topics:

- A summary of Language Environment at the time of the dump
- Runtime Options
- Storage Management Control Blocks
- Condition Management Control Blocks
- Message Handler Control Blocks
- C/C++ Control Blocks
- PL/I Control Blocks

Format

```
VERBEXIT LEDATA [ 'parameter[,parameter]...']

Report Type Parameters:
 [  AUTH  ]
 [  NTHREADS(value)  ]
 [  SUM  ]
 [  HEAP  |  STACK  | SM  ]
 [  HPT(number) [ HPTTCB (address) ] [ HPTCELL(address) ] [ HPTLOC(location) ] ]
 [  CM  ]
 [  MH  ]
 [  CEEDUMP  ]
 [  COMP(value) ]
 [  PTBL(value)  ]
 [  SW3164  ]
 [  ALL  ]

Data Selection Parameters:
 [  DETAIL  |  EXCEPTION  ]

Control Block Selection Parameters:

 [  CAA(caa-address)  ]
 [  DSA(dsa-address)  ]
 [  TCB(tcb-address)  ]
 [  ASID(address-space-id)  ]
 [  NTHREADS(value)  ]
 [  LAA(laa-address)  ]
```

Parameters

The following sections describe the various types of parameters you can specify for VERBEXIT LEDATA. Only hexadecimal characters can be specified as addresses provided in LEDATA parameters. Special characters cause the formatter to fail. Therefore, to specify a 64 bit address as a parameter, it must be in the form like 123456789 instead of 1_23456789.

Report type parameters

Use these parameters to select the type of report. If you omit these parameters, the default is SUMMARY.

Address space report types: Use these parameters to select a report that shows the Language Environment activity for an address space. Only one of these reports can be specified.

NTHREADS(*value*)
: Requests a report that shows the traceback for the TCBs in the address space. *value* is the number of TCBs for which the traceback are displayed. If *value* is specified as asterisk (*), all TCBs are displayed. The LAA, CAA, or TCB parameter can be used to limit the display to only TCBs that are part of the same enclave.

AUTH
Requests a report on all preinitialized environments for authorized programs control blocks for the address space. NTHREADS is ignored when AUTH is specified.

PTBL(*value*)
Requests that PreInit tables be formatted according to the following values.

CURRENT
If current is specified, the PreInit table that is associated with the current or specified TCB is displayed.

address
If an address is specified, the PreInit table at that address is specified.

*****
All active and dormant PreInit tables within the current address space are displayed; this option is time-consuming.

ACTIVE
The PreInit tables for all TCBs in the address space are displayed.

Thread-specific report types: Use these parameters to select reports that show Language Environment activity for a specific TCB. These report types are ignored if AUTH or NTHREADS is specified. You can specify as many of these reports as you want.

SUMmary
Requests a summary of the Language Environment at the time of the dump. The following information is included:

- TCB address.
- Address Space Identifier.
- Language Environment Release.
- Active members.
- Formatted CAA, PCB, RCB, EDB, LAA, and LCA.
- Runtime Options in effect.

HEAP | STACK | SM

HEAP
Requests a report on Storage Management control blocks pertaining to HEAP storage, as well as a detailed report on heap segments. The detailed report includes information about the free storage tree in the heap segment, and information about each allocated storage element. It also specifies a heap pools report with information useful to find potential damaged cells.

Note: Language Environment does not support alternative Vendor Heap Manager (VHM) data.

STACK
Requests a report on Storage Management control blocks pertaining to STACK storage.

SM
Requests a report on Storage Management control blocks. This is the same as specifying both HEAP and STACK.

HPT(*number*) [HPTTCB (*address*)] [HPTCELL(*address*)] [HPTLOC(*location*)]

HPT(*number*)
Requests that the heap pool trace, if available, be formatted. If the value is 0 or *, the trace for every heap pool ID is formatted. If the value is a single number (1-12), the trace for the specific heap pool ID is formatted. If only the HPT keyword is specified with no value, the trace behaves similar to when the value is *. If no filter is specified, all of the entries are formatted for the specific pool ID.

HPTTCB (*address*)
Filters the heap pool trace table, if available, printing only those entries for a given TCB address (*address*).

HPTCELL(*address*)
Filters the heap pool trace table, if available, printing only those entries for a given cell address (*address*).

HPTLOC(*value*)
Filters the heap pool trace table, if available, and prints only those entries for a given virtual storage location (*location*). The following values are valid:

31
Display entries that are located in virtual storage below the bar.

64
Display entries that are located in virtual storage above the bar.

ALL
Display entries that are located in virtual storage below or above the bar.

Note:

1. Filter options without specifying HPT implies HPT(*).
2. You can specify multiple options together, like HPTTCB and HPTCELL. All pieces of information must match the trace entry for it to be formatted. If location and cell contradict each other, such as HPTLOC(31) and HPTCELL(64bit addr), an error will be displayed.

CM
Requests a report on Condition Management control blocks.

MH
Requests a report on Message Handler control blocks.

CEEdump
Requests a CEEDUMP-like report. This includes the traceback, the Language Environment trace, and thread synchronization control blocks at process, enclave, and thread levels.

COMP(*value*)
Requests component control blocks to be formatted according to the following values:

C
Requests a report on C/C++ runtime control blocks.

CIO
Requests a report on C/C++ I/O control blocks.

COBOL
Requests a report on COBOL-specific control blocks.

PLI
Requests a report on PL/I-specific control blocks.

ALL
Requests a report on all the previous control blocks.

If the value specified in COMP is not one of the values (C, CIO, COBOL, PL/I, or ALL), a message is displayed and it continues executing as if COMP(ALL) was specified.

The ALL parameter for LEDATA also generates a report that includes all the component control blocks.

SW3164
Requests a report on AMODE 31 and AMODE 64 interoperability. The following information is included:

- Formatted SW3164 structure.

ALL
Requests all reports, as well as C/C++, COBOL, and PL/I reports.

Data selection parameters

Data selection parameters limit the scope of the data in the report. If no data selection parameter is selected, the default is DETAIL.

DETail
Requests formatting all control blocks for the selected components. Only significant fields in each control block are formatted. For the Heap and Storage Management Reports, the DETAIL parameter will provide a detailed heap segment report for each heap segment in the dump. The detailed heap segment report includes information on the free storage tree in the heap segments, and all allocated storage elements. This report will also identify problems detected in the heap management data structures. For more information about the Heap Reports, see "Understanding the HEAP LEDATA output" on page 376.

EXCeption
Requests validating all control blocks for the selected components. Output is only produced naming the control block and its address for the first control block in a chain that is invalid. Validation consists of control block header verification at the very least. For the Summary, CEEDUMP, C/C++, PL/I reports, the EXCEPTION parameter has not been implemented. For these reports, DETAIL output is always produced.

Control block selection parameters

Use these parameters to select the control blocks used as the starting points for formatting.

CAA(*caa-address*)
specifies the address of the CAA. If not specified, the CAA address is obtained from the LAA.

DSA(*dsa-address*)
specifies the address of the DSA. If not specified, the DSA address may be obtained from the TCB or the IPCS symbol REGGEN.

TCB(*tcb-address*)
specifies the address of the TCB. If not specified, the TCB address may be obtained from the CAA or the CVT.

LAA(*laa-address*)
specifies the address of the LAA. If not specified, the LAA address may be obtained from the TCB or the PSA.

ASID(*address-space-id*)
specifies the hexadecimal address space ID. If not specified, the IPCS default address space ID is used. This parameter is not needed when the dump only has one address space.

Examples

For examples of the output produced by LEDATA and explanation of the content, refer to "Understanding the Language Environment IPCS VERBEXIT LEDATA output" on page 362.

Understanding the Language Environment IPCS VERBEXIT LEDATA output

The Language Environment IPCS VERBEXIT LEDATA generates formatted output of the Language Environment runtime environment control blocks from a system dump. The following sample illustrates the output produced when the LEDATA VERBEXIT is invoked with the ALL parameter. The system dump being formatted was obtained by specifying the TERMTHDACT(UADUMP) runtime option when running the program CELQSAMP in Figure 162 on page 342.

"Sections of the Language Environment LEDATA VERBEXIT formatted output" on page 372 describes the information in the formatted output. Ellipses are used to summarize some sections of the dump. For easy reference, the sections of the following dump are numbered to correspond with the descriptions in "Sections of the Language Environment LEDATA VERBEXIT formatted output" on page 372.

```
     ALL
    ********************************************************************************
                      64 BIT LANGUAGE ENVIRONMENT DATA
    ********************************************************************************

     Language Environment Product 04 V01 R09.00

[1]  Information for enclave main

[2]    Information for thread 253E019000000000
       TCB Address: 007FF050
       CAA Address: 00000001_00007B18
       PCB Address: 00000001_00003CA0

[3]    Registers and PSW:
       GPR0..... 0000000084000000  GPR1..... 0000000084000FC7  GPR2..... 00000001082FBE00  GPR3..... 3C10000000000000
       GPR4..... 00000001082FA900  GPR5..... 00000000253C45F8  GPR6..... 00000000253C4500  GPR7..... 00000000251B9B1A
       GPR8..... 00000001082FBE00  GPR9..... 00000000253C459A  GPR10.... 00000001082FBABF  GPR11.... 00000001082FBE00
       GPR12.... 00000001082FBB08  GPR13.... 00000001082FE680  GPR14.... 0000000100005DC8  GPR15.... 0000000000000000
       PSW..... 07851401 80000000 00000000 253C459A

[4]    Traceback:
         DSA      Entry       E  Offset  Statement   Load Mod            Program Unit                   Service  Status
         1        CEEHSDMP    +0000009A              CELQLIB             CEEHSDMP                       D1908    Call
         2        CEEHDSP     +00003AB8              CELQLIB             CEEHDSP                        D1908    Call
         3        CEEOSIGJ    +0000094E              CELQLIB             CEEOSIGJ                       D1908    Call
         4        CELQHROD    +0000024E              CELQLIB             CELQHROD                       D1908    Call
         5        CEEOSIGG    +00000000              CELQLIB             CEEOSIGG                       D1908    Call
         6        CELQHROD    +0000024E              CELQLIB             CELQHROD                       D1908    Call
         7        div_zero    +00000040              CELQDLL                                            1.4.f.0  Exception
         8        main        +00000468              CELQSAMP                                           1.2.d    Call
         9        CELQINIT    +0000134C              CELQLIB             CELQINIT                       D1908    Call

         DSA      DSA Addr           E Addr             PU Addr            PU Offset   Comp Date  Compile Attributes
         1        00000001_082FA900  00000000_253C4500  00000000_253C4500  +0000009A0  20061215   CEL       POSIX XPLINK EBCDIC  HFP
         2        00000001_082FAAC0  00000000_251B6060  00000000_251B6060  +00003AB80  20061215   CEL       POSIX XPLINK EBCDIC  HFP
         3        00000001_082FD3E0  00000000_2504AAB0  00000000_2504AAB0  +0000094E0  20070109   CEL       POSIX XPLINK EBCDIC  HFP
         4        00000001_082FDDE0  00000000_251C9480  00000000_251C9480  +0000024E0  20061215   CEL       POSIX XPLINK EBCDIC  HFP
         5        00000001_082FE020  00000000_253D11F8  00000000_253D11F8  +000000000  20061215   CEL       POSIX XPLINK EBCDIC  HFP
         6        00000001_082FEE40  00000000_251C9480  00000000_251C9480  +0000024E0  20061215   CEL       POSIX XPLINK EBCDIC  HFP
         7        00000001_082FF080  00000000_2575B5A0  00000000_00000000  +2575B5E00  20070116   C/C++     POSIX XPLINK EBCDIC  IEEE
         8        00000001_082FF180  00000000_250000D8  00000000_00000000  +250005400  20070116   C/C++     POSIX XPLINK EBCDIC  IEEE
         9        00000001_082FF280  00000000_25005010  00000000_25005010  +0000134C0  20061215   CEL       POSIX XPLINK EBCDIC  HFP

         Full Service Level
          DSA    Entry      Service
          6      div_zero    1.4.f.0001

  [5]    Control Blocks Associated with the Thread:
         Thread Synchronization Queue Element (SQEL): 00000000_257520A0
           +000000 00000000_257520A0  00000000 00000000 00000000 00000000 |................|
           +000010 00000000_257520B0  00000000 00000000 00000001 08358750 |..............g&|
           +000020 00000000_257520C0  00000000 00000000 00000000 00000000 |................|
           +000030 00000000_257520D0  00000000 00000000 00000001 00007B18 |..............#.|
           +000040 00000000_257520E0  00000000 00000000 00000000 00000000 |................|
           +000050 00000000_257520F0 - +000000 00000000_2575210F             same as above

  [6]    Enclave Control Blocks:

        Mutex and Condition Variable Blocks (MCVB+MHT+CHT): 00000001_089100B8
           +000000 00000001_089100B8  00000000 00011E78 00000001 08910100 |............j..|
           +000010 00000001_089100C8  000007F0 00007F00 00000000 00000000 |...0..".........|
           +000020 00000001_089100D8  00000001 08FC7490 00000001 08910900 |............j..|
           +000030 00000001_089100E8  000001F0 00001F00 00000000 00000000 |...0............|
           +000040 00000001_089100F8  00000001 08FC74D0 00000000 00000000 |................|
           +000050 00000001_08910108  00000000 00000000 00000000 00000000 |................|
           +000060 00000001_08910118 - +000000 00000001_08910207             same as above
           +000150 00000001_08910208  00000001 08358A20 00000000 00000000 |................|
           +000160 00000001_08910218  00000001 08358900 00000000 00000000 |......i.........|
           +000170 00000001_08910228  00000001 08358990 00000000 00000000 |......i.........|
           +000180 00000001_08910238  00000000 00000000 00000000 00000000 |................|
           +000190 00000001_08910248 - +000000 00000001_08910297             same as above
           +0001E0 00000001_08910298  00000001 08358750 00000000 00000000 |......g&........|
           +0001F0 00000001_089102A8  00000000 00000000 00000000 00000000 |................|
           +000200 00000001_089102B8 - +000000 00000001_08910307             same as above
           +000250 00000001_08910308  00000001 0831AB10 00000000 00000000 |................|
           +000260 00000001_08910318  00000001 0831ABD0 00000000 00000000 |................|
           +000270 00000001_08910328  00000001 0831A990 00000000 00000000 |......z.........|
           +000280 00000001_08910338  00000001 0831AA50 00000000 00000000 |.......&........|
```

Figure 174. Example of formatted output from LEDATA VERBEXIT (AMODE 64) (Part 1 of 10)

The following is part two of the example of formatted output from LEDATA VERBEXIT (AMODE 64).

```
          +000290 00000001_08910348  00000001 0831A810 00000000 00000000 |......y.........|
          +0002A0 00000001_08910358  00000001 0831A8D0 00000000 00000000 |......y.........|
          +0002B0 00000001_08910368  00000001 0831A690 00000000 00000000 |......w.........|
          +0002C0 00000001_08910378  00000001 0831A750 00000000 00000000 |......x&........|
          +0002D0 00000001_08910388  00000001 0831A510 00000000 00000000 |......v.........|
          +0002E0 00000001_08910398  00000001 0831A5D0 00000000 00000000 |......v.........|
          +0002F0 00000001_089103A8  00000000 00000000 00000000 00000000 |................|
          +000300 00000001_089103B8  00000001 0831A450 00000000 00000000 |......u&........|
          +000310 00000001_089103C8  00000000 00000000 00000000 00000000 |................|
          +000320 00000001_089103D8 - +000000 00000001_089104C7             same as above
          +000410 00000001_089104C8  00000001 08358870 00000000 00000000 |......h.........|
          +000420 00000001_089104D8  00000000 00000000 00000000 00000000 |................|
          +000430 00000001_089104E8  00000001 0831AC30 00000000 00000000 |................|
          +000440 00000001_089104F8  00000001 083587E0 00000000 00000000 |......g.........|
          +000450 00000001_08910508  00000000 00000000 00000000 00000000 |................|
          +000460 00000001_08910518 - +000000 00000001_08910A37             same as above
          +000980 00000001_08910A38  00000001 08FC7510 00000000 00000000 |................|
          +000990 00000001_08910A48  00000000 00000000 00000000 00000000 |................|
          +0009A0 00000001_08910A58 - +000000 00000001_08910AC7             same as above
          +000A10 00000001_08910AC8  00000001 08FC7410 00000000 00000000 |................|
          +000A20 00000001_08910AD8  00000001 08FC7450 00000000 00000000 |.......&........|
          +000A30 00000001_08910AE8  00000000 00000000 00000000 00000000 |................|
          +000A40 00000001_08910AF8 - +000000 00000001_08910B07             same as above

        Thread Synchronization Enclave Latch Table (EPALT): 00000001_08910B00
          +000000 00000001_08910B00  00000000 00000000 00000000 00000000 |................|
          +000010 00000001_08910B10 - +000000 00000001_089115DF             same as above
          +000AE0 00000001_089115E0  00000000 2524F9C0 00000000 00000000 |......9.........|
          +000AF0 00000001_089115F0  00000000 00000000 00000000 00000000 |................|
          +000B00 00000001_08911600 - +000000 00000001_0891176F             same as above
          +000C70 00000001_08911770  00000000 2538B4E0 00000000 00000000 |................|
          +000C80 00000001_08911780  00000000 00000000 00000000 00000000 |................|
          +000C90 00000001_08911790 - +000000 00000001_08911EFF             same as above

        HEAPCHK Option Control Block (HCOP): 00000001_089234D0
          +000000 00000001_089234D0  C8C3D6D7 00000048 00000001 00000000 |HCOP............|
          +000010 00000001_089234E0  00000000 0000000A 0000000A 00000000 |................|
          +000020 00000001_089234F0  00000001 08FC0090 00000001 08923518 |.............k..|
          +000030 00000001_08923500  00000001 08A00050 00000000 00000000 |.......&........|
          +000040 00000001_08923510  00000000 00000000 C8C3C6E3 00004000 |........HCFT.. .|
         HEAPCHK Element Table (HCEL) for Heapid 00000001 :

        Header: 00000001_08FC0090
          +000000 00000001_08FC0090  C8C3C5D3 00000000 00000000 00000000 |HCEL............|
          +000010 00000001_08FC00A0  00000000 00000000 00000001 00100138 |................|
          +000020 00000001_08FC00B0  000001F4 0000000C 0000000D 00000000 |...4............|

                   Address           Seg Addr           Length
        Table: 00000001_08FC00C0
          +000000  00000001_08300040 00000001_08300000  00000000 00000180 00000001 08FC3F50 |....... .......................&|
          +000020  00000001_083001C0 00000001_08300000  00000000 00019660 00000001 08FC5B30 |......................o-......$.|
          +000040  00000001_08319820 00000001_08300000  00000000 00025B40 00000001 08FC5C90 |......q..............$ ......*.|
          +000060  00000001_0833F360 00000001_08300000  00000000 00019340 00000001 08FC5EB0 |......3-.............l ......;.|
          +000080  00000001_083586A0 00000001_08300000  00000000 000189E0 00000001 08FC6010 |......f..............i.......-.|
          +0000A0  00000001_08371080 00000001_08300000  00000000 00000060 00000001 08FC7050 |.......................-.......&|
          +0000C0  00000001_083710E0 00000001_08300000  00000000 0001F420 00000001 08FE9790 |......................4.......p.|
          +0000E0  00000001_08390500 00000001_08300000  00000000 00005C00 00000001 08FEC530 |......................*.......E.|
          +000100  00000001_08396100 00000001_08300000  00000000 0000A320 00000001 08FEE210 |....../..............t.......S.|
          +000120  00000001_083A0420 00000001_08300000  00000000 00000180 00000001 08FEE530 |..............................V.|
          +000140  00000001_083A05A0 00000001_08300000  00000000 00017400 00000001 08FEE730 |..............................X.|
          +000160  00000000_00000000 00000000_00000000  00000000 00000000 00000000 00000000 |................................|
          +000180  00000001_083B79A0 00000001_08300000  00000000 00017720 00000001 08FEEA90 |................................|

[7]      Language Environment Trace Table:
           Most recent trace entry is at displacement: 005A80
              Displacement Trace Entry in Hexadecimal                                                 Trace Entry in EBCDIC
              ------------ ----------------------------------------------------------------------   --------------------------------
                +000000    Time 21.22.38.487562    Date 2007.01.16    Thread ID... 253E019000000000
                +000010    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
                +000018    94818995 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |main                            |
                +000038    60606E4D F0F0F6C6 5D409799 8995A386  4D5D4040 40404040 40404040 40404040  |-->(006F) printf()              |
                +000058    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
                +000078    40404040 40404040                                                         |                                |
```

Figure 175. Example of formatted output from LEDATA VERBEXIT (AMODE 64) (Part 2 of 10)

The following is part three of the example of formatted output from LEDATA VERBEXIT (AMODE 64).

```
            +000080    Time 21.22.38.497576    Date 2007.01.16    Thread ID... 253E019000000000
            +000090    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
            +000098    4C60604D F0F0F6C6 5D40D9F1 7EF0F0F0  F0F0F0F0 F1F0F0F0 F0F9C4C6 F040D9F2  |<--(006F) R1=0000000100009DF0 R2|
            +0000B8    7EF0F0F0 F0F0F0F0 F0F2F5F5 F7F4F6C4  F040D9F3 7EF0F0F0 F0F0F0F0 F0F0F0F0  |=00000000255746D0 R3=00000000000|
            +0000D8    F0F0F0F0 C340C5D9 D9D5D67E F0F0F0F0  F0F0F0F0 40C5D9D9 D5D6F27E F0F0F0F0  |0000C ERRNO=00000000 ERRNO2=0000|
            +0000F8    F0F0F0F0 00000000                                                           |0000....                        |

            +000100    Time 21.22.38.497582    Date 2007.01.16    Thread ID... 253E019000000000
            +000110    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
            +000118    94818995 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |main                            |
            +000138    60606E4D F0F1F7F0 5D408493 93939681  844D5D40 40404040 40404040 40404040  |-->(0170) dllload()             |
            +000158    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
            +000178    40404040 40404040                                                           |                                |

            +000180    Time 21.22.38.526042    Date 2007.01.16    Thread ID... 253E019000000000
            +000190    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
            +000198    4C60604D F0F1F7F0 5D40D9F1 7EF0F0F0  F0F0F0F0 F1F0F8F2 C6C6F4F6 F040D9F2  |<--(0170) R1=00000001082FF460 R2|
            +0001B8    7EF0F0F0 F0F0F0F0 F0F2F5F5 F7F4F6C4  F040D9F3 7EF0F0F0 F0F0F0F0 F1F0F8C6  |=00000000255746D0 R3=0000000108F|
            +0001D8    C3F5C5F3 F040C5D9 D9D5D67E F0F0F0F0  F0F0F0F0 40C5D9D9 D5D6F27E F0F0F0F0  |C5E30 ERRNO=00000000 ERRNO2=0000|
            +0001F8    F0F0F0F0 00000000                                                           |0000....                        |

            +000200    Time 21.22.38.526049    Date 2007.01.16    Thread ID... 253E019000000000
            +000210    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
            +000218    94818995 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |main                            |
            +000238    60606E4D F0F0F6C6 5D409799 8995A386  4D5D4040 40404040 40404040 40404040  |-->(006F) printf()              |
            +000258    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
            +000278    40404040 40404040                                                           |                                |

            +000280    Time 21.22.38.526081    Date 2007.01.16    Thread ID... 253E019000000000
            +000290    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
            +000298    4C60604D F0F0F6C6 5D40D9F1 7EF0F0F0  F0F0F0F0 F1F0F0F0 F0F9C4C6 F040D9F2  |<--(006F) R1=0000000100009DF0 R2|
            +0002B8    7EF0F0F0 F0F0F0F0 F0F2F5F5 F7F4F6C4  F040D9F3 7EF0F0F0 F0F0F0F0 F0F0F0F0  |=00000000255746D0 R3=00000000000|
            +0002D8    F0F0F0F0 C440C5D9 D9D5D67E F0F0F0F0  F0F0F0F0 40C5D9D9 D5D6F27E F0F0F0F0  |0000D ERRNO=00000000 ERRNO2=0000|
            +0002F8    F0F0F0F0 00000000                                                           |0000....                        |

            +000300    Time 21.22.38.526083    Date 2007.01.16    Thread ID... 253E019000000000
            +000310    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
            +000318    94818995 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |main                            |
            +000338    60606E4D F0F1F6C4 5D408493 9398A485  99A88695 4D5D4040 40404040 40404040  |-->(016D) dllqueryfn()          |
            +000358    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
            +000378    40404040 40404040                                                           |                                |
 ⋮
            +005900    Time 21.22.38.942077    Date 2007.01.16    Thread ID... 253E019000000000
            +005910    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
            +005918    6D979696 936D8699 85856D81 93936D96  866D9695 856D8481 A3817CC1 C6F1F26D  |_pool_free_all_of_one_data@AF12_|
            +005938    60606E4D F0F0F5F9 5D408699 85854DF0  A7F0F0F0 F0F0F0F0 F1F0F8F3 F5F8C1C2  |-->(0059) free(0x0000000108358AB|
            +005958    F05D4040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |0)                              |
            +005978    40404040 40404040                                                           |                                |

            +005980    Time 21.22.38.942079    Date 2007.01.16    Thread ID... 253E019000000000
            +005990    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
            +005998    4C60604D F0F0F5F9 5D40D9F1 7EF0F0F0  F0F0F0F0 F0F0F0F0 F0F0F0F1 F240D9F2  |<--(0059) R1=0000000000000012 R2|
            +0059B8    7EF0F0F0 F0F0F0F0 F0F2F5F5 F7F4F6C4  F040D9F3 7EF0F0F0 F0F0F0F0 F1F0F8F3  |=00000000255746D0 R3=00000001083|
            +0059D8    F5F8C2C3 F040C5D9 D9D5D67E F0F0F0F0  F0F0F7F9 40C5D9D9 D5D6F27E C3F2F5C6  |58BC0 ERRNO=00000079 ERRNO2=C25F|
            +0059F8    F0F0F0F1 00000000                                                           |0001....                        |

            +005A00    Time 21.22.38.942080    Date 2007.01.16    Thread ID... 253E019000000000
            +005A10    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
            +005A18    6D848497 896D8699 85856D81 93936D96  866D9695 856D8995 86967CC1 C6F1F36D  |_ddpi_free_all_of_one_info@AF13_|
            +005A38    60606E4D F0F0F5F9 5D408699 85854DF0  A7F0F0F0 F0F0F0F0 F1F0F8F3 C1F0F5C3  |-->(0059) free(0x00000001083A05C|
            +005A58    F05D4040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |0)                              |
            +005A78    40404040 40404040                                                           |                                |

            +005A80    Time 21.22.38.942084    Date 2007.01.16    Thread ID... 253E019000000000
            +005A90    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
            +005A98    4C60604D F0F0F5F9 5D40D9F1 7EF0F0F0  F0F0F0F0 F0F0F0F0 F0F0F0F0 F240D9F2  |<--(0059) R1=0000000000000002 R2|
            +005AB8    7EF0F0F0 F0F0F0F0 F0F2F5F5 F7F4F6C4  F040D9F3 7EF0F0F0 F0F0F0F0 F0F0F0F0  |=00000000255746D0 R3=00000000000|
            +005AD8    F0F0F0F0 F040C5D9 D9D5D67E F0F0F0F0  F0F0F7F9 40C5D9D9 D5D6F27E C3F2F5C6  |00000 ERRNO=00000079 ERRNO2=C25F|
            +005AF8    F0F0F0F1 00000000                                                           |0001....                        |
[8]  Process Control Blocks:
       Thread Synchronization Process Latch Table (PPALT): 00000001_08911F00
        +000000 00000001_08911F00  00000000 00000000 00000000 00000000 |................|
        +000010 00000001_08911F10 - +000000 00000001_089132FF             same as above
```

Figure 176. Example of formatted output from LEDATA VERBEXIT (AMODE 64) (Part 3 of 10)

The following is part four of the example of formatted output from LEDATA VERBEXIT (AMODE 64).

```
[9] TCB: 007FF050                  LE Level: 15                   ASID: 0028

[10] Active Members: C/C++

[11]   CEELAA:  00000000_7F7547D8
       +000000  EYE_CATCHER:LAA   VERSION:00000001        PREVIOUS:00000000
       +00000C  NEXT:00000000     STCB:7F7543A0     ASID:0028
       +000018  FLOOR31:FFBAD000        OVERFLOW31:00000000     GTAB31:00000000
       +000024  LCA31:00000000    TRT31:00000000    FLOOR64:00000001_08200000
       +000048  OVERFLOW64:00000000_25250098        GTAB64:00000001_0871CA00
       +000058  LCA64:00000001_00000000       TRT64:00000001_00000030
       +0000C8  FLAG1:A1    FLAG2:00    CB_STG64:00000001_00000000
       +0000F8  CB_STG31:00000000_257520A0    SvcVec31:00000000
       +000104  SANC31:00000000   CurKey31:00       SvcVec64:00000000 00000000
       +000120  SANC64:00000001_00100000      CurKey64:80       ENSQ64:00000001_00100108
       +000138  LHEAP64ID:00000001 001002A8   LHEAP31ID:00000000 00000000
       +000148  IPTLAA:7F7547D8   SYSTEM_RETURN_CODE:00000000
       +000150  SYSTEM_REASON_CODE:00000000   SLE_REASON_CODE:00000000
       +000158  MSTRLAA:7F7547D8        SLEPC_ROUTER:829E9CE0   ALEI:00000000_00000000
[12]   CEELCA:  00000001_00000000
       +000000  EYE_CATCHER:LCA   VERSION:00000001        CAA:00000001_00007B18
       +000010  DIA:25752320      LAA:7F7547D8      SAVSTACK:00000000_00000000
       +000028  QINIT:00000000_25005010       TLC:00000000_255D39E0
[13]   CEECAA:  00000001_00007B18
       +000288  DLLF:00000000_00000000        INVAR:8000  FLAG0:00
       +000304  TORC:00000000     FLAG2:30    LEVEL:15    _PM:04
       +000368  DMC:00000000_00000000   CD:00000000       RS:00000000
       +000378  ERR:00000001_082FBE00   DDSA:00000001_082FF760
       +000388  EDB:00000001_00005340   PCB:00000001_00003CA0   EYEPTR:00000001_00007B00
       +0003A0  CAA:00000001_00007B18   SHAB:00000000_00000000
       +0003B0  PRGCK:00000000_00000000       URC:00000000      PICICB:00000000_00000000
       +0003C8  SIGSCTR:00000000        SIGSFLG:08000000        THDID:253E0190_00000000
       +0003D8  RCB:00000001_00003A10   MEMBR:00000001_000084D0
       +0003E8  SIGNAL_STATUS:00000000_00000008      HCOM_REG14:00000000_00000000
       +0003F8  EDCHPXV:00000000_25546C78     THREADHEAPID:00000000_00000000
       +000408  SYS_RTNCODE:00000000    SYS_RSNCODE:00000000    SIGNGPTR:00000001_00007F30
       +000418  SIGNG:00000001    AB_STATUS:00      STACKDIRECTION:00
       +00041F  AB_ICD1:00  AB_GR0:00000000 00000000
       +000428  AB_GR15:00000000 00000000     AB_ABCC:00000000
       +000434  AB_CRC:00000000   USERRTN:00000000_00000000     FVEC:00000000
       +000450  CGOCB:00000000_00000000       QINITDSA:00000050_082FF220
       +0004E8  IFLAG:0008  TRMRSN:00   ANCHOR3164:00000000     DEVH:00000000_25BC85E0
       +0004F8  PtatPtr:00000000_00000000     SQELADDR:00000000_264E1010
       +000510  VBA:00000050_08713310   TCS:00000000_00000000
       +000520  CONDWAITDSAREG:00000000_00000000    THDSTATUS:00000000_00000000
       +000570  FBTOK:00000000 00000000 00000000 00000000       PTXLPTR:00000000_00000000
       +000588  TICB_PTR:00000050_00106E60    FWD_CHAIN:00000050_00108398
       +0005A0  BKWD_CHAIN:00000050_00108398        TCB:008F8240
       +0007EC  DIA:264E12A0      DLLFFLAG:00       MCBPTR:00000000_2655ADA8
       +000838  MAD:00000000_2655A048   MFD:00000000_264E1918

[14]   CEEPCB:  00000001_00003CA0
       +000000  EYE:CEEPCB        SYSTM:03    HRDWR:03    SBSYS:02    FLAG2:08
       +000108  DBGEH:00000000_00000000       DMEMBR:00000001_00004048
       +000118  ZLOD:00000000_00000000        ZDEL:00000000_00000000
       +000128  ZGETST:00000000_00000000      ZFREEST:00000000_00000000
       +000138  RCB:00000001_00003A10   OMVS_LEVEL:7FC00000     CHAIN:00000000_00000000
       +000150  PRFEH:00000000_00000000       FLAG6:00    HABD_CLEANUP:0000
       +000160  QFEXIT:00000000_252A3F48      ABENDCODE:00000000
       +0001C4  REASON:00000000   F3456:00000040    MEML:00000001_00004020
       +0001D8  MEMBR:00000001_00004048       LEHL:00000001_00001560
       +0001E8  CMXB:00000001_00001738        STV:02      PM_BYTE:00  FLAG1:00
       +0001F8  ISA:00000001_00000000   ISA_SIZE:0001CA00
       +000204  SRV_COUNT:00000000      SRV_UWORD:00000000 00000000
       +000210  WORKAR:00000000_00000000      LOAD:00000000_2571C250
       +000220  DELETE:00000000_2571C240      GETSTOR:00000000_00000000
       +000230  FREESTOR:00000000_00000000    EXCEPT:00000000_00000000
       +000240  ATTN:00000000_00000000        MSGS:00000000_00000000
       +000250  ABEND:00000000_00000000       MSGOU:00000000_00000000
       +000260  GLAT:00000000_2571C230        RLAT:00000000_2571C220
       +000270  ELAT:00000000_2571C210        1PTQ:00000000_2571C200
       +000280  1ENV:00000000_2571C1F0        LODTYP:FFFFFFFF   LEVEL:FFFFFFFF
       +000290  LLTPTR:00000001_00000738      RC:00000000       REASON:00000000
       +0002A0  RC_MOD:00000000   FBTOK:00000000 00000000 00000000 00000000
       +0002B8  PPALTADDR:00000001_08911F00   PPALTSIZE:00001400
       +0002C8  PICB:00000001_00003C80        XPLINKFLAGS:80    QICB:00000001_00010688
       +0002E0  CALLERS_SAVE:00000000_00006F58

      CEEMEML:  00000001_00004048
       +000000  MEMLDEF:........  EXIT:00000000_00000000       LLVTL:00000000_00000000
```

Figure 177. Example of formatted output from LEDATA VERBEXIT (AMODE 64) (Part 4 of 10)

The following is part five of the example of formatted output from LEDATA VERBEXIT (AMODE 64).

```
 [15]   CEERCB:  00000001_00003A10
       +000000  EYE:CEERCB        SYSTEM:03   HARDWARE:03       SUBSYS:02
       +000043  FLAGS:00    DMEMBR:00000001_00004048      VERSION_ID:04010900
       +000058  PCB_CHAIN:00000001_00003CA0

[16]   CEEEDB:  00000001_00005340
       +000000  EYE:CEEEDB        FLAG:97     BIPM:00     CREATOR_ID:01
       +000108  BMEMBR:00000001_000068F8      OPTCB:00000001_00005DC8
       +000118  USER_RC:00000000        RSN_CODE:00000000       PCB:00000001_00003CA0
       +000128  APPL_STR:00000000_00000000    ENVAR:00000001_00004810
       +000140  ENV_ANCHOR:00000001_00005478        BOTRB:00000001_08910090
       +000150  CAACHAIN:00000001_00007B18    FLAGS1:82000000   THDSACT:00000000_00000003
       +000168  DCB:00000000      INPUT_R1:00000000_00006FF0
       +000178  LAST_RB:00000000        LAST_RBCT:00000000
       +000180  ENV_LGTH:00000000 00000200    ENVAR_A:00000001_00004A18
       +000190  ENV_ANCHOR_A:00000001_000054C8

      CEEMEML:  00000001_000068F8
       +000000  MEMLDEF:........  EXIT:00000000_00000000        LLVTL:FFFFFFFF_FFFFFFFF
 [17] Language Environment Runtime Options in effect.

    LAST WHERE SET          Override   OPTIONS
    ********************************************************************************
    DD:CEEOPTS              OVR        CEEDUMP(00000000,SYSOUT=*,
                                               FREE=END,SPIN=UNALLOC)
    IBM-SUPPLIED DEFAULT    OVR        DYNDUMP(*USERID,
                                               NODYNAMIC,TDUMP)
    IBM-SUPPLIED DEFAULT    OVR        ENVAR("")
    IBM-SUPPLIED DEFAULT    OVR        FILETAG(NOAUTOCVT,NOAUTOTAG)
    DD:CEEOPTS              OVR        HEAPCHK(ON,00000001,00000000,00000010,
                                               00000010)
    PROGRAMMER DEFAULT      OVR        HEAPPOOLS(ON,
                                                 00000008,00000010,
                                                 00000032,00000010,
                                                 00000128,00000010,
                                                 00000256,00000010,
                                                 00001024,00000010,
                                                 00002048,00000010,
                                                 00000000,00000010,
                                                 00000000,00000010,
                                                 00000000,00000010,
                                                 00000000,00000010,
                                                 00000000,00000010,
                                                 00000000,00000010)

    DD:CEEOPTS              OVR        HEAPPOOLS64(ON,
                                                   00000008,00004000,
                                                   00000032,00002000,
                                                   00000128,00000700,
                                                   00000256,00000350,
                                                   00001024,00000100,
                                                   00002048,00000050)
                                                   00003072,00000050)
                                                   00004096,00000050)
                                                   00008192,00000025)
                                                   00016384,00000010)
                                                   00032768,00000005)
                                                   00065536,00000005)
    IBM-SUPPLIED DEFAULT    OVR        HEAPZONES(0000,ABEND,0000,ABEND)
    IBM-SUPPLIED DEFAULT    OVR        HEAP64(0000000000000001,0000000000000001,
                                              KEEP,00032768,00032768,KEEP,
                                              000004096,00004096,FREE)
    IBM-SUPPLIED DEFAULT    OVR        INFOMSGFILTER(OFF)
    IBM-SUPPLIED DEFAULT    OVR        IOHEAP64(0000000000000001,0000000000000001,
                                               FREE,00012288,00000081,FREE,
                                               00004096,00004096,FREE)
    IBM-SUPPLIED DEFAULT    OVR        LIBHEAP64(0000000000000001,0000000000000001,
                                                 FREE,00016384,00008192,FREE,
                                                 00008192,00004096,FREE)
    IBM-SUPPLIED DEFAULT    OVR        NATLANG(ENU)
    IBM-SUPPLIED DEFAULT    OVR        PAGEFRAMESIZE64(4K,4K,4K,4K,4K,4K,4K)
    PROGRAMMER DEFAULT      OVR        POSIX(ON)
    IBM-SUPPLIED DEFAULT    OVR        PROFILE(OFF,"")
    DD:CEEOPTS              OVR        RPTOPTS(ON)
    DD:CEEOPTS              OVR        RPTSTG(ON)
    IBM-SUPPLIED DEFAULT    OVR        STACK64(0000000000000001,0000000000000001,
                                               0000000000000128)
    IBM-SUPPLIED DEFAULT    OVR        STORAGE(NONE,NONE,NONE)
    PROGRAMMER DEFAULT      OVR        TERMTHDACT(UADUMP,CESE,00000096)
    IBM-SUPPLIED DEFAULT    OVR      NOTEST(ALL,*,PROMPT,INSPPREF)
    IBM-SUPPLIED DEFAULT    OVR        THREADSTACK64(OFF,0000000000000001,
                                                     0000000000000001,
                                                     0000000000000128)
    PROGRAMMER DEFAULT      OVR        TRACE(ON,01048576,NODUMP,LE=00000001)
    IBM-SUPPLIED DEFAULT    OVR        TRAP(ON,SPIE)
```

Figure 178. Example of formatted output from LEDATA VERBEXIT (AMODE 64) (Part 5 of 10)

The following is part six of the example of formatted output from LEDATA VERBEXIT (AMODE 64).

```
[18] Heap Storage Control Blocks
       Heappools trace available. To display: IP VERBX LEDATA 'HPT(*)'

         ENSQ:  00000001_00100108
       +000000  EYE_CATCHER:ENSQ  HEAPALLOC_VAL:00000000
       +000008  HEAPFREE_VAL:00000000   DSAALLOC_VAL:00000000   FLAGS1:80000000
       +000014  IPT_TOKEN:000000A0 00000002 00000016 007FF050
       +000024  HEAPLOCKWORD:00000000   RPT_STOR:00000001_00100410
       +000030  UHEAP64:C8D7C3D8 00000000 00000001 001005B0 00000001 001007F0 00000000 00000001 00
       +000060  LHEAP64:C8D7C3D8 00000000 00000001 001005E0 00000001 00100670 00000000 00000001 00
       +000090  UHEAP31:C8D7C3D8 00000000 00000001 00100198 00000001 00100198 00000000 00008000 00
       +0000C0  LHEAP31:C8D7C3D8 00000000 00000001 001007C0 00000001 001007C0 00000000 00004000 00
       +0000F0  UHEAP24:C8D7C3D8 00000000 00000001 001001F8 00000001 001001F8 00000000 00001000 00
       +000120  LHEAP24:C8D7C3D8 00000000 00000001 00100228 00000001 00100228 00000000 00002000 00
       +000174  IPT_TCB:007FF050        HEAPCHK:00000000_00000000
       +000188  STSB:00000000_00000000        SASB:00000000_00000000
       +000198  TOKEN:7F7547D8 00000000
       +0001A0  THDLHEAP64:C8D7C3D8 00000000 00000001 00100790 00000001 00100790 00000000 00000001 00
       +0001D0  IOHEAP64:C8D7C3D8 00000000 00000001 00100760 00000001 00100760 00000000 00000001 00
       +000200  IOHEAP31:C8D7C3D8 00000000 00000001 001006A0 00000001 001006A0 00000000 00003000 00
       +000230  IOHEAP24:C8D7C3D8 00000000 00000001 001006D0 00000001 001006D0 00000000 00001000 00
       +000260  SM_CELL_BLOCK:00000001_00100490     SPDE:00000001_00100730

        User Heap64 Control Blocks

         HPCQ:  00000001_00100138
       +000000  EYE_CATCHER:HPCQ  FIRST:00000001_001005B0       LAST:00000001_001007F0
       +000018  INITSIZE:00000000 00000001    INCRSIZE:00000000 00000001
       +00002C  OPTIONS:80000000

         HPSQ:  00000001_00005058
       +000000  BYTES_ALLOC:00000000 001C3320
       +000008  CURR_ALLOC:00000000 000CF080        GET_REQ:00000000 0000000D
       +000018  FREE_REQ:00000000 00000001    GETMAINS:00000000 00000001
       +000028  FREEMAINS:00000000 00000000

         THNQ:  00000001_001005B0
       +000000  EYE_CATCHER:THNQ  FLAGS:80000000    NEXT:00000001_001007F0
       +000010  PREV:00000001_00100138        HEAPID:00000001_00100138
       +000020  SEGMENT:00000001_08300000     SEG_LEN:00000000 00100000

         HANQ:  00000001_08300000
       +000000  EYE_CATCHER:HANQ  FLAGS:80000000    HEAPID:00000001_00100138
       +000020  SEGMENT:00000001_08300000     ROOT:00000001_083CF0C0
       +000030  SEG_LEN:00000000 00100000     ROOT_LEN:00000000 00030F40

       Free Storage Tree for Heap Segment 0000000108300000
                   Node              Node              Parent            Left             Right                Left              Right
     Depth      Address            Length             Node              Node             Node                Length            Length
         0  00000001083CF0C0  0000000000030F40  0000000000000000  0000000000000000  0000000000000000  0000000000000000  0000000000000000

       Map of Heap Segment 0000000108300000

     To display entire segment: IP LIST 0000000108300000 LEN(X'0000000000100000') ASID(X'0028')

     0000000108300040: Allocated storage element, length=0000000000000180.
    To display: IP LIST 0000000108300040 LEN(X'0000000000000180') ASID(X'0028')
     0000000108300050: C36DE6E2 C1F6F440 40404040 40404040  00000001 08300070 00000000 250005A8 |C_WSA64         ...............y|

     00000001083001C0: Allocated storage element, length=0000000000019660.
    To display: IP LIST 00000001083001C0 LEN(X'0000000000019660') ASID(X'0028')
     00000001083001D0: 00000000 00000005 00000000 00000005  00000001 08319840 00000001 08319A28 |.....................q ........|

     0000000108319820: Allocated storage element, length=0000000000025B40.
    To display: IP LIST 0000000108319820 LEN(X'0000000000025B40') ASID(X'0028')
     0000000108319830: 00000000 00000007 00000000 00000007  00000000 00000000 00000000 00000000 |................................|

     000000010833F360: Allocated storage element, length=0000000000019340.
    To display: IP LIST 000000010833F360 LEN(X'0000000000019340') ASID(X'0028')
     000000010833F370: 00000000 00000006 00000000 00000006  00000000 00000000 00000000 00000000 |................................|

     00000001083586A0: Allocated storage element, length=00000000000189E0.
    To display: IP LIST 00000001083586A0 LEN(X'00000000000189E0') ASID(X'0028')
     00000001083586B0: 00000000 00000003 00000000 00000003  C3C4D3D3 00000000 00000000 00000000 |................CDLL............|

     0000000108371080: Allocated storage element, length=0000000000000060.
    To display: IP LIST 0000000108371080 LEN(X'0000000000000060') ASID(X'0028')
     0000000108371090: C36DE6E2 C1F6F440 40404040 40404040  00000000 000006F0 00000000 25574500 |C_WSA64         .......0........|
```

Figure 179. Example of formatted output from LEDATA VERBEXIT (AMODE 64) (Part 6 of 10)

The following is part seven of the example of formatted output from LEDATA VERBEXIT (AMODE 64).

```
     00000001083710E0: Allocated storage element, length=000000000001F420.
    To display: IP LIST 00000001083710E0 LEN(X'000000000001F420') ASID(X'0028')
     00000001083710F0: 00000000 00000001 00000000 00000001  00000001 08358990 00000000 00000000 |......................i.........|

     0000000108390500: Allocated storage element, length=0000000000005C00.
    To display: IP LIST 0000000108390500 LEN(X'0000000000005C00') ASID(X'0028')
     0000000108390510: C36DE6E2 C1F6F440 40404040 40404040  000000FF 00000000 00000001 08394360 |C_WSA64         ...............-|

     0000000108396100: Allocated storage element, length=000000000000A320.
    To display: IP LIST 0000000108396100 LEN(X'000000000000A320') ASID(X'0028')
     0000000108396110: C36DE6E2 C1F6F440 40404040 40404040  00000001 08399D80 00000000 258492C0 |C_WSA64         .............dk.|

     00000001083A0420: Allocated storage element, length=0000000000000180.
    To display: IP LIST 00000001083A0420 LEN(X'0000000000000180') ASID(X'0028')
     00000001083A0430: C36DE6E2 C1F6F440 40404040 40404040  00000000 00000000 00000001 08FEC410 |C_WSA64         ..............D.|

     00000001083A05A0: Allocated storage element, length=0000000000017400.
    To display: IP LIST 00000001083A05A0 LEN(X'0000000000017400') ASID(X'0028')
     00000001083A05B0: 00000000 00000004 00000000 00000000  00000000 00000000 00000000 00000000 |................................|

     00000001083B79A0: Allocated storage element, length=0000000000017720.
    To display: IP LIST 00000001083B79A0 LEN(X'0000000000017720') ASID(X'0028')
     00000001083B79B0: 00000000 00000002 00000000 00000000  00000000 00000000 00000000 D3D4D9C5 |............................LMRE|

     00000001083CF0C0: Free storage element, length=0000000000030F40.
    To display: IP LIST 00000001083CF0C0 LEN(X'0000000000030F40') ASID(X'0028')

     Summary of analysis for Heap Segment 0000000108300000:
        Amounts of identified storage:  Free:00030F40          Allocated:000CF080          Total:000FFFC0
        Number of identified areas   :  Free:       1  Allocated:      12  Total:      13
        00000000 bytes of storage were not accounted for.
        No errors were found while processing this heap segment.
:
[19] Stack Storage Control Blocks

         SANC:  00000001_00100000
       +000000  EYE_CATCHER:SANC  VERSION:0001      LENGTH:0100
       +000008  SEGMENT_SIZE:00000000 00000081      ACTIVE_STACK:00000001_00200000
       +000018  BOS:00000001_082FFFE0   INIT_SIZE:00000000 00000001
       +000028  INCR_SIZE:00000000 00000001   USER_STACK:00000001_00200000
       +000038  USER_BOS:00000001_082FFFE0    USER_FLOOR:00000001_08200000
       +000048  RESERVE_STACK:00000001_08500000     SDCB:00000000_00000000
       +000060  PTDATA:00000000_00000000      OCB_INCRSZ:00000000 00000001
       +000070  CURR_ALLOC:00000000 00000001        FLAGS1:00000000
       +00007C  FLAGS2:00000000   USER_ORIGIN:00000001 00200000

     DSA backchain
          DSA:  00000001_082FA900
       +000800  HPR4:00000001 082FAAC0        HPR5:00000000 253C45F8
       +000810  HPR6:00000000 253C4500        HPR7:00000000 251B9B1A
       +000820  HPR8:00000001 082FBB08        HPR9:00000001 00000004
       +000830  HPR10:00000001 082FBABF       HPR11:00000001 082FBE00
       +000840  HPR12:00000001 082FCABE       HPR13:00000001 082FE680
       +000850  HPR14:00000001 00005DC8       HPR15:00000001 00006554
       +000860  HPHKSAV:00000001 082FBA80     HPTRAN:00000001 082FB208
       +000878  HPRENT:00000000 251181E8

      Contents of DSA at Location : 00000001_082FB100

       +000000 00000001_082FB100  00000001 082FAAC0 00000000 253C45F8 |...............8|
       +000010 00000001_082FB110  00000000 253C4500 00000000 251B9B1A |................|
       +000020 00000001_082FB120  00000001 082FBB08 00000001 00000004 |................|
       +000030 00000001_082FB130  00000001 082FBABF 00000001 082FBE00 |................|
       +000040 00000001_082FB140  00000001 082FCABE 00000001 082FE680 |..............W.|
       +000050 00000001_082FB150  00000001 00005DC8 00000001 00006554 |......)H........|
       +000060 00000001_082FB160  00000001 082FBA80 00000001 082FC6E0 |..............F.|
       +000070 00000001_082FB170  00000001 082FB208 00000000 251181E8 |..............aY|
       +000080 00000001_082FB180  00000001 082FAAC0 00000000 25743020 |................|
       +000090 00000001_082FB190  00000000 2558CB50 00000000 251B78DA |.......&........|
       +0000A0 00000001_082FB1A0  00000001 082FBE00 00000001 082FBF60 |...............-|
       +0000B0 00000001_082FB1B0  00000001 082FBABF 00000001 082FBA08 |................|
       +0000C0 00000001_082FB1C0  00000001 082FCABE 00000001 082FE680 |..............W.|
       +0000D0 00000001_082FB1D0  00000001 082FB208 00000000 251181D8 |..............aQ|
       +0000E0 00000001_082FB1E0  00000001 082FC6E0 89848540 85A78385 |......F.ide exce|
       +0000F0 00000001_082FB1F0  00000000 00000000 A8A2A385 9440C396 |........ystem Co|
```

Figure 180. Example of formatted output from LEDATA VERBEXIT (AMODE 64) (Part 7 of 10)

The following is part eight of the example of formatted output from LEDATA VERBEXIT (AMODE 64).

```
          DSA:  00000001_082FAAC0
      +000800  HPR4:00000001 082FD3E0        HPR5:00000000 251BABA0
      +000810  HPR6:00000000 251B6060        HPR7:00000000 2504B400
      +000820  HPR8:00000001 089135B0        HPR9:00000000 00000005
      +000830  HPR10:00000001 082FE3DF       HPR11:00000001 082FE0C0
      +000840  HPR12:00000001 089135B0       HPR13:00000001 082FE680
      +000850  HPR14:00000000 2504B300       HPR15:00000000 2530A300
      +000860  HPHKSAV:00000000 00000000     HPTRAN:00000000 00000000
      +000878  HPRENT:00000000 00000000

    Contents of DSA at Location : 00000001_082FB2C0

      +000000 00000001_082FB2C0  00000001 082FD3E0 00000000 251BABA0 |......L.........|
      +000010 00000001_082FB2D0  00000000 251B6060 00000000 2504B400 |......--........|
      +000020 00000001_082FB2E0  00000001 089135B0 00000000 00000005 |.....j..........|
      +000030 00000001_082FB2F0  00000001 082FE3DF 00000001 082FE0C0 |......T.........|
      +000040 00000001_082FB300  00000001 089135B0 00000001 082FE680 |.....j........W.|
      +000050 00000001_082FB310  00000000 2504B300 00000000 2530A300 |..............t.|
      +000060 00000001_082FB320  00000000 00000000 00000000 00000000 |................|
      +000070 00000001_082FB330 - +000000 00000001_082FB33F             same as above
      +000080 00000001_082FB340  00000001 082FBB08 00000001 00000003 |................|
      +000090 00000001_082FB350  00000001 00000003 00000001 00007208 |................|
      +0000A0 00000001_082FB360  00000001 082FC190 00000001 082FBF90 |......A.........|
      +0000B0 00000001_082FB370  00000000 25773048 00000000 00000000 |................|
      +0000C0 00000001_082FB380  00000000 00000000 00000000 00000000 |................|
      +0000D0 00000001_082FB390 - +000000 00000001_082FB3BF             same as above

         DSA:  00000001_082FD3E0
      +000800  HPR4:00000001 082FDDE0        HPR5:00000000 2504C3EC
      +000810  HPR6:00000000 2504AAB0        HPR7:00000000 251C96D0
      +000820  HPR8:00000000 25754AD8        HPR9:00000000 25754BD0
      +000830  HPR10:00000000 25754A30       HPR11:00000000 00000020
      +000840  HPR12:00000001 00007B18       HPR13:00000001 082FE680
      +000850  HPR14:00000000 253D6504       HPR15:00000000 00000003
      +000860  HPHKSAV:00000001 00000000     HPTRAN:082FDB18 00000000
      +000878  HPRENT:00000060 00000000

    Contents of DSA at Location : 00000001_082FDBE0

      +000000 00000001_082FDBE0  00000001 082FDDE0 00000000 2504C3EC |..............C.|
      +000010 00000001_082FDBF0  00000000 2504AAB0 00000000 251C96D0 |..............o.|
      +000020 00000001_082FDC00  00000000 25754AD8 00000000 25754BD0 |.......Q........|
      +000030 00000001_082FDC10  00000000 25754A30 00000000 00000020 |................|
      +000040 00000001_082FDC20  00000001 00007B18 00000001 082FE680 |......#.......W.|
      +000050 00000001_082FDC30  00000000 253D6504 00000000 00000003 |................|
⋮
 [20] Condition Management Control Blocks
        HCOM:  00000000_25753700
      +000000  PICA_AREA:00000000 00000000   EYES:HCOM   SIZE:28E0   LEVEL:0001
      +000010  CAA_PTR1:00000001_00007B18    CVTDCB:9B   FLAG1:60104000
      +000020  EXIT_STK:00000000_00000000    RSM_PTR:00000000_00000000
      +000030  HDLL_STK:00000000_00000000    SRP_TOKEN:00000000_00000000
      +000040  CURR_STK:00000000_00000000    CIBH:00000001_082FCFE0
      +000050  SPIE_TOKEN:00000000     DMCP:00000000_00000000
      +0000D0  COND_LOG:00000001_08FE9910    4083_DSA:00000000_00000000
      +000100  HCHK5_RESULTS:00000000        SHUNT_VALIDFLAG:00000000
      +000704  SHUNT_COUNTER:00000000        SHUNT_ADDR:00000000_00000000
      +000710  SHUNT_PSW:00000000 00000000 00000000 00000000
      +000720  SHUNT_REG0:00000000 00000000
      +000728  SHUNT_REG1:00000000 00000000
      +000730  SHUNT_REG2:00000000 00000000
      +000738  SHUNT_REG3:00000000 00000000
      +000740  SHUNT_REG4:00000000 00000000
      +000748  SHUNT_REG5:00000000 00000000
      +000750  SHUNT_REG6:00000000 00000000
      +000758  SHUNT_REG7:00000000 00000000
      +000760  SHUNT_REG8:00000000 00000000
      +000768  SHUNT_REG9:00000000 00000000
      +000770  SHUNT_REG10:00000000 00000000
      +000778  SHUNT_REG11:00000000 00000000
      +000780  SHUNT_REG12:00000000 00000000
      +000788  SHUNT_REG13:00000000 00000000
      +000790  SHUNT_REG14:00000000 00000000
      +000798  SHUNT_REG15:00000000 00000000       SHUNT_CODE1:00000000_00000000
      +0007A8  SHUNT_CODE2:00000000_00000000       SIGNAL_LOG:00000001_08913470
```

Figure 181. Example of formatted output from LEDATA VERBEXIT (AMODE 64) (Part 8 of 10)

The following is part nine of the example of formatted output from LEDATA VERBEXIT (AMODE 64).

```
  CIBH:  00000001_082FCFE0
+000000  EYE:CIBH    BACK:00000001_00006AB8        FWD:00000000_00000000
+000018  LEVEL:0002  SIZE:0C00   PTR_CIB:00000000_00000000
+000028  FLAG1:00000000    HDLQ:00000000_00000000        STATE:00000000
+000040  PRM_DESC:00000000_00000000    PRM_PREFIX:00000000_00000000
+000050  PRM_LIST:00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
+000070  PARM_DESC:00000000_00000000   PARM_PREFIX:00000000_00000000
+000080  PARM_LIST:00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
+0000A0  FUNC_CODE:00000000      SIZ:0000    VER:0000    FLAG5:00
+0000A9  FLAG6:00    FLAG7:00    FLAG8:00    FLAG1:00    FLAG2:00
+0000AE  FLAG3:00    FLAG4:00    ABCD:00000000     ABRC:00000000
+0000B8  OLD_COND64:00000000 00000000
+0000C0  OLD_MIB:00000000 00000000     COND64:00000000 00000000
+0000D0  MIB:00000000_00000000   PL:00000000_00000000    SV2:00000000_00000000
+0000E8  SV1:00000000_00000000   INT:00000000_00000000   MID:00000000
+000100  HDL_SF:00000000_00000000      HDL_EPT:00000000_00000000
+000110  HDL_RST:00000000_00000000     RSM_SF:00000000_00000000
+000120  RSM_PT:00000000_00000000      RSM_MACH:00000000_00000000
+000130  SUSPEND_EH:00000000_00000000        COND_DFT:00000000
+000140  Q_DATA_TOKEN:00000000 00000000      FDBK:00000000_00000000
+000150  ABNAME:........   BBRANCH_OFFSET:00000000
+00031C  BBRANCH_STMTID:........       BBRANCH_STMTLEN:0000
                   Machine State
+000348  MCH_EYE:....
+000350  GPR00:00000000 00000000       GPR01:00000000 00000000
+000360  GPR02:00000000 00000000       GPR03:00000000 00000000
+000370  GPR04:00000000 00000000       GPR05:00000000 00000000
+000380  GPR06:00000000 00000000       GPR07:00000000 00000000
+000390  GPR08:00000000 00000000       GPR09:00000000 00000000
+0003A0  GPR10:00000000 00000000       GPR11:00000000 00000000
+0003B0  GPR12:00000000 00000000       GPR13:00000000 00000000
+0003C0  GPR14:00000000 00000000       GPR15:00000000 00000000
+0003D0  PSW:00000000 00000000 00000000 00000000
+0003E0  ILC:0000    IC1:00      IC2:00      PFT:00000000_00000000
+0003F0  FLT_0:00000000 00000000       FLT_2:00000000 00000000
+000400  FLT_4:00000000 00000000       FLT_6:00000000 00000000
+000410  FLT_1:00000000 00000000
+000418  FLT_3:00000000 00000000
+000420  FLT_5:00000000 00000000
+000428  FLT_7:00000000 00000000
+000430  FLT_8:00000000 00000000       FLT_9:00000000 00000000
+000440  FLT_10:00000000 00000000      FLT_11:00000000 00000000
+000450  FLT_12:00000000 00000000      FLT_13:00000000 00000000
+000460  FLT_14:00000000 00000000      FLT_15:00000000 00000000
+000470  FPC:00000000      AFP_FLAGS:00      INT_SF:00000000_00000000
+00048F  FLAGS:00    EXT:00000000_00000000   BEA:00000000_00000000
+0004A8  SAVSTACK_ASYNC_PTR:00000000_00000000
+0004C8  AR00:00000000     AR01:00000000
+0004D0  AR02:00000000     AR03:00000000
+0004D8  AR04:00000000     AR05:00000000
+0004E0  AR06:00000000     AR07:00000000
+0004E8  AR08:00000000     AR09:00000000
+0004F0  AR10:00000000     AR11:00000000
+0004F8  AR12:00000000     AR13:00000000
+000500  AR14:00000000     AR15:00000000
+000508  VR_0:00000000 00000000 00000000 00000000
+000518  VR_1:00000000 00000000 00000000 00000000
+000528  VR_2:00000000 00000000 00000000 00000000
+000538  VR_3:00000000 00000000 00000000 00000000
+000548  VR_4:00000000 00000000 00000000 00000000
+000558  VR_5:00000000 00000000 00000000 00000000
+000568  VR_6:00000000 00000000 00000000 00000000
+000578  VR_7:00000000 00000000 00000000 00000000
+000588  VR_8:00000000 00000000 00000000 00000000
+000598  VR_9:00000000 00000000 00000000 00000000
+0005A8  VR_10:00000000 00000000 00000000 00000000
+0005B8  VR_11:00000000 00000000 00000000 00000000
+0005C8  VR_12:00000000 00000000 00000000 00000000
+0005D8  VR_13:00000000 00000000 00000000 00000000
+0005E8  VR_14:00000000 00000000 00000000 00000000
+0005F8  VR_15:00000000 00000000 00000000 00000000
+000608  VR_16:00000000 00000000 00000000 00000000
+000618  VR_17:00000000 00000000 00000000 00000000
+000628  VR_18:00000000 00000000 00000000 00000000
+000638  VR_19:00000000 00000000 00000000 00000000
+000648  VR_20:00000000 00000000 00000000 00000000
+000658  VR_21:00000000 00000000 00000000 00000000
+000668  VR_22:00000000 00000000 00000000 00000000
+000678  VR_23:00000000 00000000 00000000 00000000
+000688  VR_24:00000000 00000000 00000000 00000000
+000698  VR_25:00000000 00000000 00000000 00000000
+0006A8  VR_26:00000000 00000000 00000000 00000000
+0006B8  VR_27:00000000 00000000 00000000 00000000
+0006C8  VR_28:00000000 00000000 00000000 00000000
+0006D8  VR_29:00000000 00000000 00000000 00000000
+0006E8  VR_30:00000000 00000000 00000000 00000000
+0006F8  VR_31:00000000 00000000 00000000 00000000
      CIBH:  00000001_00006AB8
+000000  EYE:CIBH    BACK:00000000_00000000        FWD:00000001_082FCFE0
+000018  LEVEL:0002  SIZE:0C00   PTR_CIB:00000001_082FBE00
+000028  FLAG1:C12B0000    HDLQ:00000000_00000000        STATE:00000000
+000040  PRM_DESC:00000000_00000000    PRM_PREFIX:00000000_00000000
+000050  PRM_LIST:00000001 082FBE28 00000001 082FBF50 00000001 082FBF60 00000001 00007208
+000070  PARM_DESC:00000000_00000000   PARM_PREFIX:00000000_00000000
+000080  PARM_LIST:00000001 082FBF48 00000001 082FBE00 00000001 082FBF60 00000001 00007208
+0000A0  FUNC_CODE:00000067      SIZ:0190    VER:0004    FLAG5:48
+0000A9  FLAG6:22    FLAG7:04    FLAG8:00    FLAG1:00    FLAG2:00
+0000AE  FLAG3:00    FLAG4:05    ABCD:940C9000     ABRC:00000009
+0000B8  OLD_COND64:00030C89 59C3C5C5 (CEE3209S)
+0000C0  OLD_MIB:00000000 00000000     COND64:00030C89 59C3C5C5 (CEE3209S)
+0000D0  MIB:00000000_00000000   PL:00000000_250008C0    SV2:00000001_082FF080
+0000E8  SV1:00000001_082FF080   INT:00000000_2575B5E0   MID:00000003
+000100  HDL_SF:00000001_082FF280      HDL_EPT:00000000_251BB1D0
+000110  HDL_RST:00000000_00000000     RSM_SF:00000001_082FF080
+000120  RSM_PT:00000000_2575B5E2      RSM_MACH:00000001_00007000
+000130  SUSPEND_EH:00000000_00000000        COND_DFT:00000003
+000140  Q_DATA_TOKEN:00000000 00000000      FDBK:00000000_00000000
+000150  ABNAME:........   BBRANCH_OFFSET:00000000
+00031C  BBRANCH_STMTID:........       BBRANCH_STMTLEN:0000
```

Figure 182. Example of formatted output from LEDATA VERBEXIT (AMODE 64) (Part 9 of 10)

The following is part ten of the example of formatted output from LEDATA VERBEXIT (AMODE 64).

```
             Machine State
        +000348  MCH_EYE:ZMCH
        +000350  GPR00:00000000 00000000       GPR01:00000001 00009DF0
        +000360  GPR02:00000001 082FEEF8       GPR03:00000000 00000012
        +000370  GPR04:00000001 082FF080       GPR05:00000000 000006F0
        +000380  GPR06:00000000 00000000       GPR07:00000000 00000001
        +000390  GPR08:00000000 250000E4       GPR09:00000000 2575B630
        +0003A0  GPR10:00000000 250014E0       GPR11:00000001 08FC5E70
        +0003B0  GPR12:00000001 00005340       GPR13:00000000 00006F58
        +0003C0  GPR14:00000000 25250098       GPR15:00000000 0000001F
        +0003D0  PSW:07852401 80000000 00000000 2575B5E2
        +0003E0  ILC:0002    IC1:00      IC2:09      PFT:00000000_00000000
        +0003F0  FLT_0:4328007E 7DC78A9C       FLT_2:00000000 00000000
        +000400  FLT_4:3C100000 00000000       FLT_6:34100000 00000000
        +000410  FLT_1:00000000 00000000
        +000418  FLT_3:00000000 00000000
        +000420  FLT_5:00000000 00000000
        +000428  FLT_7:00000000 00000000
        +000430  FLT_8:00000000 00000000       FLT_9:00000000 00000000
        +000440  FLT_10:00000000 00000000      FLT_11:00000000 00000000
        +000450  FLT_12:00000000 00000000      FLT_13:00000000 00000000
        +000460  FLT_14:00000000 00000000      FLT_15:00000000 00000000
        +000470  FPC:00000000      AFP_FLAGS:00      INT_SF:00000001_082FF080
        +00048F  FLAGS:20    EXT:00000000_00000000   BEA:00000000_00000001
        +0004A8  SAVSTACK_ASYNC_PTR:00000000_00000000
        +0004C8  AR00:00000000     AR01:00000000
        +0004D0  AR02:00000000     AR03:00000000
        +0004D8  AR04:00000000     AR05:00000000
        +0004E0  AR06:00000000     AR07:00000000
        +0004E8  AR08:00000000     AR09:00000000
        +0004F0  AR10:00000000     AR11:00000000
        +0004F8  AR12:00000000     AR13:00000000
        +000500  AR14:00000000     AR15:00000000
        +000508  VR_0:00000000 00000000 00000000 00000000
        +000518  VR_1:00000000 00000000 00000000 00000000
        +000528  VR_2:00000000 00000000 00000000 00000000
        +000538  VR_3:00000000 00000000 00000000 00000000
        +000548  VR_4:00000000 00000000 00000000 00000000
        +000558  VR_5:00000000 00000000 00000000 00000000
        +000568  VR_6:00000000 00000000 00000000 00000000
        +000578  VR_7:00000000 00000000 00000000 00000000
        +000588  VR_8:00000000 00000000 00000000 00000000
        +000598  VR_9:00000000 00000000 00000000 00000000
        +0005A8  VR_10:00000000 00000000 00000000 00000000
        +0005B8  VR_11:00000000 00000000 00000000 00000000
        +0005C8  VR_12:00000000 00000000 00000000 00000000
        +0005D8  VR_13:00000000 00000000 00000000 00000000
        +0005E8  VR_14:00000000 00000000 00000000 00000000
        +0005F8  VR_15:00000000 00000000 00000000 00000000
        +000608  VR_16:00000000 00000000 00000000 00000000
        +000618  VR_17:00000000 00000000 00000000 00000000
        +000628  VR_18:00000000 00000000 00000000 00000000
        +000638  VR_19:00000000 00000000 00000000 00000000
        +000648  VR_20:00000000 00000000 00000000 00000000
        +000658  VR_21:00000000 00000000 00000000 00000000
        +000668  VR_22:00000000 00000000 00000000 00000000
        +000678  VR_23:00000000 00000000 00000000 00000000
        +000688  VR_24:00000000 00000000 00000000 00000000
        +000698  VR_25:00000000 00000000 00000000 00000000
        +0006A8  VR_26:00000000 00000000 00000000 00000000
        +0006B8  VR_27:00000000 00000000 00000000 00000000
        +0006C8  VR_28:00000000 00000000 00000000 00000000
        +0006D8  VR_29:00000000 00000000 00000000 00000000
        +0006E8  VR_30:00000000 00000000 00000000 00000000
        +0006F8  VR_31:00000000 00000000 00000000 00000000

              CIB:  00000001_082FBE00
        +000000  EYE:CIB     BACK:00000000_00000000        FWD:00000000_00000000
        +000018  SIZE:0190   VERSION:0004      PLAT_ID:00000000
        +000028  COND:000300C6 59C3C5C5 (CEE0198S)   MIB:00000000_00000000
        +000038  MACHINE:00000001 082FBF90     OLD_COND_64:00030C89 59C3C5C5 (CEE3209S)
        +000048  OLD_MIB:00000000_00000000     FLG_1:00    FLG_2:00    FLG_3:00
        +000053  FLG_4:04    HDL_SF:00000001_082FF180      HDL_EPT:00000000_251BB1D0
        +000068  HDL_RST:00000000_00000000     RSM_SF:00000001_082FF080
        +000078  RSM_PT:00000000_2575B5E2      RSM_MACH:00000001_00007000
        +000088  COND_DEFAULT:00000003   PH_CALLEE_SF:00000001_082FF080
        +000098  HDL_SF_FMT:01     PH_CALLEE_FMT:01  BBRANCH_STMTLEN:0000
        +00009C  BBRANCH_OFFSET:00000000       BBRANCH_STMTID:........
        +0000D0  VSR:00000000 00000000   VSTOR:00000000_00000000
        +0000E0  VRPSA:00000000_00000000       MCB:00000000_00000000
        +0000F0  MRN:........      MFLAG:00    FLG_5:48    FLG_6:22    FLG_7:04
        +000103  FLG_8:00    ABCD:940C9000     ABRC:00000009     ABNAME:........
        +000118  PL:00000000_250008C0    SV2:00000001_082FF080   SV1:00000001_082FF080
        +000130  INT:00000000_2575B5E0   Q_DATA_TOKEN:00000000 00000000
        +000140  FDBK:00000000_00000000        FUN:00000067
        +000150  TOKEN:00000001 082FF180       MID:00000003      STATE:00000000
        +000160  RTCC:00000014     PPAV:00000004     AB_TERM_EXIT:........
        +000170  SDWA:00000000_00000000        SIGNO:00000008    PPSD:00000001_00007220
[21]  Message Processing Control Blocks
           CMXB:  00000001_00001738
        +000000  EYE:CMXB    SIZE:0160   FLAGS:8000  DHEAD1:00000000_00000000
        +000010  DHEAD2:00000000_00000000

          TMXB:  00000001_00007858
        +000000  EYE:TMXB    MIB_CHAIN_PTR:00000001_000078A0

           MGF:  00000001_000078A0
        +000000  EYE:CMIB    PREV:00000001_000078A0        NEXT:00000001_000078A0
        +000018  SEQ:00000000 00000001   CTOK:00000BE3 41C3C5C5 (CEE3043I)
 [22] No PIPICB associated with CAA at address : 00000001_00007B18
 ⋮
    Exiting Language Environment Data
```

Figure 183. Example of formatted output from LEDATA VERBEXIT (AMODE 64) (Part 10 of 10)

Sections of the Language Environment LEDATA VERBEXIT formatted output

Table 54 on page 373 lists the sections of the LEDATA VERBEXIT output, which appear independently of the Language Environment-conforming languages used.

Section Number and Heading	Contents
`[1] - [8] CEEDUMP Formatted Control Blocks:` These sections are included when the CEEDUMP parameter is specified on the LEDATA invocation.	
`[1] - [4] NTHREADS data:` These sections are also included, once for each thread, when the NTHREADS() parameter is specified on the LEDATA invocations. For a description of NTHREADS, see Report type parameters.	
`[1] Enclave Identifier`	Names the enclave for which information is provided.
`[2] Information for thread`	Shows the system identifier for the thread. Each thread has a unique identifier.
`[3] Registers and PSW`	Displays the register and program status word (PSW) values that were used to create the traceback. These values may come from the TCB, the RTM2 work area, a linkage stack entry or output from the BPXGMSTA service. This section is not displayed when the DSA() parameter is specified on the LEDATA invocation.
`[4] Traceback`	For all active routines in a particular thread, the traceback section shows routine information in two parts. The first part contains: • DSA number: A number assigned to the information for this active routine by LEDATA. The number is only used to associate information from the first part of the traceback with information in the second part of the traceback. • Entry: For PL/I routines, this is the entry point name. For C/C++ routines, this is the function name. If a function name or entry point was not specified for a particular routine, then the string *** NoName *** will appear. • Entry point offset • Load module • Program unit: The primary entry point of the external procedure. For C and PL/I routines, this is the compile unit name. For Language Environment-conforming assemblers, this is the ENTNAME = value on the CELQPRLG macro. • Service level: The latest service level applied to the compile unit (for example, for IBM products, it would be the PTF number. – If the service level string is equal or less than 7 bytes, all of the string will be output. – If the service level string is longer than 7 bytes, the Service column will only show the first 7 bytes of the service string, and the full service string will be shown in section of Full Service Level with max length of 64 bytes. • Status: Routine status can be call, exception, or running. The second part contains: • DSA number: A number assigned to the information for this active routine by LEDATA. The number is only used to associate information from the first part of the traceback with information in the second part of the traceback. • Stack frame (DSA) address • Entry point address • Program unit address • Program unit offset: The offset of the last instruction to run in the routine. If the offset is a negative number, zero, or a very large positive number, the routine associated with the offset probably did not allocate a save area, or the routine could have been called using SVC-assisted linkage. Adding the program unit address to the offset gives you the location of the current instruction in the routine. This offset is from the starting address of the routine. The third part of the traceback, which is also referred to as the "Full Service Level" section, contains the following: • DSA number • Entry • Service: The full service level string with max length of 64 bytes will be displayed here.

Table 54. Contents of the Language Environment LEDATA VERBEXIT formatted output (AMODE 64)

Table 54. Contents of the Language Environment LEDATA VERBEXIT formatted output (AMODE 64) (continued)

Section Number and Heading	Contents
`[5] Control Blocks Associated with the Thread`	Lists the contents of the thread synchronization queue element (SQEL).
`[6] Enclave Control Blocks`	If the POSIX runtime option was set to ON, this section lists the contents of the mutex and condition variable control blocks, the enclave level latch table, and the thread synchronization trace block and trace table. If the HEAPCHK runtime option is set to ON, this section lists the contents of the HEAPCHK options control block (HCOP) and the HEAPCHK element tables (HCEL). A HEAPCHK element table contains the location and length of all allocated storage elements for a heap in the order that they were allocated.
`[7] Language Environment Trace Table`	If the TRACE runtime option was set to ON, this section shows the contents of the Language Environment trace table.
`[8] Process Control Blocks`	If the POSIX runtime option was set to ON, this section lists the contents of the process level latch table.
`[9] - [17] Summary:` These sections are included when the SUMMARY parameter is specified on the LEDATA invocation.	
`[9] Summary Header`	The summary header section contains: • Address of Thread control block (TCB) • Release number • Address Space ID (ASID)
`[10] Active Members List`	Lists active members, which is extracted from the enclave member list (MEML).
`[11] CEELAA`	Formats the contents of the Language Environment library anchor area (LAA). For more information about LAA, see Language Environment library anchor area in *z/OS Language Environment Vendor Interfaces*.
`[12] CEELCA`	Formats the contents of the Language Environment library control area (LCA). For more information about the LCA, see Language Environment common anchor area in *z/OS Language Environment Vendor Interfaces*.
`[13] CEECAA`	Formats the contents of the Language Environment common anchor area (CAA). See Language Environment common anchor area in *z/OS Language Environment Vendor Interfaces* for a description of the fields in the CAA. If there is any, DLL failure data is also formatted.
`[14] CEEPCB`	Formats the contents of the Language Environment process control block (PCB), and the process level member list.
`[15] CEERCB`	Formats the contents of the Language Environment region control block (RCB).
`[16] CEEEDB`	Formats the contents of the Language Environment enclave data block (EDB), and the enclave level member list.
`[17] Runtime Options`	Lists the runtime options in effect at the time of the dump, and indicates where they were set.
`[18] Heap Storage Control Blocks`	This section is included when the HEAP or SM parameter is specified on the LEDATA invocation. It formats the Enclave-level storage management control block (ENSQ) and for each different type of heap storage: • Heap control block (HPCQ) • Chain of heap anchor blocks (HANQ). A HANQ immediately precedes each segment of heap storage. This section includes a detailed heap segment report for each segment in the dump. For more information about the detailed heap segment report, see "Understanding the HEAP LEDATA output" on page 376.

Table 54. Contents of the Language Environment LEDATA VERBEXIT formatted output (AMODE 64) (continued)

Section Number and Heading	Contents
`[19] Stack Storage Control Blocks`	This section is included when the STACK or SM parameter is specified on the LEDATA invocation. This section formats: • Stack anchor (SANC) • Chain of dynamic save areas (DSA)
`[20] Condition Management Control Blocks`	This section is included when the CM parameter is specified on the LEDATA invocation. It formats the chain of Condition Information Block Headers (CIBH) and Condition Information Blocks. The Machine State Information Block is contained with the CIBH starting with the field labeled MCH_EYE.
`[21] Message Processing Control Blocks`	This section is included when the MH parameter is specified on the LEDATA invocation.
`[22] Preinitialization Information`	This section is included when the PTBL parameter is specified on the LEDATA invocation. It formats information related to preinitialization. See "PTBL LEDATA output" on page 375 for more information. If the preinitialization service CELQPIPI was not used to initialize this environment, the message: `No PIPICB associated with CAA` is displayed instead.

PTBL LEDATA output

The Language Environment IPCS VERBEXIT LEDATA command generates formatted output of PreInit tables when the PTBL or ALL parameter are specified. If ALL is specified, PTBL defaults to CURRENT value. Figure 184 on page 375 illustrates the output produced when the VERBEXIT LEDATA command is invoked with the PTBL parameter.

```
PTBL(CURRENT)
*********************************************************************************
                   64 BIT LANGUAGE ENVIRONMENT DATA
*********************************************************************************

 Language Environment Product 04 V01 R09.00

PreInitialization Programming Interface Trace Data
CELQPIPI Environment Table Entry and Trace Entry :
 Active CELQPIPI Environment (  Address 00000001_00010B80 )
 Eyecatcher  : CELQIPTB
 TCB address : 008D6E88

 CELQPIPI Environment :
  Environment Type : MAIN
  Sequence of Calls not active
  Exits not established
  Signal Interrupt Routines not registered
  Service Routines are not active

  CELQPIPI Environment Enclave Initialized
  Number of CELQPIPI Table Entries = 3

 CELQPIPI Table Entry Information :
 CELQPIPI Table Index 0  ( Entry 1   )
  Routine Name  = ISJPPCA3
  Routine Type  = C/C++
  Routine Entry Point  = 00000000_21053000
  Routine Function Pointer  = 00000000_210530C0
  Routine was loaded by Language Environment
  Routine Address was resolved
  Routine Function Descriptor was valid
  Routine was valid
  Routine Return Code    = 0
  Routine Reason Code    = 0

  Entry of routine in CELQPIPI Table for Index 0  ( 00000001_00010D38 )

   +000000 00000001_00010D38  00000000 00000000 00000000 210530C0 |................|
   +000010 00000001_00010D48  00000000 2105A808 80000000 00000000 |......y.........|
   +000020 00000001_00010D58  00000000 00000000 00000000 00000000 |................|
   +000030 00000001_00010D68 - +000000 00000001_00010D77            same as above
   +000040 00000001_00010D78  00000000 00000000 00000000 21053000 |................|
   +000050 00000001_00010D88  00000000 00000003 00000000 2105A908 |..............z.|
   +000060 00000001_00010D98  00000000 00000000 00000003 00000000 |................|
   +000070 00000001_00010DA8  00000000 21053000 00000000 21053000 |................|
   +000080 00000001_00010DB8  00009000 00000000 C9E2D1D7 D7C3C1F3 |........ISJPPCA3|
   +000090 00000001_00010DC8  40404040 40404040 00000000 00000000 |        ........|

 CELQPIPI Table Index 1  ( Entry 2   ) not in use.

 CELQPIPI Table Index 2  ( Entry 3   ) not in use.
```

Figure 184. Example of formatted PTBL output from LEDATA VERBEXIT (Part 1 of 2)

```
CELQPIPI Trace Table Entries :
 Call Type =  INIT_MAIN
  PIPI Driver Address  = 00000000_2090082A
  Load Service Return Code   = 0
  Load Service Reason Code   = 0
  Most Recent Return Code    = 0
  Most Recent Reason Code    = 0
  An ABEND will be issued if storage can not be obtained
  Service RC = 0 :A new environment was initialized.

 Call Type =  ADD_ENTRY
  Routine Table Index        = 1
  Routine Name  = ISJPPCA1
  Routine Address = 00000000_2105E000
  Load Service Return Code   = 0
  Load Service Reason Code   = 3
  Service RC = 0 :The routine was added to the PreInit table.

 Call Type =  IDENTIFY_ENTRY
  Routine Table Index        = 1
  Routine Programming Language  = C/C++
  Service RC = 0 :The programming language has been returned.

 Call Type =  CALL_MAIN
  Routine Table Index     = 1
  Enclave Return Code     = 0
  Enclave Reason Code     = 0
  Routine Feedback Code   = 0000000000000000
  Service RC = 0 :The environment was activated and the routine called.

 Call Type =  DELETE_ENTRY
  Routine Table Index     = 1
  Routine Name  = ISJPPCA1
  Routine Address = 00000000_2105E000
  Service RC = 0 :The routine was deleted from the PreInit table.

 Call Type =  CALL_MAIN
  Routine Table Index     = 0
  Enclave Return Code     = 0
  Enclave Reason Code     = 0
  Routine Feedback Code   = 0000000000000000
  Service RC = 0 :The environment was activated and the routine called.

Exiting Language Environment Data
```

Figure 185. Example of formatted PTBL output from LEDATA VERBEXIT (Part 2 of 2)

Understanding the HEAP LEDATA output

The Language Environment IPCS VERBEXIT LEDATA generates a detailed heap segment report when the HEAP option is used with the DETAIL option, or when the SM,DETAIL option is specified. The detailed heap segment report is useful when trying to pinpoint damage because it provides specific information. The report describes the nature of the damage, and specifies where the actual damage occurred. The report can also be used to diagnose storage leaks, and to identify heap fragmentation. Figure 186 on page 377 shows the output produced by specifying the HEAP option. “Heap report sections of the LEDATA output” on page 384 describes the information in the formatted output.

For easy reference, the sections of the dump are numbered to correspond with the description of each section that follows. Ellipses are used to summarize some sections of the dump.

Note: Language Environment does not provide support for alternative Vendor Heap Manager (VHM) data. LEDATA VERBEXIT will state that an alternative VHM is in use.

```
  HEAP
  ********************************************************************************
                     64 BIT LANGUAGE ENVIRONMENT DATA
  ********************************************************************************

   Language Environment Product 04 V01 R09.00

   Heap Storage Control Blocks

    Heappools trace available. To display: IP VERBX LEDATA 'HPT(*)'

       ENSQ:  00000001_00100108
     +000000  EYE_CATCHER:ENSQ  HEAPALLOC_VAL:00000000
     +000008  HEAPFREE_VAL:00000000   DSAALLOC_VAL:00000000   FLAGS1:80000000
     +000014  IPT_TOKEN:000000A0 00000002 00000016 007FF050
     +000024  HEAPLOCKWORD:00000000   RPT_STOR:00000001_00100410
     +000030  UHEAP64:C8D7C3D8 00000000 00000001 001005B0 00000001 001007F0 00000000 00000001 00
     +000060  LHEAP64:C8D7C3D8 00000000 00000001 001005E0 00000001 00100670 00000000 00000001 00
     +000090  UHEAP31:C8D7C3D8 00000000 00000001 00100198 00000001 00100198 00000000 00008000 00
     +0000C0  LHEAP31:C8D7C3D8 00000000 00000001 001007C0 00000001 001007C0 00000000 00004000 00
     +0000F0  UHEAP24:C8D7C3D8 00000000 00000001 001001F8 00000001 001001F8 00000000 00001000 00
     +000120  LHEAP24:C8D7C3D8 00000000 00000001 00100228 00000001 00100228 00000000 00002000 00
     +000174  IPT_TCB:007FF050        HEAPCHK:00000000_00000000
     +000188  STSB:00000000_00000000        SASB:00000000_00000000
     +000198  TOKEN:7F7547D8 00000000
     +0001A0  THDLHEAP64:C8D7C3D8 00000000 00000001 00100790 00000001 00100790 00000000 00000001 00
     +0001D0  IOHEAP64:C8D7C3D8 00000000 00000001 00100760 00000001 00100760 00000000 00000001 00
     +000200  IOHEAP31:C8D7C3D8 00000000 00000001 001006A0 00000001 001006A0 00000000 00003000 00
     +000230  IOHEAP24:C8D7C3D8 00000000 00000001 001006D0 00000001 001006D0 00000000 00001000 00
     +000260  SM_CELL_BLOCK:00000001_00100490     SPDE:00000001_00100730

   User Heap64 Control Blocks

       HPCQ:  00000001_00100138
     +000000  EYE_CATCHER:HPCQ  FIRST:00000001_001005B0       LAST:00000001_001007F0
     +000018  INITSIZE:00000000 00000001    INCRSIZE:00000000 00000001
     +00002C  OPTIONS:80000000

       HPSQ:  00000001_00005058
     +000000  BYTES_ALLOC:00000000 001C3320
     +000008  CURR_ALLOC:00000000 000CF080        GET_REQ:00000000 0000000D
     +000018  FREE_REQ:00000000 00000001    GETMAINS:00000000 00000001
     +000028  FREEMAINS:00000000 00000000

       THNQ:  00000001_001005B0
     +000000  EYE_CATCHER:THNQ  FLAGS:80000000    NEXT:00000001_001007F0
     +000010  PREV:00000001_00100138        HEAPID:00000001_00100138
     +000020  SEGMENT:00000001_08300000     SEG_LEN:00000000 00100000

       HANQ:  00000001_08300000
     +000000  EYE_CATCHER:HANQ  FLAGS:80000000    HEAPID:00000001_00100138
     +000020  SEGMENT:00000001_08300000     ROOT:00000001_083CF0C0
     +000030  SEG_LEN:00000000 00100000     ROOT_LEN:00000000 00030F40

[1]    Free Storage Tree for Heap Segment 0000000108300000

            Node             Node              Parent           Left             Right            Left             Right
Depth       Address          Length            Node             Node             Node             Length           Length
    0  00000001083CF0C0  0000000000030F40 0000000000000000 0000000000000000 0000000000000000 0000000000000000 0000000000000000
```

Figure 186. Example formatted detailed heap segment report from LEDATA VERBEXIT (AMODE 64) (Part 1 of 8)

The following is part two of the example formatted detailed heap segment report from LEDATA VERBEXIT (AMODE 64).

```
[2]    Map of Heap Segment 0000000108300000

     To display entire segment: IP LIST 0000000108300000 LEN(X'0000000000100000') ASID(X'0028')

     0000000108300040: Allocated storage element, length=0000000000000180.
    To display: IP LIST 0000000108300040 LEN(X'0000000000000180') ASID(X'0028')
     0000000108300050: C36DE6E2 C1F6F440 40404040 40404040  00000001 08300070 00000000 250005A8 |C_WSA64         ..............y|

     00000001083001C0: Allocated storage element, length=0000000000019660.
    To display: IP LIST 00000001083001C0 LEN(X'0000000000019660') ASID(X'0028')
     00000001083001D0: 00000000 00000005 00000000 00000005  00000001 08319840 00000001 08319A28 |.....................q ........|
⋮
     00000001083B79A0: Allocated storage element, length=0000000000017720.
    To display: IP LIST 00000001083B79A0 LEN(X'0000000000017720') ASID(X'0028')
     00000001083B79B0: 00000000 00000002 00000000 00000000  00000000 00000000 00000000 D3D4D9C5 |...........................LMRE|

     00000001083CF0C0: Free storage element, length=0000000000030F40.
    To display: IP LIST 00000001083CF0C0 LEN(X'0000000000030F40') ASID(X'0028')

     Summary of analysis for Heap Segment 0000000108300000:
        Amounts of identified storage:  Free:00030F40          Allocated:000CF080          Total:000FFFC0
        Number of identified areas   :  Free:       1  Allocated:      12  Total:      13
        00000000 bytes of storage were not accounted for.
        No errors were found while processing this heap segment.

         THNQ:  00000001_001007F0
       +000000  EYE_CATCHER:THNQ  FLAGS:00000000    NEXT:00000001_00100138
       +000010  PREV:00000001_001005B0        HEAPID:00000001_00100138
       +000020  SEGMENT:00000001_19C00000     SEG_LEN:00000000 00100000

         HANQ:  00000001_19C00000
       +000000  EYE_CATCHER:HANQ  FLAGS:00000000    HEAPID:00000001_00100138
       +000020  SEGMENT:00000001_19C00000     ROOT:00000001_19C00040
       +000030  SEG_LEN:00000000 00100000     ROOT_LEN:00000000 000FFFC0

         This is the last heap segment in the current heap

[1]    Free Storage Tree for Heap Segment 0000000119C00000

              Node             Node             Parent           Left             Right                Left             Right
     Depth     Address           Length            Node             Node             Node                Length           Length
         0  0000000119C00040  00000000000FFFC0  0000000000000000  0000000000000000  0000000000000000  0000000000000000  0000000000000000

[2]    Map of Heap Segment 0000000119C00000

     To display entire segment: IP LIST 0000000119C00000 LEN(X'0000000000100000') ASID(X'0028')

     0000000119C00040: Free storage element, length=00000000000FFFC0.
    To display: IP LIST 0000000119C00040 LEN(X'00000000000FFFC0') ASID(X'0028')

     Summary of analysis for Heap Segment 0000000119C00000:
        Amounts of identified storage:  Free:000FFFC0          Allocated:00000000          Total:000FFFC0
        Number of identified areas   :  Free:       1  Allocated:       0  Total:       1
        00000000 bytes of storage were not accounted for.
        No errors were found while processing this heap segment.
        This is the last heap segment in the current heap.

     Library Heap64 Control Blocks

         HPCQ:  00000001_00100168
       +000000  EYE_CATCHER:HPCQ  FIRST:00000001_001005E0       LAST:00000001_00100670
       +000018  INITSIZE:00000000 00000001    INCRSIZE:00000000 00000001
       +00002C  OPTIONS:90000000

         HPSQ:  00000001_000050E8
       +000000  BYTES_ALLOC:00000000 0067A940
       +000008  CURR_ALLOC:00000000 0067A840        GET_REQ:00000000 00000042
       +000018  FREE_REQ:00000000 00000003    GETMAINS:00000000 00000003
       +000028  FREEMAINS:00000000 00000000

         THNQ:  00000001_001005E0
       +000000  EYE_CATCHER:THNQ  FLAGS:80000000    NEXT:00000001_00100610
       +000010  PREV:00000001_00100168        HEAPID:00000001_00100168
       +000020  SEGMENT:00000001_08400000     SEG_LEN:00000000 00100000

         HANQ:  00000001_08400000
       +000000  EYE_CATCHER:HANQ  FLAGS:80000000    HEAPID:00000001_00100168
       +000020  SEGMENT:00000001_08400000     ROOT:00000001_08400040
       +000030  SEG_LEN:00000000 00100000     ROOT_LEN:00000000 000FFFC0
```

Figure 187. Example formatted detailed heap segment report from LEDATA VERBEXIT (AMODE 64) (Part 2 of 8)

The following is part three of the example formatted detailed heap segment report from LEDATA VERBEXIT (AMODE 64).

```
[1]    Free Storage Tree for Heap Segment 0000000108400000

                 Node              Node              Parent            Left              Right               Left              Right
     Depth      Address           Length             Node              Node              Node               Length            Length
         0  0000000108400040  00000000000FFFC0  0000000000000000  0000000000000000  0000000000000000  0000000000000000  0000000000000000

[2]    Map of Heap Segment 0000000108400000

     To display entire segment: IP LIST 0000000108400000 LEN(X'0000000000100000') ASID(X'0028')

     0000000108400040: Free storage element, length=00000000000FFFC0.
    To display: IP LIST 0000000108400040 LEN(X'00000000000FFFC0') ASID(X'0028')

     Summary of analysis for Heap Segment 0000000108400000:
        Amounts of identified storage:  Free:000FFFC0          Allocated:00000000          Total:000FFFC0
        Number of identified areas   :  Free:       1  Allocated:       0  Total:       1
        00000000 bytes of storage were not accounted for.
        No errors were found while processing this heap segment.

         THNQ:  00000001_00100610
       +000000  EYE_CATCHER:THNQ  FLAGS:00000000    NEXT:00000001_00100640
       +000010  PREV:00000001_001005E0        HEAPID:00000001_00100168
       +000020  SEGMENT:00000001_08800000     SEG_LEN:00000000 00200000

         HANQ:  00000001_08800000
       +000000  EYE_CATCHER:HANQ  FLAGS:00000000    HEAPID:00000001_00100168
       +000020  SEGMENT:00000001_08800000     ROOT:00000001_08943AC0
       +000030  SEG_LEN:00000000 00200000     ROOT_LEN:00000000 000BC540
[1]    Free Storage Tree for Heap Segment 0000000108800000

                 Node              Node              Parent            Left              Right               Left              Right
     Depth      Address           Length             Node              Node              Node               Length            Length
         0  0000000108943AC0  00000000000BC540  0000000000000000  0000000000000000  0000000000000000  0000000000000000  0000000000000000

[2]    Map of Heap Segment 0000000108800000

     To display entire segment: IP LIST 0000000108800000 LEN(X'0000000000200000') ASID(X'0028')

     0000000108800040: Allocated storage element, length=0000000000100040.
    To display: IP LIST 0000000108800040 LEN(X'0000000000100040') ASID(X'0028')
     0000000108800050: C003F3EE 2540A23A 253E0190 00000000  03000000 00000005 94818995 40404040 |..3.. s................main    |

     0000000108900080: Allocated storage element, length=00000000000132A0.
    To display: IP LIST 0000000108900080 LEN(X'00000000000132A0') ASID(X'0028')
     0000000108900090: 00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000 |................................|

⋮
     0000000108943600: Allocated storage element, length=00000000000004C0.
    To display: IP LIST 0000000108943600 LEN(X'00000000000004C0') ASID(X'0028')
     0000000108943610: D8D7C3C2 000004B0 0000000C 00010000  00000001 00000000 00000001 08E00050 |QPCB..........................&|

     0000000108943AC0: Free storage element, length=00000000000BC540.
    To display: IP LIST 0000000108943AC0 LEN(X'00000000000BC540') ASID(X'0028')

     Summary of analysis for Heap Segment 0000000108800000:
        Amounts of identified storage:  Free:000BC540          Allocated:00143A80          Total:001FFFC0
        Number of identified areas   :  Free:       1  Allocated:       8  Total:       9
        00000000 bytes of storage were not accounted for.
        No errors were found while processing this heap segment.

         THNQ:  00000001_00100640
       +000000  EYE_CATCHER:THNQ  FLAGS:00000000    NEXT:00000001_00100670
       +000010  PREV:00000001_00100610        HEAPID:00000001_00100168
       +000020  SEGMENT:00000001_08A00000     SEG_LEN:00000000 00400000
         HANQ:  00000001_08A00000

       +000000  EYE_CATCHER:HANQ  FLAGS:00000000    HEAPID:00000001_00100168
       +000020  SEGMENT:00000001_08A00000     ROOT:00000001_08D48340
       +000030  SEG_LEN:00000000 00400000     ROOT_LEN:00000000 000B7CC0
```

Figure 188. Example formatted detailed heap segment report from LEDATA VERBEXIT (AMODE 64) (Part 3 of 8)

The following is part four of the example formatted detailed heap segment report from LEDATA VERBEXIT (AMODE 64).

```
[1]    Free Storage Tree for Heap Segment 0000000108A00000

                Node              Node              Parent            Left              Right               Left              Right
     Depth      Address           Length            Node              Node              Node                Length            Length
         0  0000000108D48340  00000000000B7CC0  0000000000000000  0000000000000000  0000000000000000  0000000000000000  0000000000000000

[2]    Map of Heap Segment 0000000108A00000

     To display entire segment: IP LIST 0000000108A00000 LEN(X'0000000000400000') ASID(X'0028')

     0000000108A00040: Allocated storage element, length=0000000000348300.
    To display: IP LIST 0000000108A00040 LEN(X'0000000000348300') ASID(X'0028')
     0000000108A00050: C8D7E3C1 0000000C 00046030 000000F0  00000001 08A000C8 00000001 08A460F8 |HPTA......-....0.......H.....u-8|

     0000000108D48340: Free storage element, length=00000000000B7CC0.
    To display: IP LIST 0000000108D48340 LEN(X'00000000000B7CC0') ASID(X'0028')

     Summary of analysis for Heap Segment 0000000108A00000:
        Amounts of identified storage:  Free:000B7CC0          Allocated:00348300          Total:003FFFC0
        Number of identified areas   :  Free:       1  Allocated:       1  Total:       2
        00000000 bytes of storage were not accounted for.
        No errors were found while processing this heap segment.

         THNQ:  00000001_00100670
       +000000  EYE_CATCHER:THNQ  FLAGS:00000000    NEXT:00000001_00100168
       +000010  PREV:00000001_00100640        HEAPID:00000001_00100168
       +000020  SEGMENT:00000001_08E00000     SEG_LEN:00000000 00200000

         HANQ:  00000001_08E00000
       +000000  EYE_CATCHER:HANQ  FLAGS:00000000    HEAPID:00000001_00100168
       +000020  SEGMENT:00000001_08E00000     ROOT:00000001_08FEEC20
       +000030  SEG_LEN:00000000 00200000     ROOT_LEN:00000000 000113E0

         This is the last heap segment in the current heap

[1]    Free Storage Tree for Heap Segment 0000000108E00000

                Node              Node              Parent            Left              Right               Left              Right
     Depth      Address           Length            Node              Node              Node                Length            Length
         0  0000000108FEEC20  00000000000113E0  0000000000000000  0000000108FEE960  0000000000000000  0000000000000120  0000000000000000
         1  0000000108FEE960  0000000000000120  0000000108FEEC20  0000000000000000  0000000000000000  0000000000000000  0000000000000000

[2]    Map of Heap Segment 0000000108E00000

     To display entire segment: IP LIST 0000000108E00000 LEN(X'0000000000200000') ASID(X'0028')

     0000000108E00040: Allocated storage element, length=00000000001C0040.
    To display: IP LIST 0000000108E00040 LEN(X'00000000001C0040') ASID(X'0028')
     0000000108E00050: 00000000 00000002 00000000 00000000  00000000 00000001 00000000 00000000 |................................|

     0000000108FC0080: Allocated storage element, length=0000000000003EC0.
    To display: IP LIST 0000000108FC0080 LEN(X'0000000000003EC0') ASID(X'0028')
     0000000108FC0090: C8C3C5D3 00000000 00000000 00000000  00000000 00000000 00000001 00100138 |HCEL............................|
⋮
     0000000108FEEA80: Allocated storage element, length=00000000000001A0.
    To display: IP LIST 0000000108FEEA80 LEN(X'00000000000001A0') ASID(X'0028')
     0000000108FEEA90: 00000000 25462598 00000000 00000000  C3C5D3D8 D3C9C240 00000008 C3C5D3D8 |.......q........CELQLIB ....CELQ|

     0000000108FEEC20: Free storage element, length=00000000000113E0.
    To display: IP LIST 0000000108FEEC20 LEN(X'00000000000113E0') ASID(X'0028')

     Summary of analysis for Heap Segment 0000000108E00000:
        Amounts of identified storage:  Free:00011500          Allocated:001EEAC0          Total:001FFFC0
        Number of identified areas   :  Free:       2  Allocated:      54  Total:      56
        00000000 bytes of storage were not accounted for.
        No errors were found while processing this heap segment.
        This is the last heap segment in the current heap.

    User Heap31 Control Blocks

         HPCQ:  00000001_00100198
       +000000  EYE_CATCHER:HPCQ  FIRST:00000001_00100198       LAST:00000001_00100198
       +000018  INITSIZE:00000000 00008000    INCRSIZE:00000000 00008000
       +00002C  OPTIONS:40000000
```

Figure 189. Example formatted detailed heap segment report from LEDATA VERBEXIT (AMODE 64) (Part 4 of 8)

The following is part five of the example formatted detailed heap segment report from LEDATA VERBEXIT (AMODE 64).

```
            ** NO SEGMENTS ALLOCATED **
       HPSQ:  00000001_00005088
     +000000  BYTES_ALLOC:00000000 00000000
     +000008  CURR_ALLOC:00000000 00000000        GET_REQ:00000000 00000000
     +000018  FREE_REQ:00000000 00000000    GETMAINS:00000000 00000000
     +000028  FREEMAINS:00000000 00000000

   Library Heap31 Control Blocks

       HPCQ:  00000001_001001C8
     +000000  EYE_CATCHER:HPCQ  FIRST:00000001_001007C0       LAST:00000001_001007C0
     +000018  INITSIZE:00000000 00004000    INCRSIZE:00000000 00002000
     +00002C  OPTIONS:50000000

       HPSQ:  00000001_00005118
     +000000  BYTES_ALLOC:00000000 00001128
     +000008  CURR_ALLOC:00000000 00001128        GET_REQ:00000000 00000001
     +000018  FREE_REQ:00000000 00000000    GETMAINS:00000000 00000001
     +000028  FREEMAINS:00000000 00000000

       THNQ:  00000001_001007C0
     +000000  EYE_CATCHER:THNQ  FLAGS:00000000    NEXT:00000001_001001C8
     +000010  PREV:00000001_001001C8        HEAPID:00000001_001001C8
     +000020  SEGMENT:00000000_25773000     SEG_LEN:00000000 00004000

       HANQ:  00000000_25773000
     +000000  EYE_CATCHER:HANQ  FLAGS:00000000    HEAPID:00000001_001001C8
     +000020  SEGMENT:25773000        ROOT:25774168     SEG_LEN:00004000
     +00002C  ROOT_LEN:00002E98

       This is the last heap segment in the current heap

[1]    Free Storage Tree for Heap Segment 25773000

            Node      Node     Parent     Left      Right     Left     Right
   Depth  Address    Length     Node      Node      Node     Length    Length
       0  25774168  00002E98  00000000  00000000  00000000  00000000  00000000

[2]    Map of Heap Segment 25773000

   To display entire segment: IP LIST 25773000 LEN(X'00004000') ASID(X'0028')

   25773040: Allocated storage element, length=00001128. To display: IP LIST 25773040 LEN(X'00001128') ASID(X'0028')
   25773048: 00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000 |................................|

   25774168: Free storage element, length=00002E98. To display: IP LIST 25774168 LEN(X'00002E98') ASID(X'0028')

   Summary of analysis for Heap Segment 25773000:
      Amounts of identified storage:  Free:00002E98  Allocated:00001128  Total:00003FC0
      Number of identified areas   :  Free:       1  Allocated:       1  Total:       2
      00000000 bytes of storage were not accounted for.
      No errors were found while processing this heap segment.
      This is the last heap segment in the current heap.

   User Heap24 Control Blocks

       HPCQ:  00000001_001001F8
     +000000  EYE_CATCHER:HPCQ  FIRST:00000001_001001F8       LAST:00000001_001001F8
     +000018  INITSIZE:00000000 00001000    INCRSIZE:00000000 00001000
     +00002C  OPTIONS:30000000

            ** NO SEGMENTS ALLOCATED **
       HPSQ:  00000001_000050B8
     +000000  BYTES_ALLOC:00000000 00000000
     +000008  CURR_ALLOC:00000000 00000000        GET_REQ:00000000 00000000
     +000018  FREE_REQ:00000000 00000000    GETMAINS:00000000 00000000
     +000028  FREEMAINS:00000000 00000000

  Library Heap24 Control Blocks

       HPCQ:  00000001_00100228
     +000000  EYE_CATCHER:HPCQ  FIRST:00000001_00100228       LAST:00000001_00100228
     +000018  INITSIZE:00000000 00002000    INCRSIZE:00000000 00001000
     +00002C  OPTIONS:30000000
```

Figure 190. Example formatted detailed heap segment report from LEDATA VERBEXIT (AMODE 64) (Part 5 of 8)

The following is part six of the example formatted detailed heap segment report from LEDATA VERBEXIT (AMODE 64).

```
              ** NO SEGMENTS ALLOCATED **
       HPSQ:  00000001_00005148
     +000000  BYTES_ALLOC:00000000 00000000
     +000008  CURR_ALLOC:00000000 00000000        GET_REQ:00000000 00000000
     +000018  FREE_REQ:00000000 00000000    GETMAINS:00000000 00000000
     +000028  FREEMAINS:00000000 00000000

   Library Thread Heap64 Control Blocks

       HPCQ:  00000001_001002A8
     +000000  EYE_CATCHER:HPCQ  FIRST:00000001_00100790       LAST:00000001_00100790
     +000018  INITSIZE:00000000 00000001    INCRSIZE:00000000 00000001
     +00002C  OPTIONS:90000000

       HPSQ:  00000001_00005208
     +000000  BYTES_ALLOC:00000000 00000340
     +000008  CURR_ALLOC:00000000 00000340        GET_REQ:00000000 00000001
     +000018  FREE_REQ:00000000 00000000    GETMAINS:00000000 00000001
     +000028  FREEMAINS:00000000 00000000

       THNQ:  00000001_00100790
     +000000  EYE_CATCHER:THNQ  FLAGS:00000000    NEXT:00000001_001002A8
     +000010  PREV:00000001_001002A8        HEAPID:00000001_001002A8
     +000020  SEGMENT:00000001_19B00000     SEG_LEN:00000000 00100000

       HANQ:  00000001_19B00000
     +000000  EYE_CATCHER:HANQ  FLAGS:00000000    HEAPID:00000001_001002A8
     +000020  SEGMENT:00000001_19B00000     ROOT:00000001_19B00380
     +000030  SEG_LEN:00000000 00100000     ROOT_LEN:00000000 000FFC80

       This is the last heap segment in the current heap

[1]    Free Storage Tree for Heap Segment 0000000119B00000

               Node              Node             Parent            Left             Right                Left              Right
   Depth      Address           Length             Node             Node             Node                Length             Length
       0  0000000119B00380  00000000000FFC80  0000000000000000  0000000000000000  0000000000000000  0000000000000000  0000000000000000

[2]    Map of Heap Segment 0000000119B00000

   To display entire segment: IP LIST 0000000119B00000 LEN(X'0000000000100000') ASID(X'0028')

   0000000119B00040: Allocated storage element, length=0000000000000340.
  To display: IP LIST 0000000119B00040 LEN(X'0000000000000340') ASID(X'0028')
   0000000119B00050: D7C3C9C2 00000000 00000000 00000000  00000000 00000000 00010310 00000000 |PCIB............................|

   0000000119B00380: Free storage element, length=00000000000FFC80.
  To display: IP LIST 0000000119B00380 LEN(X'00000000000FFC80') ASID(X'0028')

   Summary of analysis for Heap Segment 0000000119B00000:
      Amounts of identified storage:  Free:000FFC80          Allocated:00000340          Total:000FFFC0
      Number of identified areas   :  Free:       1  Allocated:       1  Total:       2
      00000000 bytes of storage were not accounted for.
      No errors were found while processing this heap segment.
      This is the last heap segment in the current heap.

   I/O Heap64 Control Blocks

       HPCQ:  00000001_001002D8
     +000000  EYE_CATCHER:HPCQ  FIRST:00000001_00100760       LAST:00000001_00100760
     +000018  INITSIZE:00000000 00000001    INCRSIZE:00000000 00000001
     +00002C  OPTIONS:90000000

       HPSQ:  00000001_00005178
     +000000  BYTES_ALLOC:00000000 00010380
     +000008  CURR_ALLOC:00000000 00010380        GET_REQ:00000000 00000003
     +000018  FREE_REQ:00000000 00000000    GETMAINS:00000000 00000001
     +000028  FREEMAINS:00000000 00000000

       THNQ:  00000001_00100760
     +000000  EYE_CATCHER:THNQ  FLAGS:00000000    NEXT:00000001_001002D8
     +000010  PREV:00000001_001002D8        HEAPID:00000001_001002D8
     +000020  SEGMENT:00000001_19A00000     SEG_LEN:00000000 00100000

        HANQ:  00000001_19A00000
     +000000  EYE_CATCHER:HANQ  FLAGS:00000000    HEAPID:00000001_001002D8
     +000020  SEGMENT:00000001_19A00000     ROOT:00000001_19A103C0
     +000030  SEG_LEN:00000000 00100000     ROOT_LEN:00000000 000EFC40

       This is the last heap segment in the current heap
```

Figure 191. Example formatted detailed heap segment report from LEDATA VERBEXIT (AMODE 64) (Part 6 of 8)

The following is part seven of the example formatted detailed heap segment report from LEDATA VERBEXIT (AMODE 64).

```
 [1]    Free Storage Tree for Heap Segment 0000000119A00000

                Node              Node              Parent            Left              Right                 Left              Right
     Depth      Address           Length            Node              Node              Node                  Length            Length
         0  0000000119A103C0  00000000000EFC40  0000000000000000  0000000000000000  0000000000000000  0000000000000000  0000000000000000

[2]    Map of Heap Segment 0000000119A00000

     To display entire segment: IP LIST 0000000119A00000 LEN(X'0000000000100000') ASID(X'0028')

     0000000119A00040: Allocated storage element, length=0000000000000300.
    To display: IP LIST 0000000119A00040 LEN(X'0000000000000300') ASID(X'0028')
     0000000119A00050: 00000001 19A00120 00000000 00000001  00000000 00000000 00000000 00000000 |................................|

     0000000119A00340: Allocated storage element, length=0000000000000060.
    To display: IP LIST 0000000119A00340 LEN(X'0000000000000060') ASID(X'0028')
     0000000119A00350: 94859496 99A84B84 81A38100 00000000  00000000 00000000 00000000 00000000 |memory.data.....................|

     0000000119A003A0: Allocated storage element, length=0000000000010020.
    To display: IP LIST 0000000119A003A0 LEN(X'0000000000010020') ASID(X'0028')
     0000000119A003B0: A2969485 408481A3 81A29694 85409496  99854084 81A38185 A5859540 94969985 |some datasome more dataeven more|

     0000000119A103C0: Free storage element, length=00000000000EFC40.
    To display: IP LIST 0000000119A103C0 LEN(X'00000000000EFC40') ASID(X'0028')

     Summary of analysis for Heap Segment 0000000119A00000:
        Amounts of identified storage:  Free:000EFC40          Allocated:00010380          Total:000FFFC0
        Number of identified areas   :  Free:       1  Allocated:       3  Total:       4
        00000000 bytes of storage were not accounted for.
        No errors were found while processing this heap segment.
        This is the last heap segment in the current heap.

     I/O Heap31 Control Blocks

         HPCQ:  00000001_00100308
       +000000  EYE_CATCHER:HPCQ  FIRST:00000001_001006A0       LAST:00000001_001006A0
       +000018  INITSIZE:00000000 00003000    INCRSIZE:00000000 00002000
       +00002C  OPTIONS:50000000

         HPSQ:  00000001_000051A8
       +000000  BYTES_ALLOC:00000000 00002490
       +000008  CURR_ALLOC:00000000 00002490        GET_REQ:00000000 0000000E
       +000018  FREE_REQ:00000000 00000000    GETMAINS:00000000 00000001
       +000028  FREEMAINS:00000000 00000000

         THNQ:  00000001_001006A0
       +000000  EYE_CATCHER:THNQ  FLAGS:00000000    NEXT:00000001_00100308
       +000010  PREV:00000001_00100308        HEAPID:00000001_00100308
       +000020  SEGMENT:00000000_25757000     SEG_LEN:00000000 00003000

         HANQ:  00000000_25757000
       +000000  EYE_CATCHER:HANQ  FLAGS:00000000    HEAPID:00000001_00100308
       +000020  SEGMENT:25757000        ROOT:257594D0     SEG_LEN:00003000
       +00002C  ROOT_LEN:00000B30

     This is the last heap segment in the current heap

[1]    Free Storage Tree for Heap Segment 25757000

             Node      Node     Parent     Left      Right     Left     Right
     Depth  Address    Length     Node      Node      Node     Length    Length
         0  257594D0  00000B30  00000000  00000000  00000000  00000000  00000000

[2]    Map of Heap Segment 25757000

     To display entire segment: IP LIST 25757000 LEN(X'00003000') ASID(X'0028')

     25757040: Allocated storage element, length=00000388. To display: IP LIST 25757040 LEN(X'00000388') ASID(X'0028')
     25757048: 00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000 |................................|

     257573C8: Allocated storage element, length=00000070. To display: IP LIST 257573C8 LEN(X'00000070') ASID(X'0028')

     257573D0: D6E2C9D6 00007048 00000000 000077F0  000078A8 00000001 00000001 FFFFFFFF |OSIO...........0...y............|

     25757438: Allocated storage element, length=00000040. To display: IP LIST 25757438 LEN(X'00000040') ASID(X'0028')
     25757440: C4C3C2C5 00380000 00007048 00000000  C0880000 80000000 00000000 00000000 |DCBE.............h..............|
⋮
```

Figure 192. Example formatted detailed heap segment report from LEDATA VERBEXIT (AMODE 64) (Part 7 of 8)

The following is part eight of the example formatted detailed heap segment report from LEDATA VERBEXIT (AMODE 64).

```
  257590C8: Allocated storage element, length=00000370. To display: IP LIST 257590C8 LEN(X'00000370') ASID(X'0028')
     257590D0: C1C6C3C2 00000000 00000000 257590F8  AFCBAFCB 00000000 00000001 08371120 |AFCB...........8................|

     25759438: Allocated storage element, length=00000098. To display: IP LIST 25759438 LEN(X'00000098') ASID(X'0028')
     25759440: 007D0000 40404040 40404040 4040F0F0  F0F0F0F0 F0F0F2F5 F7F5C2F5 C5F04B84 |.'..          000000002575B5E0.d|

     257594D0: Free storage element, length=00000B30. To display: IP LIST 257594D0 LEN(X'00000B30') ASID(X'0028')

     Summary of analysis for Heap Segment 25757000:
        Amounts of identified storage:  Free:00000B30  Allocated:00002490  Total:00002FC0
        Number of identified areas   :  Free:       1  Allocated:      14  Total:      15
        00000000 bytes of storage were not accounted for.
        No errors were found while processing this heap segment.
        This is the last heap segment in the current heap.

     I/O Heap24 Control Blocks

         HPCQ:  00000001_00100338
       +000000  EYE_CATCHER:HPCQ  FIRST:00000001_001006D0       LAST:00000001_001006D0
       +000018  INITSIZE:00000000 00001000    INCRSIZE:00000000 00001000
       +00002C  OPTIONS:30000000

         HPSQ:  00000001_000051D8
       +000000  BYTES_ALLOC:00000000 00000B10
       +000008  CURR_ALLOC:00000000 00000B10        GET_REQ:00000000 0000000A
       +000018  FREE_REQ:00000000 00000000    GETMAINS:00000000 00000001
       +000028  FREEMAINS:00000000 00000000

         THNQ:  00000001_001006D0
       +000000  EYE_CATCHER:THNQ  FLAGS:00000000    NEXT:00000001_00100338
       +000010  PREV:00000001_00100338        HEAPID:00000001_00100338
       +000020  SEGMENT:00000000_00007000     SEG_LEN:00000000 00001000

         HANQ:  00000000_00007000
       +000000  EYE_CATCHER:HANQ  FLAGS:00000000    HEAPID:00000001_00100338
       +000020  SEGMENT:00007000        ROOT:00007B50     SEG_LEN:00001000
       +00002C  ROOT_LEN:000004B0

         This is the last heap segment in the current heap

[1]    Free Storage Tree for Heap Segment 00007000

             Node      Node     Parent     Left      Right     Left     Right
     Depth  Address    Length    Node      Node      Node     Length    Length
         0  00007B50  000004B0  00000000  00000000  00000000  00000000  00000000

[2]    Map of Heap Segment 00007000

     To display entire segment: IP LIST 00007000 LEN(X'00001000') ASID(X'0028')

     00007040: Allocated storage element, length=00000088. To display: IP LIST 00007040 LEN(X'00000088') ASID(X'0028')
     00007048: 25757440 00000000 00000000 0B000000  00020000 01008FF0 03724000 00006DD8 |... ...................0.. ..._Q|

     000070C8: Allocated storage element, length=00000248. To display: IP LIST 000070C8 LEN(X'00000248') ASID(X'0028')
     000070D0: 00000000 00000000 00000000 00000000  00000000 00000000 00000000 00000000 |................................|

     00007310: Allocated storage element, length=000004D8. To display: IP LIST 00007310 LEN(X'000004D8') ASID(X'0028')
     00007318: EBECD008 0024B909 00FFB904 00B1E3E0  10000004 E3E0E000 00040530 89E00002 |..............T.....T.......i...|
⋮
     00007B18: Allocated storage element, length=00000038. To display: IP LIST 00007B18 LEN(X'00000038') ASID(X'0028')
     00007B20: 00007B20 25759440 00000000 0000007D  00000000 00000000 00000000 00000000 |..#...m .......'................|

     00007B50: Free storage element, length=000004B0. To display: IP LIST 00007B50 LEN(X'000004B0') ASID(X'0028')
      Summary of analysis for Heap Segment 00007000:
        Amounts of identified storage:  Free:000004B0  Allocated:00000B10  Total:00000FC0
        Number of identified areas   :  Free:       1  Allocated:      10  Total:      11
        00000000 bytes of storage were not accounted for.
        No errors were found while processing this heap segment.
        This is the last heap segment in the current heap.

    Exiting Language Environment Data
```

Figure 193. Example formatted detailed heap segment report from LEDATA VERBEXIT (AMODE 64) (Part 8 of 8)

Heap report sections of the LEDATA output

The Heap Report sections of the LEDATA output provide information for each heap segment in the dump. The detailed heap segment reports include information on the free storage tree in the heap segments, the allocated storage elements, and the cause of heap management data structure problems.

Table 55. Contents of Heap report sections of the LEDATA output (AMODE 64)

Section Number and Heading	Contents
[1] `Free Storage Tree Report`	Within each heap segment, Language Environment keeps track of unallocated storage areas by chaining them together into a tree. Each free area represents a node in the tree. Each node contains a header, which points to its left and right child nodes. The header also contains the length of each child. The LEDATA HEAP option formats the free storage tree within each heap, and validates all node addresses and lengths within each node. Each node address is validated to ensure that it: • Falls on a doubleword boundary • Falls within the current heap segment • Does not point to itself • Does not point to a node that was previously traversed Each node length is validated to ensure that it: • Is a multiple of 8 • Is not larger than the heap segment length • Does not cause the end of the node to fall outside of the current heap segment • Does not cause the node to overlap another node If the formatter finds a problem, then it will place an error message describing the problem directly after the formatted line of the node that failed validation
[2] `Heap Segment Map Report`	The LEDATA HEAP option produces a report that lists all of the storage areas within each heap segment, and identifies the area as either allocated or freed. For each allocated area the contents of the first X'20' bytes of the area are displayed in order to help identify the reason for the storage allocation.Each allocated storage element has a prefix used by Language Environment to manage the area. The prefix contains a pointer to the start of the heap segment followed by the length of the allocated storage element. For HEAP64 heaps, the prefix is 16 bytes, with 8-byte pointer and length fields. For HEAP31 and HEAP24 heaps, the pointer is 8 bytes with 4-byte pointer and length field. The formatter validates this header to ensure that its heap segment pointer is valid. The length is also validated to ensure that it: • Is a multiple of 8 • Is not zero • Is not larger than the heap segment length • Does not cause the end of the element to fall outside of the current heap segment • Does not cause the element to overlap a free storage node If the heap_free_value of the STORAGE runtime option was specified, then the formatter also checks that the free storage within each free storage element is set to the requested heap_free_value. If a problem is found, then an error message describing the problem is placed after the formatted line of the storage element that failed validation.

Diagnosing heap damage problems

Heap storage errors can occur when an application allocates a heap storage element that is too small for it to use, and therefore, accidentally overlays heap storage. If this situation occurs, then some of the typical error messages that are generated are:

- The node address does not represent a valid node within the heap segment
- The length of the segment is not valid, or
- The heap segment pointer is not valid.

If one of these error messages is generated by one of the reports, then examine the storage element that immediately precedes the damaged node to determine whether this storage element is owned by the application program. Check the size of the storage element and ensure that it is sufficient for the program's use. If the size of the storage element is not sufficient, then adjust the allocation size.

If an error occurs indicating that the node's pointers form a circular loop within the free storage tree, then check the Free Storage Tree Report to see whether such a loop exists. If a loop exists, then contact the IBM support center for assistance because this may be a problem in the Language Environment heap management routines.

Additional diagnostic information regarding heap damage can be obtained by using the HEAPCHK runtime option. This option provides a more accurate time perspective on when the heap damage actually occurred, which could help to determine the program that caused the damage. For more information about HEAPCHK, see HEAPCHK in *z/OS Language Environment Programming Reference*.

Diagnosing storage leak problems

A storage leak occurs when a program does not return storage back to the heap after it has finished using it. To determine if this problem exists, do one of the following:

- The *call-level* suboption of the HEAPCHK runtime option causes a report to be produced in the CEEDUMP. Any still-allocated (that is, not freed) storage identified by HEAPCHK is listed in the report, along with the corresponding traceback. This shows any storage that wasn't freed, as well as all the calls that were involved in allocating the storage. For more information about the HEAPCHK runtime option, see HEAPCHK in *z/OS Language Environment Programming Reference*.
- Examine the Heap Segment Map report to see if any data areas, within the allocated storage elements, appear more frequently than expected. If they do, then check to see if these data areas are still being used by the application program. If the data areas are not being used, then change the program to free the storage element after it is done with it.

Diagnosing heap fragmentation problems

Heap fragmentation occurs when allocated storage is interlaced with many free storage areas that are too small for the application to use. Heap fragmentation could indicate that the application is not making efficient use of its heap storage. Check the Heap Segment Map report for frequent free storage elements that are interspersed with the allocated storage elements.

Understanding the heap pool LEDATA output

The Language Environment IPCS VERBEXIT LEDATA generates a detailed heap pool report when HEAPPOOLS is ON. The detailed heap pool report is useful when trying to find potential damaged cells because it provides very specific information.Figure 194 on page 387 illustrates the details of heap pool report. “Heap pool report sections of the LEDATA output” on page 391 describes the information contained in the formatted output.

```
Heap Pool Report
    QPCB:  00000008_08733600
  +000000  EYECATCHER:QPCB   LENGTH:00001800   NUMPOOLS:00000010
  +00000C  LARGEST_CELL_SIZE:00010000    BIG_REQUESTS:00000000
  +000018  STORAGE_HITS_ADDR:00000000_00000000       FLAGS:0400
  +000022  NUMGETARRAYS:05   NUMCELLSIZES:0C
  +000028  GET_POOLINFO_ARRAYS_PTR:00000008_08733800

  Data for pool 1:
POOLDATA:  00000008_08733D00
  +000000  POOL_INDEX:00000001     INPUT_CELL_SIZE:00000008
  +000008  CELL_SIZE:00000020      INPUT_COUNT:0000000A
  +000010  CELL_POOL_SIZE:00000140       CELL_POOL_NUM:0000000A
  +000018  POOL_LATCH_ADDR:00000008_087117E0   POOL_EXTENTS:00000001
  +000028  LAST_CELL:00000008_0862E680   NEXT_CELL:00000008_0862E580
  +000040  Q_CONTROL_INFO:00000000 00000005    Q_FIRST_CELL:00000008_0862E560
  +000050  POOL_NUM_GET_TOTAL:00000000 00000003
  +000058  POOL_NUM_FREE:00000000 00000001     POOL_EXTENTS_ANCHOR:00000008_0862E550
  +000068  POOL_INDEX_SAME_SIZE:01       POOL_INDEX_SIZE:01
  +00006A  POOL_NUM_SAME_SIZE:01   POOL_TRACE_TABLE:00000008_088000E0
    [2]Heap Pool Extent Mapping
EXTENT:  00000008_0862E550
  +000000  EYE_CATCHER:EX64  NEXT_EXTENT:00000000_00000000
    To display entire pool extent: IP LIST 000000080862E550 LEN(X'00000150') ASID(X'0021')
    000000080862E560: Free storage cell. To display: IP LIST 000000080862E560 LEN(X'00000020') ASID(X'0021')
    [1]Verifying free chain for pool: 1...
       No errors were found while processing free chain.
    Summary of analysis for Pool 1:
       Number of cells:  Unused:       9  Free:       1  Allocated:       0  Total Used:       10
       00000000 free cells were not accounted for.
       No errors were found while processing this Pool.

  Data for pool 2:
POOLDATA:  00000008_08733E00
  +000000  POOL_INDEX:00000002     INPUT_CELL_SIZE:00000020
  +000008  CELL_SIZE:00000030      INPUT_COUNT:00000004
  +000010  CELL_POOL_SIZE:000000C0       CELL_POOL_NUM:00000004
  +000018  POOL_LATCH_ADDR:00000008_08711808   POOL_EXTENTS:00000001
  +000028  LAST_CELL:00000008_0862E750   NEXT_CELL:00000008_0862E6F0
  +000040  Q_CONTROL_INFO:00000000 00000005    Q_FIRST_CELL:00000008_0862E6C0
  +000050  POOL_NUM_GET_TOTAL:00000000 00000003
  +000058  POOL_NUM_FREE:00000000 00000001     POOL_EXTENTS_ANCHOR:00000008_0862E6B0
  +000068  POOL_INDEX_SAME_SIZE:01       POOL_INDEX_SIZE:02
  +00006A  POOL_NUM_SAME_SIZE:01   POOL_TRACE_TABLE:00000008_08846110
  [2]Heap Pool Extent Mapping
  EXTENT:  00000008_0862E6B0
  +000000  EYE_CATCHER:EX64  NEXT_EXTENT:00000000_00000000
    To display entire pool extent: IP LIST 000000080862E6B0 LEN(X'000000D0') ASID(X'0021')
    000000080862E6C0: Free storage cell. To display: IP LIST 000000080862E6C0 LEN(X'00000030') ASID(X'0021')
  [1]Verifying free chain for pool: 2...
No errors were found while processing free chain.
    Summary of analysis for Pool 2:
       Number of cells:  Unused:       3  Free:       1  Allocated:       0  Total Used:       4
       00000000 free cells were not accounted for.
       No errors were found while processing this Pool.

  Data for pool 3:
POOLDATA:  00000008_08733F00
  +000000  POOL_INDEX:00000003     INPUT_CELL_SIZE:00000080
  +000008  CELL_SIZE:00000090      INPUT_COUNT:00000004
  +000010  CELL_POOL_SIZE:00000240       CELL_POOL_NUM:00000004
  +000018  POOL_LATCH_ADDR:00000008_08711830   POOL_EXTENTS:00000002
  +000028  LAST_CELL:00000008_0862E950   NEXT_CELL:00000008_0862E950
  +000040  Q_CONTROL_INFO:00000000 00000010    Q_FIRST_CELL:00000008_0862E830
  +000050  POOL_NUM_GET_TOTAL:00000000 0000000E
  +000058  POOL_NUM_FREE:00000000 00000002     POOL_EXTENTS_ANCHOR:00000008_0862E790
  +000068  POOL_INDEX_SAME_SIZE:01       POOL_INDEX_SIZE:03
  +00006A  POOL_NUM_SAME_SIZE:01   POOL_TRACE_TABLE:00000008_0888C140
```

Figure 194. Example formatted detailed heap pool report from LEDATA VERBEXIT (AMODE 64) (Part 1 of 5)

The following is part two of the example formatted detailed heap pool report from LEDATA VERBEXIT (AMODE 64).

```
[2]Heap Pool Extent Mapping
  EXTENT:  00000008_0862E790
  +000000  EYE_CATCHER:EX64  NEXT_EXTENT:00000008_0862E2F0
    To display entire pool extent: IP LIST 000000080862E790 LEN(X'00000250') ASID(X'0021')
    000000080862E7A0: Free storage cell. To display: IP LIST 000000080862E7A0 LEN(X'00000090') ASID(X'0021')
    000000080862E830: Free storage cell. To display: IP LIST 000000080862E830 LEN(X'00000090') ASID(X'0021')
    000000080862E8C0: Allocated storage cell. To display: IP LIST 000000080862EE8C0 LEN(X'00000090') ASID(X'0021')
    000000080862E8D0: 00000008 0862D2D0 00000000 000005E8 00000000 0000000B 00000000 00000008|......K}.......Y................|
  EXTENT:  00000008_0862E2F0
  +000000  EYE_CATCHER:EX64  NEXT_EXTENT:00000000_00000000
    To display entire pool extent: IP LIST 000000080862E2F0 LEN(X'00000250') ASID(X'0021')
    000000080862E300: Allocated storage cell. To display: IP LIST 000000080862E300 LEN(X'00000090') ASID(X'0021')
    000000080862E310: C3C4D3D3 00000000 00000000 00000000 C0000000 00000000 00000000 00000000|CDLL............{...............|
    000000080862E390: Allocated storage cell. To display: IP LIST 000000080862E390 LEN(X'00000090') ASID(X'0021')
    000000080862E3A0: 00000000 00000000 00000008 08C65E90 20004000 00000000 00000000 00000000|.............F;... .............|
    000000080862E420: Allocated storage cell. To display: IP LIST 000000080862E420 LEN(X'00000090') ASID(X'0021')
    000000080862E430: 00000000 00000000 00000008 08C65EA8 20004000 00000000 00000000 00000000|.............F;y.. .............|
    000000080862E4B0: Allocated storage cell. To display: IP LIST 000000080862E4B0 LEN(X'00000090') ASID(X'0021')
    000000080862E4C0: 00000000 00000000 00000008 00005968 20004000 00000000 00000000 00000000|.................. .............|
  [1]Verifying free chain for pool: 3...
       No errors were found while processing free chain.
    Summary of analysis for Pool 3:
       Number of cells:  Unused:       1  Free:       2  Allocated:       5  Total Used:       8
       00000000 free cells were not accounted for.
       No errors were found while processing this Pool.

  Data for pool 4:
POOLDATA:  00000008_08734000
  +000000  POOL_INDEX:00000004     INPUT_CELL_SIZE:00000100
  +000008  CELL_SIZE:00000110      INPUT_COUNT:00000004
  +000010  CELL_POOL_SIZE:00000440       CELL_POOL_NUM:00000004
  +000018  POOL_LATCH_ADDR:00000008_08711858   POOL_EXTENTS:00000001
  +000028  LAST_CELL:00000008_0862ED30   NEXT_CELL:00000008_0862EC20
  +000040  Q_CONTROL_INFO:00000000 0000000A    Q_FIRST_CELL:00000008_0862EB10
  +000050  POOL_NUM_GET_TOTAL:00000000 00000006
  +000058  POOL_NUM_FREE:00000000 00000002     POOL_EXTENTS_ANCHOR:00000008_0862E9F0
  +000068  POOL_INDEX_SAME_SIZE:01       POOL_INDEX_SIZE:04
  +00006A  POOL_NUM_SAME_SIZE:01   POOL_TRACE_TABLE:00000008_088D2170
  [2]Heap Pool Extent Mapping
EXTENT:  00000008_0862E9F0
  +000000  EYE_CATCHER:EX64  NEXT_EXTENT:00000000_00000000
    To display entire pool extent: IP LIST 000000080862E9F0 LEN(X'00000450') ASID(X'0021')
    000000080862EA00: Free storage cell. To display: IP LIST 000000080862EA00 LEN(X'00000110') ASID(X'0021')
    000000080862EB10: Free storage cell. To display: IP LIST 000000080862EB10 LEN(X'00000110') ASID(X'0021')
  [1]Verifying free chain for pool: 4...
No errors were found while processing free chain.
    Summary of analysis for Pool 4:
       Number of cells:  Unused:       2  Free:       2  Allocated:       0  Total Used:       4
       00000000 free cells were not accounted for.
       No errors were found while processing this Pool.

Data for pool 5.1:
POOLDATA:  00000008_08734100
  +000000  POOL_INDEX:00000005     INPUT_CELL_SIZE:00000400
  +000008  CELL_SIZE:00000410      INPUT_COUNT:00000004
  +000010  CELL_POOL_SIZE:00001040       CELL_POOL_NUM:00000004
  +000018  POOL_LATCH_ADDR:00000008_08711880   POOL_EXTENTS:00000001
  +000028  LAST_CELL:00000008_08606330   NEXT_CELL:00000008_08605B10
  +000040  Q_CONTROL_INFO:00000000 00000000    Q_FIRST_CELL:00000000_00000000
  +000050  POOL_NUM_GET_TOTAL:00000000 00000001
  +000058  POOL_NUM_FREE:00000000 00000000     POOL_EXTENTS_ANCHOR:00000008_086056F0
  +000068  POOL_INDEX_SAME_SIZE:01       POOL_INDEX_SIZE:05
  +00006A  POOL_NUM_SAME_SIZE:05   POOL_TRACE_TABLE:00000008_089181A0
```

Figure 195. Example formatted detailed heap pool report from LEDATA VERBEXIT (AMODE 64) (Part 2 of 5)

The following is part three of the example formatted detailed heap pool report from LEDATA VERBEXIT (AMODE 64).

```
  [2]Heap Pool Extent Mapping
EXTENT:  00000008_086056F0
  +000000  EYE_CATCHER:EX64  NEXT_EXTENT:00000000_00000000
    To display entire pool extent: IP LIST 00000008086056F0 LEN(X'00001050') ASID(X'0021')
    0000000808605700: Allocated storage cell. To display: IP LIST 0000000808605700 LEN(X'00000410') ASID(X'0021')
    0000000808605710: 00000008 08606770 00000008 08606958 00000008 08606995 00000008 086069D2|.....-.......-.......-.n.....-.K|
    Summary of analysis for Pool 5.1:
       Number of cells:  Unused:       3  Free:       0  Allocated:       1  Total Used:       4
       00000000 free cells were not accounted for.
       No errors were found while processing this Pool.

  Data for pool 5.2:
POOLDATA:  00000008_08734200
  +000000  POOL_INDEX:00000006     INPUT_CELL_SIZE:00000400
  +000008  CELL_SIZE:00000410      INPUT_COUNT:00000004
  +000010  CELL_POOL_SIZE:00001040       CELL_POOL_NUM:00000004
  +000018  POOL_LATCH_ADDR:00000008_08711880   POOL_EXTENTS:00000001
  +000028  LAST_CELL:00000008_0862FA90   NEXT_CELL:00000008_0862FA90
  +000040  Q_CONTROL_INFO:00000000 0000000F    Q_FIRST_CELL:00000008_0862F680
  +000050  POOL_NUM_GET_TOTAL:00000000 00000009
  +000058  POOL_NUM_FREE:00000000 00000003     POOL_EXTENTS_ANCHOR:00000008_0862EE50
  +000068  POOL_INDEX_SAME_SIZE:02       POOL_INDEX_SIZE:05
  +00006A  POOL_NUM_SAME_SIZE:05   POOL_TRACE_TABLE:00000008_0895E1D0
  [2]Heap Pool Extent Mapping
  EXTENT:  00000008_0862EE50
  +000000  EYE_CATCHER:EX64  NEXT_EXTENT:00000000_00000000
    To display entire pool extent: IP LIST 000000080862EE50 LEN(X'00001050') ASID(X'0021')
    000000080862EE60: Free storage cell. To display: IP LIST 000000080862EE60 LEN(X'00000410') ASID(X'0021')
    000000080862F270: Free storage cell. To display: IP LIST 000000080862F270 LEN(X'00000410') ASID(X'0021')
    000000080862F680: Free storage cell. To display: IP LIST 000000080862F680 LEN(X'00000410') ASID(X'0021')
  [1]Verifying free chain for pool: 5.2...
    Verifying free chain for pool: 5.2...
       No errors were found while processing free chain.
    Summary of analysis for Pool 5.2:
       Number of cells:  Unused:       1  Free:       3  Allocated:       0  Total Used:       4
       00000000 free cells were not accounted for.
       No errors were found while processing this Pool.

  Data for pool 5.3:
POOLDATA:  00000008_08734300
  +000000  POOL_INDEX:00000007     INPUT_CELL_SIZE:00000400
  +000008  CELL_SIZE:00000410      INPUT_COUNT:00000004
  +000010  CELL_POOL_SIZE:00001040       CELL_POOL_NUM:00000004
  +000018  POOL_LATCH_ADDR:00000008_08711880   POOL_EXTENTS:00000000
  +000028  LAST_CELL:00000000_00000000   NEXT_CELL:00000000_00000000
  +000040  Q_CONTROL_INFO:00000000 00000000    Q_FIRST_CELL:00000000_00000000
  +000050  POOL_NUM_GET_TOTAL:00000000 00000000
  +000058  POOL_NUM_FREE:00000000 00000000     POOL_EXTENTS_ANCHOR:00000000_00000000
  +000068  POOL_INDEX_SAME_SIZE:03       POOL_INDEX_SIZE:05
  +00006A  POOL_NUM_SAME_SIZE:05   POOL_TRACE_TABLE:00000008_089A4200
    There are no extents for this pool.

  Data for pool 5.4:
POOLDATA:  00000008_08734400
  +000000  POOL_INDEX:00000008     INPUT_CELL_SIZE:00000400
  +000008  CELL_SIZE:00000410      INPUT_COUNT:00000004
  +000010  CELL_POOL_SIZE:00001040       CELL_POOL_NUM:00000004
  +000018  POOL_LATCH_ADDR:00000008_08711880   POOL_EXTENTS:00000000
  +000028  LAST_CELL:00000000_00000000   NEXT_CELL:00000000_00000000
  +000040  Q_CONTROL_INFO:00000000 00000000    Q_FIRST_CELL:00000000_00000000
  +000050  POOL_NUM_GET_TOTAL:00000000 00000000
  +000058  POOL_NUM_FREE:00000000 00000000     POOL_EXTENTS_ANCHOR:00000000_00000000
  +000068  POOL_INDEX_SAME_SIZE:04       POOL_INDEX_SIZE:05
  +00006A  POOL_NUM_SAME_SIZE:05   POOL_TRACE_TABLE:00000008_089EA230
    There are no extents for this pool.
```

Figure 196. Example formatted detailed heap pool report from LEDATA VERBEXIT (AMODE 64) (Part 3 of 5)

The following is part four of the example formatted detailed heap pool report from LEDATA VERBEXIT (AMODE 64).

```
  Data for pool 5.5:
POOLDATA:  00000008_08734500
  +000000  POOL_INDEX:00000009     INPUT_CELL_SIZE:00000400
  +000008  CELL_SIZE:00000410      INPUT_COUNT:00000004
  +000010  CELL_POOL_SIZE:00001040       CELL_POOL_NUM:00000004
  +000018  POOL_LATCH_ADDR:00000008_08711880   POOL_EXTENTS:00000000
  +000028  LAST_CELL:00000000_00000000   NEXT_CELL:00000000_00000000
  +000040  Q_CONTROL_INFO:00000000 00000000    Q_FIRST_CELL:00000000_00000000
  +000050  POOL_NUM_GET_TOTAL:00000000 00000000
  +000058  POOL_NUM_FREE:00000000 00000000     POOL_EXTENTS_ANCHOR:00000000_00000000
  +000068  POOL_INDEX_SAME_SIZE:05       POOL_INDEX_SIZE:05
  +00006A  POOL_NUM_SAME_SIZE:05   POOL_TRACE_TABLE:00000008_08A30260
    There are no extents for this pool.

  Data for pool 6:
POOLDATA:  00000008_08734600
  +000000  POOL_INDEX:0000000A     INPUT_CELL_SIZE:00000800
  +000008  CELL_SIZE:00000810      INPUT_COUNT:00000004
  +000010  CELL_POOL_SIZE:00002040       CELL_POOL_NUM:00000004
  +000018  POOL_LATCH_ADDR:00000008_087118A8   POOL_EXTENTS:00000001
  +000028  LAST_CELL:00000008_0862DAD0   NEXT_CELL:00000008_0862DAD0
  +000040  Q_CONTROL_INFO:00000000 0000000B    Q_FIRST_CELL:00000008_0862CAB0
  +000050  POOL_NUM_GET_TOTAL:00000000 00000008
  +000058  POOL_NUM_FREE:00000000 00000001     POOL_EXTENTS_ANCHOR:00000008_0862C290
  +000068  POOL_INDEX_SAME_SIZE:01       POOL_INDEX_SIZE:06
  +00006A  POOL_NUM_SAME_SIZE:01   POOL_TRACE_TABLE:00000008_08A76290
    [2]Heap Pool Extent Mapping
EXTENT:  00000008_0862C290
  +000000  EYE_CATCHER:EX64  NEXT_EXTENT:00000000_00000000
    To display entire pool extent: IP LIST 000000080862C290 LEN(X'00002050') ASID(X'0021')
    000000080862C2A0: Allocated storage cell. To display: IP LIST 000000080862C2A0 LEN(X'00000810') ASID(X'0021')
    000000080862C2B0: 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000|................................|
    000000080862CAB0: Free storage cell. To display: IP LIST 000000080862CAB0 LEN(X'00000810') ASID(X'0021')
    000000080862D2C0: Allocated storage cell. To display: IP LIST 000000080862D2C0 LEN(X'00000810') ASID(X'0021')
    000000080862D2D0: 00000008 082FA5A8 00000000 00000000 00000008 082FAE20 00000000 00000008|......vy........................|
    [1]Verifying free chain for pool: 6...
       No errors were found while processing free chain.
    Summary of analysis for Pool 6:
       Number of cells:  Unused:       1  Free:       1  Allocated:       2  Total Used:       4
       00000000 free cells were not accounted for.
       No errors were found while processing this Pool.

  Data for pool 7:
POOLDATA:  00000008_08734700
  +000000  POOL_INDEX:0000000B     INPUT_CELL_SIZE:00000C00
  +000008  CELL_SIZE:00000C10      INPUT_COUNT:00000032
  +000010  CELL_POOL_SIZE:00025B20       CELL_POOL_NUM:00000032
  +000018  POOL_LATCH_ADDR:00000008_087118D0   POOL_EXTENTS:00000001
  +000028  LAST_CELL:00000008_0862B670   NEXT_CELL:00000008_08607F80
  +000040  Q_CONTROL_INFO:00000000 00000000    Q_FIRST_CELL:00000000_00000000
  +000050  POOL_NUM_GET_TOTAL:00000000 00000002
  +000058  POOL_NUM_FREE:00000000 00000000     POOL_EXTENTS_ANCHOR:00000008_08606750
  +000068  POOL_INDEX_SAME_SIZE:01       POOL_INDEX_SIZE:07
  +00006A  POOL_NUM_SAME_SIZE:01   POOL_TRACE_TABLE:00000008_08ABC2C0
    [2]Heap Pool Extent Mapping
  EXTENT:  00000008_08606750
  +000000  EYE_CATCHER:EX64  NEXT_EXTENT:00000000_00000000
    To display entire pool extent: IP LIST 0000000808606750 LEN(X'00025B30') ASID(X'0021')
    0000000808606760: Allocated storage cell. To display: IP LIST 0000000808606760 LEN(X'00000C10') ASID(X'0021')
    0000000808606770: 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000|................................|
    0000000808607370: Allocated storage cell. To display: IP LIST 0000000808607370 LEN(X'00000C10') ASID(X'0021')
    0000000808607380: 00000000 00000000 00000008 08C65DD8 60004000 00000000 00000000 00000000|............F)Q-. ............|
    Summary of analysis for Pool 7:
       Number of cells:  Unused:       48  Free:       0  Allocated:       2  Total Used:       50
       00000000 free cells were not accounted for.
       No errors were found while processing this Pool.


  Data for pool 8:
POOLDATA:  00000008_08734800
  +000000  POOL_INDEX:0000000C     INPUT_CELL_SIZE:00001000
  +000008  CELL_SIZE:00001010      INPUT_COUNT:00000032
  +000010  CELL_POOL_SIZE:00032320       CELL_POOL_NUM:00000032
  +000018  POOL_LATCH_ADDR:00000008_087118F8   POOL_EXTENTS:00000000
```

Figure 197. Example formatted detailed heap pool report from LEDATA VERBEXIT (AMODE 64) (Part 4 of 5)

The following is part five of the example formatted detailed heap pool report from LEDATA VERBEXIT (AMODE 64).

```
  +000028  LAST_CELL:00000000_00000000   NEXT_CELL:00000000_00000000
  +000040  Q_CONTROL_INFO:00000000 00000000    Q_FIRST_CELL:00000000_00000000
  +000050  POOL_NUM_GET_TOTAL:00000000 00000000
  +000058  POOL_NUM_FREE:00000000 00000000     POOL_EXTENTS_ANCHOR:00000000_00000000
  +000068  POOL_INDEX_SAME_SIZE:01       POOL_INDEX_SIZE:08
  +00006A  POOL_NUM_SAME_SIZE:01   POOL_TRACE_TABLE:00000008_08B022F0
    There are no extents for this pool.

  Data for pool 9:
POOLDATA:  00000008_08734900
  +000000  POOL_INDEX:0000000D     INPUT_CELL_SIZE:00002000
  +000008  CELL_SIZE:00002010      INPUT_COUNT:00000019
  +000010  CELL_POOL_SIZE:00032190       CELL_POOL_NUM:00000019
  +000018  POOL_LATCH_ADDR:00000008_08711920   POOL_EXTENTS:00000000
  +000028  LAST_CELL:00000000_00000000   NEXT_CELL:00000000_00000000
  +000040  Q_CONTROL_INFO:00000000 00000000    Q_FIRST_CELL:00000000_00000000
  +000050  POOL_NUM_GET_TOTAL:00000000 00000000
  +000058  POOL_NUM_FREE:00000000 00000000     POOL_EXTENTS_ANCHOR:00000000_00000000
  +000068  POOL_INDEX_SAME_SIZE:01       POOL_INDEX_SIZE:09
  +00006A  POOL_NUM_SAME_SIZE:01   POOL_TRACE_TABLE:00000008_08B48320
    There are no extents for this pool.

  Data for pool 10:
POOLDATA:  00000008_08734A00
  +000000  POOL_INDEX:0000000E     INPUT_CELL_SIZE:00004000
  +000008  CELL_SIZE:00004010      INPUT_COUNT:0000000A
  +000010  CELL_POOL_SIZE:000280A0       CELL_POOL_NUM:0000000A
  +000018  POOL_LATCH_ADDR:00000008_08711948   POOL_EXTENTS:00000000
  +000028  LAST_CELL:00000000_00000000   NEXT_CELL:00000000_00000000
  +000040  Q_CONTROL_INFO:00000000 00000000    Q_FIRST_CELL:00000000_00000000
  +000050  POOL_NUM_GET_TOTAL:00000000 00000000
  +000058  POOL_NUM_FREE:00000000 00000000     POOL_EXTENTS_ANCHOR:00000000_00000000
  +000068  POOL_INDEX_SAME_SIZE:01       POOL_INDEX_SIZE:0A
  +00006A  POOL_NUM_SAME_SIZE:01   POOL_TRACE_TABLE:00000008_08B8E350
    There are no extents for this pool.

  Data for pool 11:
POOLDATA:  00000008_08734B00
  +000000  POOL_INDEX:0000000F     INPUT_CELL_SIZE:00008000
  +000008  CELL_SIZE:00008010      INPUT_COUNT:00000005
  +000010  CELL_POOL_SIZE:00028050       CELL_POOL_NUM:00000005
  +000018  POOL_LATCH_ADDR:00000008_08711970   POOL_EXTENTS:00000000
  +000028  LAST_CELL:00000000_00000000   NEXT_CELL:00000000_00000000
  +000040  Q_CONTROL_INFO:00000000 00000000    Q_FIRST_CELL:00000000_00000000
  +000050  POOL_NUM_GET_TOTAL:00000000 00000000
  +000058  POOL_NUM_FREE:00000000 00000000     POOL_EXTENTS_ANCHOR:00000000_00000000
  +000068  POOL_INDEX_SAME_SIZE:01       POOL_INDEX_SIZE:0B
  +00006A  POOL_NUM_SAME_SIZE:01   POOL_TRACE_TABLE:00000008_08BD4380
    There are no extents for this pool.

  Data for pool 12:
POOLDATA:  00000008_08734C00
  +000000  POOL_INDEX:00000010     INPUT_CELL_SIZE:00010000
  +000008  CELL_SIZE:00010010      INPUT_COUNT:00000005
  +000010  CELL_POOL_SIZE:00050050       CELL_POOL_NUM:00000005
  +000018  POOL_LATCH_ADDR:00000008_08711998   POOL_EXTENTS:00000000
  +000028  LAST_CELL:00000000_00000000   NEXT_CELL:00000000_00000000
  +000040  Q_CONTROL_INFO:00000000 00000000    Q_FIRST_CELL:00000000_00000000
  +000050  POOL_NUM_GET_TOTAL:00000000 00000000
  +000058  POOL_NUM_FREE:00000000 00000000     POOL_EXTENTS_ANCHOR:00000000_00000000
  +000068  POOL_INDEX_SAME_SIZE:01       POOL_INDEX_SIZE:0C
  +00006A  POOL_NUM_SAME_SIZE:01   POOL_TRACE_TABLE:00000008_08C1A3B0
    There are no extents for this pool.
```

Figure 198. Example formatted detailed heap pool report from LEDATA VERBEXIT (AMODE 64) (Part 5 of 5)

Heap pool report sections of the LEDATA output

As Table 56 on page 391 shows, the heap pool report provides information about the following items:

- Each cell pool.
- The free chain associated with every qpcb pool data area, and all the free and allocated cells in the extent chain.
- Errors found when the cells are validated.

Table 56. Contents of the heap pool report sections of the LEDATA output (AMODE 64)

Section Number and Heading	Contents
[1] Free Chain Validation	Within each cell pool, Language Environment keeps track of unallocated cells by chaining them together. The LEDATA HEAP option validates the free chain within each cell pool. It verifies that the cell pointer is within a valid extent and that the cell pool number is valid. If the formatter finds a problem, it will place an error message describing the problem directly after the formatted line of the cell that failed validation.

Table 56. Contents of the heap pool report sections of the LEDATA output (AMODE 64) (continued)

Section Number and Heading	Contents
[2] Heap Pool Extent Mapping Report	The LEDATA HEAP option produces a report that lists all of the cells within each pool extent, and identifies the cells as either allocated or freed. For each allocated cell, the contents of the first X'20' bytes of the area are displayed to identify the reason for the storage allocation. The formatter validates if the cell pool number in header is correct.

Understanding the heap pools trace LEDATA output

The Language Environment IPCS VERBEXIT LEDATA generates a detailed heap pools trace report when the HPT option is used (see Figure 199 on page 392. The argument *value* is the ID of the pool to be formatted in the report. Table 57 on page 396 explains the contents of each section of the report.

```
    HPT(3)
    ******************************************************************************
                  64 BIT LANGUAGE ENVIRONMENT DATA
    ******************************************************************************

    Language Environment Product 04 V01 R0A.00

[1] HEAPPOOLS64 Trace Table

[2] POOLID: 3  ASID: 001F  AVAILABLE ENTRIES: 12 OF 12

[3] Timestamp: 2008/03/14          18:20:40.239878
    Type: FREE  Cell Address: 00000001086588E0  Cpuid: 01  Tcb: 008D7820
[4] CALL NAME                           CALL ADDRESS       CALL OFFSET
    GetStorage::~GetStorage()           0000000025B001B0   00000056
    foo8()                              0000000025B00348   0000006A
    foo7()                              0000000025B003D8   00000010
    foo6()                              0000000025B00410   00000010
    foo5()                              0000000025B00448   00000010
    foo4()                              0000000025B00480   00000010
    foo3()                              0000000025B004B8   00000010
    foo2()                              0000000025B004F0   00000010
    foo1()                              0000000025B00528   00000010
    thread                              0000000025B005C8   00000000

    Timestamp: 2008/03/14          18:20:40.239875
    Type: FREE  Cell Address: 0000000108658970  Cpuid: 01  Tcb: 008D7820
    CALL NAME                           CALL ADDRESS       CALL OFFSET
    GetStorage::~GetStorage()           0000000025B001B0   00000056
    foo9()                              0000000025B00260   0000006E
    foo8()                              0000000025B00348   00000046
    foo7()                              0000000025B003D8   00000010
    foo6()                              0000000025B00410   00000010
    foo5()                              0000000025B00448   00000010
    foo4()                              0000000025B00480   00000010
    foo3()                              0000000025B004B8   00000010
    foo2()                              0000000025B004F0   00000010
    foo1()                              0000000025B00528   00000000
```

Figure 199. Example of formatted detailed heap pools trace report from LEDATA VERBEXIT (AMODE 64) (Part 1 of 5)

The following is part two of the example of formatted detailed heap pools trace report from LEDATA VERBEXIT (AMODE 64).

```
Timestamp: 2008/03/14          18:20:40.239873
Type: GET   Cell Address: 0000000108658970  Cpuid: 01  Tcb: 008D7820
CALL NAME                          CALL ADDRESS       CALL OFFSET
GetStorage::GetStorage(int)        0000000025B00118   00000058
foo9()                             0000000025B00260   0000003A
foo8()                             0000000025B00348   00000046
foo7()                             0000000025B003D8   00000010
foo6()                             0000000025B00410   00000010
foo5()                             0000000025B00448   00000010
foo4()                             0000000025B00480   00000010
foo3()                             0000000025B004B8   00000010
foo2()                             0000000025B004F0   00000010
foo1()                             0000000025B00528   00000000

Timestamp: 2008/03/14          18:20:40.239870
Type: GET   Cell Address: 00000001086588E0  Cpuid: 01  Tcb: 008D7820
CALL NAME                          CALL ADDRESS       CALL OFFSET
GetStorage::GetStorage(int)        0000000025B00118   00000058
foo8()                             0000000025B00348   00000036
foo7()                             0000000025B003D8   00000010
foo6()                             0000000025B00410   00000010
foo5()                             0000000025B00448   00000010
foo4()                             0000000025B00480   00000010
foo3()                             0000000025B004B8   00000010
foo2()                             0000000025B004F0   00000010
foo1()                             0000000025B00528   00000010
thread                             0000000025B005C8   00000000

Timestamp: 2008/03/14          18:20:40.238024
Type: FREE  Cell Address: 00000001086588E0  Cpuid: 01  Tcb: 008D7AD0
CALL NAME                          CALL ADDRESS       CALL OFFSET
GetStorage::~GetStorage()          0000000025B001B0   00000056
foo8()                             0000000025B00348   0000006A
foo7()                             0000000025B003D8   00000010
foo6()                             0000000025B00410   00000010
foo5()                             0000000025B00448   00000010
foo4()                             0000000025B00480   00000010
foo3()                             0000000025B004B8   00000010
foo2()                             0000000025B004F0   00000010
foo1()                             0000000025B00528   00000010
thread                             0000000025B005C8   00000000

Timestamp: 2008/03/14          18:20:40.238021
Type: FREE  Cell Address: 0000000108658970  Cpuid: 01  Tcb: 008D7AD0
CALL NAME                          CALL ADDRESS       CALL OFFSET
GetStorage::~GetStorage()          0000000025B001B0   00000056
foo9()                             0000000025B00260   0000006E
foo8()                             0000000025B00348   00000046
foo7()                             0000000025B003D8   00000010
foo6()                             0000000025B00410   00000010
foo5()                             0000000025B00448   00000010
foo4()                             0000000025B00480   00000010
foo3()                             0000000025B004B8   00000010
foo2()                             0000000025B004F0   00000010
foo1()                             0000000025B00528   00000000

Timestamp: 2008/03/14          18:20:40.238016
Type: GET   Cell Address: 0000000108658970  Cpuid: 01  Tcb: 008D7AD0
CALL NAME                          CALL ADDRESS       CALL OFFSET
GetStorage::GetStorage(int)        0000000025B00118   00000058
foo9()                             0000000025B00260   0000003A
foo8()                             0000000025B00348   00000046
foo7()                             0000000025B003D8   00000010
foo6()                             0000000025B00410   00000010
foo5()                             0000000025B00448   00000010
foo4()                             0000000025B00480   00000010
foo3()                             0000000025B004B8   00000010
foo2()                             0000000025B004F0   00000010
foo1()                             0000000025B00528   00000000
```

Figure 200. Example of formatted detailed heap pools trace report from LEDATA VERBEXIT (AMODE 64) (Part 2 of 5)

The following is part three of the example of formatted detailed heap pools trace report from LEDATA VERBEXIT (AMODE 64).

```
Timestamp: 2008/03/14           18:20:40.238013
 Type: GET   Cell Address: 00000001086588E0  Cpuid: 01  Tcb: 008D7AD0
 CALL NAME                           CALL ADDRESS       CALL OFFSET
 GetStorage::GetStorage(int)         0000000025B00118   00000058
 foo8()                              0000000025B00348   00000036
 foo7()                              0000000025B003D8   00000010
 foo6()                              0000000025B00410   00000010
 foo5()                              0000000025B00448   00000010
 foo4()                              0000000025B00480   00000010
 foo3()                              0000000025B004B8   00000010
 foo2()                              0000000025B004F0   00000010
 foo1()                              0000000025B00528   00000010
 thread                              0000000025B005C8   00000000

 Timestamp: 2008/03/14           18:20:40.158670
 Type: GET   Cell Address: 0000000108658850  Cpuid: 01  Tcb: 008FF038
 CALL NAME                           CALL ADDRESS       CALL OFFSET
 CEEOPMI                             0000000025D95900   00000C8C
 CEEOPC                              0000000025D588C0   00001672
 pthread_create                      0000000025D6F7E8   00000628
 main                                0000000025B00640   000000AE
 CELQINIT                            0000000025B04010   00000000

 Timestamp: 2008/03/14           18:20:40.140382
 Type: GET   Cell Address: 00000001086587C0  Cpuid: 01  Tcb: 008FF038
 CALL NAME                           CALL ADDRESS       CALL OFFSET
 CEEOPMI                             0000000025D95900   00000C8C
 pthread_mutex_init                  000000002604E6E0   0000005C
 pthread_create                      0000000025D6F7E8   0000033A
 main                                0000000025B00640   000000AE
 CELQINIT                            0000000025B04010   00000000

 Timestamp: 2008/03/14           18:20:40.140373
 Type: GET   Cell Address: 0000000108658730  Cpuid: 01  Tcb: 008FF038
 CALL NAME                           CALL ADDRESS       CALL OFFSET
 CEEOPMI                             0000000025D95900   00000C8C
 pthread_mutex_init                  000000002604E6E0   0000005C
 pthread_create                      0000000025D6F7E8   000002A2
 main                                0000000025B00640   000000AE
 CELQINIT                            0000000025B04010   00000000

 Timestamp: 2008/03/14           18:20:40.023500
 Type: GET   Cell Address: 00000001086586A0  Cpuid: 01  Tcb: 008FF038
 CALL NAME                           CALL ADDRESS       CALL OFFSET
 dllinit                             0000000025B767B8   00000090
 CEEZIDT                             0000000025CE0738   00000ADC
 CELQINMN                            0000000025CEA830   00000F52
 CELQINIT                            0000000025B04010   00000000

 HEAPPOOLS Trace Table

 POOLID: 3  ASID: 001F  AVAILABLE ENTRIES: 8 OF 8

 Timestamp: 2008/03/14           18:20:40.239877
 Type: FREE  Cell Address: 000000002635E058  Cpuid: 01  Tcb: 008D7820
 CALL NAME                           CALL ADDRESS       CALL OFFSET
 GetStorage::~GetStorage()           0000000025B001B0   0000003A
 foo8()                              0000000025B00348   0000006A
 foo7()                              0000000025B003D8   00000010
 foo6()                              0000000025B00410   00000010
 foo5()                              0000000025B00448   00000010
 foo4()                              0000000025B00480   00000010
 foo3()                              0000000025B004B8   00000010
 foo2()                              0000000025B004F0   00000010
 foo1()                              0000000025B00528   00000010
 thread                              0000000025B005C8   00000000
```

Figure 201. Example of formatted detailed heap pools trace report from LEDATA VERBEXIT (AMODE 64) (Part 3 of 5)

The following is part four of the example of formatted detailed heap pools trace report from LEDATA VERBEXIT (AMODE 64).

```
  Timestamp: 2008/03/14           18:20:40.239874
  Type: FREE  Cell Address: 000000002635E0E0  Cpuid: 01  Tcb: 008D7820
  CALL NAME                           CALL ADDRESS       CALL OFFSET
  GetStorage::~GetStorage()           0000000025B001B0   0000003A
  foo9()                              0000000025B00260   0000006E
  foo8()                              0000000025B00348   00000046
  foo7()                              0000000025B003D8   00000010
  foo6()                              0000000025B00410   00000010
  foo5()                              0000000025B00448   00000010
  foo4()                              0000000025B00480   00000010
  foo3()                              0000000025B004B8   00000010
  foo2()                              0000000025B004F0   00000010
  foo1()                              0000000025B00528   00000000

  Timestamp: 2008/03/14           18:20:40.239872
  Type: GET   Cell Address: 000000002635E0E0  Cpuid: 01  Tcb: 008D7820
  CALL NAME                           CALL ADDRESS       CALL OFFSET
  GetStorage::GetStorage(int)         0000000025B00118   0000002E
  foo9()                              0000000025B00260   0000003A
  foo8()                              0000000025B00348   00000046
  foo7()                              0000000025B003D8   00000010
  foo6()                              0000000025B00410   00000010
  foo5()                              0000000025B00448   00000010
  foo4()                              0000000025B00480   00000010
  foo3()                              0000000025B004B8   00000010
  foo2()                              0000000025B004F0   00000010
  foo1()                              0000000025B00528   00000000

  Timestamp: 2008/03/14           18:20:40.239869
  Type: GET   Cell Address: 000000002635E058  Cpuid: 01  Tcb: 008D7820
  CALL NAME                           CALL ADDRESS       CALL OFFSET
  GetStorage::GetStorage(int)         0000000025B00118   0000002E
  foo8()                              0000000025B00348   00000036
  foo7()                              0000000025B003D8   00000010
  foo6()                              0000000025B00410   00000010
  foo5()                              0000000025B00448   00000010
  foo4()                              0000000025B00480   00000010
  foo3()                              0000000025B004B8   00000010
  foo2()                              0000000025B004F0   00000010
  foo1()                              0000000025B00528   00000010
  thread                              0000000025B005C8   00000000

  Timestamp: 2008/03/14           18:20:40.238023
  Type: FREE  Cell Address: 000000002635E058  Cpuid: 01  Tcb: 008D7AD0
  CALL NAME                           CALL ADDRESS       CALL OFFSET
  GetStorage::~GetStorage()           0000000025B001B0   0000003A
  foo8()                              0000000025B00348   0000006A
  foo7()                              0000000025B003D8   00000010
  foo6()                              0000000025B00410   00000010
  foo5()                              0000000025B00448   00000010
  foo4()                              0000000025B00480   00000010
  foo3()                              0000000025B004B8   00000010
  foo2()                              0000000025B004F0   00000010
  foo1()                              0000000025B00528   00000010
  thread                              0000000025B005C8   00000000

 Timestamp: 2008/03/14           18:20:40.238018
  Type: FREE  Cell Address: 000000002635E0E0  Cpuid: 01  Tcb: 008D7AD0
  CALL NAME                           CALL ADDRESS       CALL OFFSET
  GetStorage::~GetStorage()           0000000025B001B0   0000003A
  foo9()                              0000000025B00260   0000006E
  foo8()                              0000000025B00348   00000046
  foo7()                              0000000025B003D8   00000010
  foo6()                              0000000025B00410   00000010
  foo5()                              0000000025B00448   00000010
  foo4()                              0000000025B00480   00000010
  foo3()                              0000000025B004B8   00000010
  foo2()                              0000000025B004F0   00000010
  foo1()                              0000000025B00528   00000000
```

Figure 202. Example of formatted detailed heap pools trace report from LEDATA VERBEXIT (AMODE 64) (Part 4 of 5)

The following is part five of the example of formatted detailed heap pools trace report from LEDATA VERBEXIT (AMODE 64).

```
  Timestamp: 2008/03/14           18:20:40.238015
  Type: GET   Cell Address: 000000002635E0E0  Cpuid: 01  Tcb: 008D7AD0
  CALL NAME                           CALL ADDRESS       CALL OFFSET
  GetStorage::GetStorage(int)         0000000025B00118   0000002E
  foo9()                              0000000025B00260   0000003A
  foo8()                              0000000025B00348   00000046
  foo7()                              0000000025B003D8   00000010
  foo6()                              0000000025B00410   00000010
  foo5()                              0000000025B00448   00000010
  foo4()                              0000000025B00480   00000010
  foo3()                              0000000025B004B8   00000010
  foo2()                              0000000025B004F0   00000010
  foo1()                              0000000025B00528   00000000

  Timestamp: 2008/03/14           18:20:40.238005
  Type: GET   Cell Address: 000000002635E058  Cpuid: 01  Tcb: 008D7AD0
  CALL NAME                           CALL ADDRESS       CALL OFFSET
  GetStorage::GetStorage(int)         0000000025B00118   0000002E
  foo8()                              0000000025B00348   00000036
  foo7()                              0000000025B003D8   00000010
  foo6()                              0000000025B00410   00000010
  foo5()                              0000000025B00448   00000010
  foo4()                              0000000025B00480   00000010
  foo3()                              0000000025B004B8   00000010
  foo2()                              0000000025B004F0   00000010
  foo1()                              0000000025B00528   00000010
  thread                              0000000025B005C8   00000000
 Exiting Language Environment Data
```

Figure 203. Example of formatted detailed heap pools trace report from LEDATA VERBEXIT (AMODE 64) (Part 5 of 5)

Table 57. Contents of a detailed heap pools trace report from LEDATA VERBEXIT (AMODE 64)

Section Number and Heading	Contents
`[1] Trace Header`	HEAPPOOLS64 trace header information.
`[2] Pool Information`	Includes the number of the pool (pool ID) that is currently being formatted, the ASID, the number of entries formatted, and the total number of entries taken. The trace wraps for each pool ID after a specific number of entries. The number of entries is controlled by the HEAPCHK runtime option.
`[3] Timestamp`	The time this trace entry was taken. The trace entries are formatted in reverse order (most recent trace entry first).
`[4] Trace Table Entry contents`	The individual trace entry, which contains: • The TYPE - GET or FREE. • The Cell within the pool being acted upon. • The CPU and TCB that requested or freed the cell. • A traceback at the time of the request. The number of entries in this traceback is limited by the HEAPCHK runtime option.

Understanding the C/C++-specific LEDATA output

The Language Environment IPCS VERBEXIT LEDATA generates formatted output of C/C++-specific control blocks from a system dump when the COMP(C), COMP(ALL), or ALL parameter is specified and C/C++ is active in the dump. Figure 204 on page 397 illustrates the C/C++-specific output produced. The system dump being formatted was obtained by specifying the TERMTHDACT(UADUMP) runtime option when running the program CELQSAMP Figure 162 on page 342. "C/C++-specific sections of the LEDATA output" on page 406 describes the information contained in the formatted output. Ellipses are used to summarize some sections of the dump. For easy reference, the sections of the dump are numbered to correspond with the description of each section that follows.

```
********************************************************************************
                           64 BIT CRTL ENVIRONMENT
DATA

********************************************************************************


[1]      CGEN:  00000001_00007B18
   +000310  CGENE:00000001_0000BAE0       CRENT:00000000_00000000
   +000320  CPRMS:00000001_00005598       TRACE:00000001    CTHD:00000001_00008F08
   +000338  CURR_FECB:00000001_0000B400   CGEN_CPCB:00000001_00008688
   +000348  CGEN_CEDB:00000001_0000A620   CFLG3:00    CIO:00000001_000088D8

[2]     CGENE:  00000001_0000BAE0
   +000000  CGENEYE:.-./      CGENESIZE:00C200C4      CGENEPTR:007C00C1_00C300C5
   +0000D4  CERRNO:006000A3   TEMPLONG:00E000A6 00E200E3    AMRC:00E400E5_00E600E7
   +000110  STDINFILE:00E800E9_00F200E3   STDOUTFILE:00E500D9_00E200E4
   +000120  STDERRFILE:00F000F1_00F200F3        CTYPE:00F400F5_00F600F7
   +000138  LC_CTYPE:00E000E8_00E9001F    LC_CHARMAP:08FC4E90_00000000
   +00052C  MIN_FLT:00000000 00000000 00000000 00000000
   +00053C  MAX_FLT:00000000 00000000 00000000 00000000
   +00054C  FLT_EPS:00000000        DBL_EPS:00000000 00000000
   +00055C  LDBL_EPS:00000000 00000000 00000000 C7C5D5C5
   +000574  IMSPCBLIST:0000C048_00000000        ADDRTBL:00000000_00000001
   +000710  ABND_CODE:00000000      RSN_CODE:00000000

[3]      CEDB:  00000001_0000A620
   +000000  EYE:CEDB    SIZE:00000C48     PTR:00000001_0000A620
   +000010  CLLST:00000000_20C02DB8       CEELANG:0003      CASWITCH:0000
   +000020  CLWA:00000001_0000C088        CALTLWA:00000000_00000000
   +000030  CCADDR:00000000_20C000D8      CFLGS:00000080    CANCHOR:00000000_00000000
   +000050  RPLLEN:00000000_00000000      ACBLEN:00000000_00000000
   +000060  LC:00000001_0000B270    VALID_HIGH:00000000_20C53BF0
   +000070  _LOW:00000000_20C53690        HEAD_FECB:00000000_00000000
   +000080  ATEXIT_CHAIN:00000000_00000000      _EMPTY_CHAIN:00000001_0000A770
   +000090  MAINPRMS:00000001_08FC5E70    STDINFILE:00000001_0000A2B8
   +0000A0  STDOUTFILE:00000001_00009BE8        STDERRFILE:00000001_00009F50
   +0000B0  CTYPE:00000000_21324876       TZDFLT:00000000 00003840
   +0000C0  CINFO:00000001_0000B370       CMS_WRITE_DISK:4040
   +0000CC  _DISK_SET:00000000
   +0000D0  MIN_FLT:00100000 00000000 00000000 00000000
   +0000E0  MAX_FLT:7FFFFFFF FFFFFFFF 71FFFFFF FFFFFFFF
   +0000F0  FLT_EPS:3C100000        DBL_EPS:34100000 00000000
   +000100  LDBL_EPS:26100000 00000000 18000000 00000000    FLAGS1:02080000
   +000118  MTF_MAINTASK_BLK:00000000_00000000        EMSG_SETTING:00
   +000124  DEPTH:00000000    SCREEN_WIDTH:00000000   USERID:HEALY  .
   +000138  HEAP24_ANCHOR:00000000_00000000     TCIC:00000000_00000000
   +000148  TKCLI:00000000_00000000
   +000150  ATEXIT_FUNCS01:00000001 0000A798 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000178  ATEXIT_FUNCS02:00000001 0000A7C0 00000000 00000000 00000000 00000000 00000000 00000000 00
   +0001A0  ATEXIT_FUNCS03:00000001 0000A7E8 00000000 00000000 00000000 00000000 00000000 00000000 00
   +0001C8  ATEXIT_FUNCS04:00000001 0000A810 00000000 00000000 00000000 00000000 00000000 00000000 00
   +0001F0  ATEXIT_FUNCS05:00000001 0000A838 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000218  ATEXIT_FUNCS06:00000001 0000A860 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000240  ATEXIT_FUNCS07:00000001 0000A888 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000268  ATEXIT_FUNCS08:00000001 0000A8B0 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000290  ATEXIT_FUNCS09:00000001 0000A8D8 00000000 00000000 00000000 00000000 00000000 00000000 00
   +0002B8  ATEXIT_FUNCS10:00000001 0000A900 00000000 00000000 00000000 00000000 00000000 00000000 00
   +0002E0  ATEXIT_FUNCS11:00000001 0000A928 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000308  ATEXIT_FUNCS12:00000001 0000A950 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000330  ATEXIT_FUNCS13:00000001 0000A978 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000358  ATEXIT_FUNCS14:00000001 0000A9A0 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000380  ATEXIT_FUNCS15:00000001 0000A9C8 00000000 00000000 00000000 00000000 00000000 00000000 00
   +0003A8  ATEXIT_FUNCS16:00000001 0000A9F0 00000000 00000000 00000000 00000000 00000000 00000000 00
   +0003D0  ATEXIT_FUNCS17:00000001 0000AA18 00000000 00000000 00000000 00000000 00000000 00000000 00
   +0003F8  ATEXIT_FUNCS18:00000001 0000AA40 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000420  ATEXIT_FUNCS19:00000001 0000AA68 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000448  ATEXIT_FUNCS20:00000001 0000AA90 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000470  ATEXIT_FUNCS21:00000001 0000AAB8 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000498  ATEXIT_FUNCS22:00000001 0000AAE0 00000000 00000000 00000000 00000000 00000000 00000000 00
   +0004C0  ATEXIT_FUNCS23:00000001 0000AB08 00000000 00000000 00000000 00000000 00000000 00000000 00
   +0004E8  ATEXIT_FUNCS24:00000001 0000AB30 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000510  ATEXIT_FUNCS25:00000001 0000AB58 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000538  ATEXIT_FUNCS26:00000001 0000AB80 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000560  ATEXIT_FUNCS27:00000001 0000ABA8 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000588  ATEXIT_FUNCS28:00000001 0000ABD0 00000000 00000000 00000000 00000000 00000000 00000000 00
```

Figure 204. Example of formatted C/C++ output from LEDATA VERBEXIT (AMODE 64) (Part 1 of 10)

The following is part two of the example of formatted C/C++ output from LEDATA VERBEXIT (AMODE 64)

```
   +0005B0  ATEXIT_FUNCS29:00000001 0000ABF8 00000000 00000000 00000000 00000000 00000000 00000000 00
   +0005D8  ATEXIT_FUNCS30:00000001 0000AC20 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000600  ATEXIT_FUNCS31:00000001 0000AC48 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000628  ATEXIT_FUNCS32:00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00
   +000650  HEAD_FOREIGN_FECB:00000000_00000000
   +000658  SNAP_DUMP_COUNT:00000000      ENVIRON:00000000_00000000
   +000668  GETENV_BUF:00000000_00000000        _BUF_LEN:00000000 00000000
   +000678  CDLL:00000001_08FEE770        INSPECT_GLOBALS:00000000_00000000
   +000688  _JMP_BUFF:00000000_00000000   _BACK_END:00000000_00000000
   +000698  _FLAGS:00000000   _TAB:00000000 00000000
   +0006A8  INTOFFLIST:00000000_00000000        CGEN_CRENT:00000000_00000000
   +0006B8  _CPRMS:00000001_00005598      _CEDCXV:00000000_00000000
   +0006C8  _CEDCOV:00000000_00000000     _EPCBLIST:00000000_00000000
   +0006D8  CAA_ADDR:00000001_00007B18    USERIDLENGTH:00000000 00000005
   +0006F0  TZSHR:00000001 0000B520 00000001 0000B528
   +000700  MAXUNGETCOUNT:0004      RWSTATIC:00000001_08300050
   +000710  RWLEN:00000000 00000170       CSGDLLI:00000000_00000000
   +000720  DLLISIZE:00000000 00000000    IOGET_ANY:00000000_2131EC80
   +000730  _BELOW:00000000_2131EC70      IOFREE_ANY:00000000_2131EC60
   +000740  _BELOW:00000000_2131EC50      CSGSTINIT:00000000_00000000
   +000750  STINITSIZE:00000000 00000000        MTFMAINTASKBLK:00000000_00000000
   +000760  SIGTABLE:00000001_0000B668    INIT_STDIN:00000001_0000A2B8
   +000770  _STDOUT:00000001_00009BE8     _STDERR:00000001_00009F50
   +000788  TABNUM:00000000 00000008      REDIR:00    AVAIL13:00000000_00000000
   +0007A0  OPENMVS_FLAGS:00  MRPSTDR:00000000_2131EC10     MWPSTDR:00000000_2131EC00
   +0007B8  MRPSTDC:00000000_00000000     MWPSTDC:00000000_00000000
   +0007C8  OWRP1:00000000_00000000       OWRP3:00000000_00000000
   +0007D8  STATIC_EDCOV:00000000_00000000      GETENV_BUF2:00000000_00000000
   +0007E8  _BUF2_LEN:00000000 00000000   DLCB_MUTEX:00000001_08FC7328
   +0007F8  _CONDV:00000001_08FC7330      EDCOV:00000000_00000000
   +000808  LCX:00000001_0000B520   MUTEX_ATTR:00000001 08FC7250
   +000818  STOR_INIT_B:00001000    _INCR_B:00001000
   +000820  STOR_INIT:00003000      _INCR:00002000    DEMANGLE:00000000_00000000
   +000838  TEMPR15:00000000 00000000     TERMINATE:00000000_2131EC40
   +000848  CXX_INV:00000000_00000000     D4_JOIN_MUTEX_ATTR:00000001_08FC7308
   +000860  _MUTEX:00000001_08FC7310      _CONDV_ATTR:00000001_08FC7318
   +000870  _CONDV:00000001_08FC7320      DLLANCHOR:00000000_00000000
   +000880  DLLLAST:00000000_00000000     MEM24P:00000000_00000000
   +000890  RTLMUTEX_ARRAYPTR:00000001_08FC7258       MSGCATLIST:00000000_00000000
   +0008A0  SRCHP:00000000_00000000       ETOAP:00000000_00000000
   +0008B0  ATOEP:00000000_00000000       NDMGMTP:00000000_00000000
   +0008C0  POPENP:00000000_00000000      RND48P:00000000_00000000
   +0008D0  BRK_HEAPID:00000000_00000000        _START:00000000_00000000
   +0008E0  _CURRENT:00000000_00000000    _END:00000000_00000000
   +0008F8  RESTARTTABLE:00000000_00000000      SYSLOGP:00000000_00000000
   +000908  LOGIN_NAME:.........    PREV_UMASK_VAL:00000000
   +000918  HFP_LDBL_LMS:00100000 00000000 00000000 00000000 7FFFFFFF FFFFFFFF 71FFFFFF FFFFFFFF 26
   +000948  BFP_LDBL_LMS:00010000 00000000 00000000 00000000 7FFEFFFF FFFFFFFF FFFFFFFF FFFFFFFF 3F
   +0009D8  HFP_DBL_LMS:00100000 00000000 7FFFFFFF FFFFFFFF 34100000 00000000
   +0009F0  BFP_DBL_LMS:00100000 00000000 7FEFFFFF FFFFFFFF 3CB00000 00000000 7FF00000 00000000 FF
   +000A38  HFP_MHDC:412B7E15 1628AED3 41171547 652B82FE 406F2DEC 549B9439 40B17217 F7D1CF7A 41
   +000AA8  BFP_MHDC:4005BF0A 8B145769 3FF71547 652B82FE 3FDBCB7B 1526E50E 3FE62E42 FEFA39EF 40
   +000B18  HFP_FLT_LMS:00100000 7FFFFFFF 3C100000
   +000B24  BFP_FLT_LMS:00800000 7F7FFFFF 34000000 7F800000 FF800000 7FA00000 FFA00000 7FC00000 FF
   +000B48  HFP_FHDC:00000010 0006000E 001C0006 000F0020 FFC0FFC0 FFC0FFB2 FFB2FFB2 003F003F 00
   +000B70  BFP_FHDC:00010002 00180035 00710006 000F0021 FF83FC03 C003FFDB FECDECBD 00800400 40
   +000B98  ASCII_CCSID:0333  EBCDIC_CCSID:0417       LOGIN_NAME_A:.........
   +000BA8  CINFO_A:00000001 0000BD88     LC_C:00000001_0000BC40
   +000BB8  _A:00000001_0000BCA0    LCX_A:00000001_0000BE18
   +000BC8  CORRESTABLE:00000000_214CFD58
   +000BD0  TZSHR_A:00000001 0000BE18 00000001 0000BE20     CGENVEC3:00000000_00000000
   +000BE8  CEDBVEC3:00000000_00000000    FORKQ_HEAD:00000000_00000000
   +000BF8  FORKQ_TAIL:00000000_00000000        PTHREAD_YIELD1:0001D100
   +000C04  PTHREAD_YIELD2:00002E80       ICONV_MODE:.      _TECH:.........
   +000C12  _USERSET:.

 [4]      CTHD:  00000001_00008F08
       +000000  CTHDEYE:CTHD      SIZE:00000528
CTHDPTR:00000001_00008F08
       +000010  STORPTR:00000000_00000000
TOKPTR:00000000_251DEF20
       +000020
ASCTIME_RESULT:..........................
       +00003A  SNAP_DUMP_FLAG:00       FP_MODE:C4  GMTIME_BKDN:00000001_00009638
```

Figure 205. Example of formatted C/C++ output from LEDATA VERBEXIT (AMODE 64) (Part 2 of 10)

The following is part three of the example of formatted C/C++ output from LEDATA VERBEXIT (AMODE 64)

```
       +000048  TIMECALLED:00000000
DATECALLED:00000000
       +000050  DTCALLED:00000000
LOC_CALLED:00000000
       +000058  DOFMTO_DISCARDS:00000000 00000000
CERRNO:00000079
       +000068  AMRC:00000000_25757278
AMRC2:00000000_25757380
       +000078  GDATE:00000000_00000000
OPTARGV:00000000_00000000
       +000088  OPTERRV:00000001
OPTINDV:00000001
       +000090  OPTOPTV:00000000        OPTSIND:00000000
DLGHTV:00000000
       +0000A0  TZONEV:00000000 00000000
GTDTERRV:00000000
       +0000B0  OPTARGP:00000001_00008F88
OPTERRP:00000001_00008F90
       +0000C0  OPTINDP:00000001_00008F94
OPTOPTP:00000001_00008F98
       +0000D0  DLGHTP:00000001_00008FA0
TZONEP:00000001_00008FA8
       +0000E0  GTDTERRP:00000001_00008FB0
RNDSTGP:00000000_00000000
       +0000F0  LOCNAME:00000000_00000000
ENCRYPTP:00000000_00000000
       +000100  CRYPTP:00000000_00000000      RND48P:00000000_00000000
       +000110  L64AP:00000000_00000000       WCSTOKP:00000000_00000000
       +000120  CUSERP:00000000_00000000      GPASSP:00000000_00000000
       +000130  UTMPXP:00000000_00000000      NDMGMTP:00000000_00000000
       +000140  RECOMP:00000000_00000000      STACKPTR:00000000_00000000
       +000150  STACKSIZE:00000000 00000000   STACKFLAGS:40     MCVTP:00000000
       +000160  H_ERRNO:00000000        SD:FFFFFFFF       HOSTENT_DATA_P:00000000_00000000
       +000170  HOSTENT_P:00000000_00000000   NETENT_DATA_P:00000000_00000000
       +000180  NETENT_P:00000000_00000000    PROTOENT_DATA_P:00000000_00000000
       +000190  PROTOENT_P:00000000_00000000        SERVENT_DATA_P:00000000_00000000
       +0001A0  SERVENT_P:00000000_00000000   NTOA_BUF:..................
       +0001C0  __LOC1V:00000000_00000000     __LOCSV:00000000_00000000
       +0001D0  HERRNOP:00000001_00009068     __LOC1P:00000000_00000000
       +0001E0  REXECP:00000000_00000000      CXXEXCEPTION:00000000_00000000
       +0001F0  TEMPDCBE:00000000_2135A068    T_ERRNOV:00000000
       +000200  T_ERRNOP:00000001_00009100    _LOC1P:00000000_00000000
       +000210  __loc2p:00000000_00000000     __locsp:00000000_00000000
       +000220  _loc1v:00000000_00000000      __loc2v:00000000_00000000
       +000230  THD_STORAGE:00000000_00000000       CONTEXT_LINK:00000000_00000000
       +000240  FLAGS1:00000000   LABEL_VAR:00000001_00009768
       +000250  ABND_CODE:00000000      RSN_CODE:00000000
       +000258  STRFTIME_ERADTCALLED:00000000
       +00025C  STRFTIME_ERADATECALLED:00000000
       +000260  STRFTIME_ERATIMECALLED:00000000
       +000264  STRFTIME_ERAYEARCALLED:00000000     MBRLEN_STATE:0000
       +00026A  MBRTOWC_STATE:0000      WCRTOMB_STATE:0000
       +00026E  MBSRTOWCS_STATE:0000    WCSRTOMBS_STATE:0000    MBLEN_STATE:0000
       +000274  MBTOWC_STATE:0000       CURR_HEAP_ID:00000000   CURR_CAA:00000000_00000000
       +000288  CURR_MOD_HANDLE:00000000_00000000   CURR_BMR:00000000_00000000
       +000298  CU_LIST:00000000_00000000     CURR_STATUS:00
       +0002A8  RAND_NEXT:00000000 00000001   STRERRORBUF:00000001_00008C90
       +0002B8  TMPAREA:00000000_00000000     IOWORKAREA:00000000_2135A140
       +0002C8  TEMPDCB:00000000_000070D0     TEMPJFCB:00000000_00007130
       +0002D8  TEMPDSCB:00000000_2135A0A0    NAMEBUF:00000000_00000000
       +0002E8  ERRNO_JR:C25F0001       RET_STRUCT:00000000_00000000
       +0002F8  BKDN_IS_LOCALTIME:00000000    SWPRINTF_SIZE:00008000
       +000300  SWPRINTF_BUF:00000000_00000000      S99P:2135A048
       +000310  MUTEXCTARRAY:00000001_000099C0
       +000318  STRFTIME_ERANAMECALLED:00000000     DLL_LOADLEVEL:00000000
       +000340  _CONSTLIST:00000000_00000000        FCB_MUTEX:00000000_00000000
       +000350  HSPABHWA:00000000_00000000    MUTEX_SAVE:00000001_00009A78
       +000368  INITIAL_CPU_TIME:40C065E0 00000000        FCB_MUTEX_OK:00000001
       +000378  FCB_MUTEX_SAVE:00000000_00000000
       +000380  ENTRY_ADDRTABLESIZE:00000000        ADDRESS:00000000
       +000388  NUMBEROFNAMES:00000000        NAMES1:.........................
       +0003A5  NAMES2:.........................
       +0003BE  NAMES3:.........................
       +0003D7  NAMES4:.........................
       +0003F0  NAMES5:.........................
       +000409  NAMES6:.........................
```

Figure 206. Example of formatted C/C++ output from LEDATA VERBEXIT (AMODE 64) (Part 3 of 10)

The following is part four of the example of formatted C/C++ output from LEDATA VERBEXIT (AMODE 64)

```
   +000424  ENTRY_SITETABLESIZE:00000000        KIND:00
   +00042C  NUM_ADDRS:00000000
   +000430  ADDRESSES:00000000 00000000 00000000 00000000 00000000 00000000
   +000448  NAME:00000000 00000000 00000000 00000000 00000000 00000000
   +000460  T_STRERRORBUF:00000001_00008DBC      CTHD_OURFDSET:00000000_00000000
   +000470  IEEECWAP:00000000_00000000    RETVAL_P:00000000_00000000
   +000490  CTHD_SETENV_FB:................      LIBASCIIWAP:00000000
   +0004AC  SETLOCALE_ACALLED:00    ASCIINAMEBUFL:0000
   +0004B8  ASCIINAMEBUF:00000000 00000000       LOCNAME_A:00000000_00000000
   +0004C8  EBCDICENTRY:00000001_08358B40        ASCIIENTRY:00000001_08358B58
   +0004D8  CTHD_NASCIIWAP:00000000_00000000     CTHD_PROCRESP:00000000_00000000
   +0004E8  CTHD_OPTN_P:00000000_00000000        CTHD_GAI_STRERROR_P:00000000_00000000
   +0004F8  CTHD_CKPATHDD_PARMS:00000000         CTHD_HEXDEC_PTR:00000000
   +000504  CTHD_DECHEX_PTR:00000000

[5]      CPCB:  00000001_00008688
   +000000  CPCB_EYE:CPCB      CPCB_SIZE:000000C0       CPCB_PTR:00000000_00000000
   +000010  FLAGS1:40000000   TTKNHDR:00000000_00000000     TTKN:00000000_00000000
   +000024  FOOTPRINT:00000000_00000001   CODE370:0000A620_00000000
   +000034  CIO:00000000_00000001   _Reuse:000088D8    _RSAbove:00000000_00000001
   +00004C  _RSAbovelen:00008688    _RSBelow:00000000_00000000
   +00005C  _RSBelowlen:00000000

[6]       CIO:  00000001_000088D8
   +000000  EYE:CIO     SIZE:00000108     PTR:00000000_00000000   FLG1:01
   +000011  FLG2:80     FLG3:00     FLG4:00     DUMMYF:00000001_000089E0
   +000020  EDCZ24:00000000_00000000      FCBSTART:00000000_2135C0F8
   +000030  DUMMYFCB:00000001_00008A08    MFCBSTART:00000001_19A00050
   +000040  IOANYLIST:00000000_00000000   IOBELOWLIST:00000000_00000000
   +000050  FCBDDLIST:00000001_00009C08   PERRORBUF:00000001_000087A0
   +000060  TMPCOUNTER:00000000 00000000        TEMPMEM:00000000
   +000070  PROMPTBUF:00000000_00000000   IO24:00000000_00007318
   +000080  IOEXITS:00000000_000077D0     TERMINALCHAIN:00000000_00000000
   +000090  VANCHOR:00000000_00000000     XTI:00000000_00000000
   +0000A0  ENOWP24:00000000_2131F200     MAXNUMDESCRPS:00000000 00000000
   +0000B0  DESCARRAY:00000000_00000000   TEMPFILENUM:00000000
   +0000C8  CSS:00000000_00000000   DUMMY_NAME:........
   +0000D8  HOSTNAME_CACHE:00000000_00000000    HOSTADDR_CACHE:00000000_00000000
   +0000E8  IO31:00000000_2131FC10
   +0000F0  LAST_FD_CLOSE:00000000 00000000 00000000 00000000
   +000100  IOGET64:00000000_2131EC30     IOFREE64:00000000_2131EC20

Exiting CRTL Environment Data

********************************************************************************
                     64 BIT CRTL I/O CONTROL BLOCKS
********************************************************************************

      CIO:  00000001_000088D8
   +000000  EYE:CIO     SIZE:00000108     PTR:00000000_00000000   FLG1:01
   +000011  FLG2:80     FLG3:00     FLG4:00     DUMMYF:00000001_000089E0
   +000020  EDCZ24:00000000_00000000      FCBSTART:00000000_2135C0F8
   +000030  DUMMYFCB:00000001_00008A08    MFCBSTART:00000001_19A00050
   +000040  IOANYLIST:00000000_00000000   IOBELOWLIST:00000000_00000000
   +000050  FCBDDLIST:00000001_00009C08   PERRORBUF:00000001_000087A0
   +000060  TMPCOUNTER:00000000 00000000        TEMPMEM:00000000
   +000070  PROMPTBUF:00000000_00000000   IO24:00000000_00007318
   +000080  IOEXITS:00000000_000077D0     TERMINALCHAIN:00000000_00000000
   +000090  VANCHOR:00000000_00000000     XTI:00000000_00000000
   +0000A0  ENOWP24:00000000_2131F200     MAXNUMDESCRPS:00000000 00000000
   +0000B0  DESCARRAY:00000000_00000000   TEMPFILENUM:00000000
   +0000C8  CSS:00000000_00000000   DUMMY_NAME:........
   +0000D8  HOSTNAME_CACHE:00000000_00000000    HOSTADDR_CACHE:00000000_00000000
   +0000E8  IO31:00000000_2131FC10
   +0000F0  LAST_FD_CLOSE:00000000 00000000 00000000 00000000
   +000100  IOGET64:00000000_2131EC30     IOFREE64:00000000_2131EC20
[7]     FFIL:  00000000_2135C0D0
   +000000  MARKER1:AFCB       __FP:00000000_2135C0F8
   +000010  MARKER2:AFCBAFCB        FCBMUTEX:00000001_08371120
   +000020  THREADID:2109B260 00000000
```

Figure 207. Example of formatted C/C++ output from LEDATA VERBEXIT (AMODE 64) (Part 4 of 10)

The following is part five of the example of formatted C/C++ output from LEDATA VERBEXIT (AMODE 64)

```
 File name: memory.data
   FCB:  00000000_2135C0F8
 +000000  BUFPTR:00000001_19A003D5      COUNTIN:00000000 00000000
 +000010  COUNTOUT:00000000 0000FFDB    READFUNC:00000000_2131F210
 +000020  WRITEFUNC:00000000_2131FC00   FLAGS1:1000       DEPTH:0000
 +000030  NAME:00000000_2135C3F0        _LENGTH:00000000 0000000B
 +000040  _BUFSIZE:00000000 00000048    MEMBER:........   NEXT:00000000_2135A6A0
 +000058  PREV:00000000_00000000        PARENT:00000000_2135C0F8
 +000068  CHILD:00000000_00000000       DDNAME:........   FD:FFFFFFFF
 +00007D  DEVTYPE:08  FCBTYPE:0055      FSCE:00000000_2135C2E0
 +000088  UNGETBUF:00000000_2135C2E0    REPOS:00000000_2131FBF0
 +000098  GETPOS:00000000_2131FB80      CLOSE:00000000_2131FB70
 +0000A8  FLUSH:00000000_2131FBE0       UTILITY:00000000_2131FB60
 +0000B8  USERBUF:00000000_00000000     LRECL:00000000 00000400
 +0000C8  BLKSIZE:00000000 00010000     REALBUFPTR:00000000_00000000
 +0000D8  UNGETCOUNT:00000000 00000000        BUFSIZE:00000000 00010000
 +0000E8  BUF:00000001_19A003B0   CURSOR:00000001_19A003B0
 +0000F8  ENDOFDATA:00000000_00000000   SAVEDBUF:00000000_00000000
 +000108  REALCOUNTIN:00000000 00000000
 +000110  REALCOUNTOUT:00000000 00000000      POSMAJOR:00000000 00000000
 +000120  SAVEMAJOR:00000000 00000000   POSMINOR:00000000 00000000
 +000130  SAVEMINOR:00000000 00000000   STATE:0000  SAVESTATE:0000
 +000140  EXITFTELL:00000000_00000000   EXITUNGETC:00000000_2131F780
 +000150  DBCSTART:00000000_00000000    UTILITYAREA:00000000_00000000
 +000160  INTERCEPT:00000000_00000000   FLAGS2:43020008 40001100
 +000170  DBCSSTATE:0000    FCB_CPCB:00000001_00008688
 +0001C0  LLPOSMAJOR:00000000 00000000
 +0001C8  LLSAVEMAJOR:00000000 00000000
 +0001D0  LLPOSMINOR:00000000 00000000
 +0001D8  LLSAVEMINOR:00000000 00000000

  MEMO:  00000000_2135C2E0
 +000000  MEMO_EYE:MEMO     MFCB:00000001_19A00050        NEBULA:00000001_19A00120
 +000018  NEBINDEX:0001     CURRDS:00000000 00000000      READ:00000000_2131F210
 +000030  WRITE:00000000_2131FC00       REPOS:00000000_2131FBF0
 +000040  FLUSH:00000000_2131FBE0

  FFIL:  00000000_2135A678
 +000000  MARKER1:AFCB      __FP:00000000_2135A6A0
 +000010  MARKER2:AFCBAFCB        FCBMUTEX:00000001_08371100
 +000020  THREADID:2109B260 00000000

 File name: myfile.data

   FCB:  00000000_2135A6A0
 +000000  BUFPTR:00000000_2135B0E3      COUNTIN:00000000 00000000
 +000010  COUNTOUT:00000000 00000FE5    READFUNC:00000000_2131F210
 +000020  WRITEFUNC:00000000_2131F7A0   FLAGS1:1000       DEPTH:0000
 +000030  NAME:00000000_2135A998        _LENGTH:00000000 0000000B
 +000040  _BUFSIZE:00000000 00000048    MEMBER:........   NEXT:00000001_0000A2D8
 +000058  PREV:00000000_2135C0F8        PARENT:00000000_2135A6A0
 +000068  CHILD:00000000_00000000       DDNAME:........   FD:00000000
 +00007D  DEVTYPE:09  FCBTYPE:007C      FSCE:00000000_2135A888
 +000088  UNGETBUF:00000000_2135A888    REPOS:00000000_2131F870
 +000098  GETPOS:00000000_2131F860      CLOSE:00000000_2131F840
 +0000A8  FLUSH:00000000_2131F850       UTILITY:00000000_2131F800
 +0000B8  USERBUF:00000000_00000000     LRECL:00000000 00000000
 +0000C8  BLKSIZE:00000000 00000000     REALBUFPTR:00000000_2135B0C8
 +0000D8  UNGETCOUNT:00000000 00000000        BUFSIZE:00000000 00001000
 +0000E8  BUF:00000000_2135B0C8   CURSOR:00000000_00000000
 +0000F8  ENDOFDATA:00000000_00000000   SAVEDBUF:00000000_00000000
 +000108  REALCOUNTIN:00000000 00000000
 +000110  REALCOUNTOUT:00000000 00000000      POSMAJOR:FFFFFFFF FFFFFFFF
 +000120  SAVEMAJOR:00000000 00000000   POSMINOR:00000000 00000000
 +000130  SAVEMINOR:00000000 00000000   STATE:0000  SAVESTATE:0000
 +000140  EXITFTELL:00000000_00000000   EXITUNGETC:00000000_2131F780
 +000150  DBCSTART:00000000_00000000    UTILITYAREA:00000000_00000000
 +000160  INTERCEPT:00000000_00000000   FLAGS2:40120040 00001300
 +000170  DBCSSTATE:0000    FCB_CPCB:00000001_00008688
 +0001C0  LLPOSMAJOR:00000000 00000000
 +0001C8  LLSAVEMAJOR:00000000 00000000
 +0001D0  LLPOSMINOR:00000000 00000000
 +0001D8  LLSAVEMINOR:00000000 00000000
```

Figure 208. Example of formatted C/C++ output from LEDATA VERBEXIT (AMODE 64) (Part 5 of 10)

The following is part six of the example of formatted C/C++ output from LEDATA VERBEXIT (AMODE 64)

```
      HFSF:  00000000_2135A888
    +000000  HFSF_EYE:HFSF     READ:00000000_2131F210        WRITE:00000000_2131F7A0
    +000018  REPOS:00000000_2131F870       GETPOS:00000000_2131F860
    +000028  FLUSH:00000000_2131F850       READBUFLEN:00000000 00000000
    +000038  OPENFLAG:00000491       FLAG1:00000000    HFSF_ST_MODE:030001A4
    +000048  HFSF_LAST_FSTAT:43281E34 A142E3FC

      FFIL:  00000001_0000A2B0
    +000000  MARKER1:AFCB      __FP:00000001_0000A2D8
    +000010  MARKER2:AFCBAFCB        FCBMUTEX:00000001_08FC7290
    +000020  THREADID:2109B260 00000000

     File name: DD:SYSIN

       FCB:  00000001_0000A2D8
    +000000  BUFPTR:00000000_00000000      COUNTIN:00000000 00000000
    +000010  COUNTOUT:00000000 00000000    READFUNC:00000000_2131FEC0
    +000020  WRITEFUNC:00000000_2131F200   FLAGS1:8000        DEPTH:0000
    +000030  NAME:00000001_0000A5D0        _LENGTH:00000000 0000000B
    +000040  _BUFSIZE:00000000 00000048    MEMBER:........   NEXT:00000001_00009F70
    +000058  PREV:00000000_2135A6A0        PARENT:00000001_0000A2D8
    +000068  CHILD:00000000_00000000       DDNAME:SYSIN       FD:FFFFFFFF
    +00007D  DEVTYPE:06  FCBTYPE:0041      FSCE:00000001_0000A4C0
    +000088  UNGETBUF:00000001_0000A4C0    REPOS:00000000_213206C0
    +000098  GETPOS:00000000_2131FC60      CLOSE:00000000_2131FD80
    +0000A8  FLUSH:00000000_2131FEB0       UTILITY:00000000_2131FEA0
    +0000B8  USERBUF:00000000_00000000     LRECL:00000000 00000000
    +0000C8  BLKSIZE:00000000 00001800     REALBUFPTR:00000000_00000000
    +0000D8  UNGETCOUNT:00000000 00000000        BUFSIZE:00000000 00001801
    +0000E8  BUF:00000000_00000000   CURSOR:00000000_00000000
    +0000F8  ENDOFDATA:00000000_00000000   SAVEDBUF:00000000_00000000
    +000108  REALCOUNTIN:00000000 00000000
    +000110  REALCOUNTOUT:00000000 00000000      POSMAJOR:00000000
 00000000
    +000120  SAVEMAJOR:00000000 00000000   POSMINOR:00000000 00000000
    +000130  SAVEMINOR:00000000 00000000   STATE:0000  SAVESTATE:0000
    +000140  EXITFTELL:00000000_2131FC20   EXITUNGETC:00000000_00000000
    +000150  DBCSTART:00000000_00000000    UTILITYAREA:00000000_00000000
    +000160  INTERCEPT:00000000_00000000   FLAGS2:00110000 60088040
    +000170  DBCSSTATE:0000    FCB_CPCB:00000001_00008688
    +0001C0  LLPOSMAJOR:00000000 00000000
    +0001C8  LLSAVEMAJOR:00000000 00000000
    +0001D0  LLPOSMINOR:00000000 00000000
    +0001D8  LLSAVEMINOR:00000000 00000000

      OSNS:  00000001_0000A4C0
    +000000  OSNS_EYE:OSNS     READ:00000000_2131FD70        WRITE:00000000_2131F200
    +000018  REPOS:00000000_213206C0       GETPOS:00000000_2131FC60
    +000028  CLOSE:00000000_2131FD80       FLUSH:00000000_2131FD50
    +000038  UTILITY:00000000_2131FD40     EXITFTELL:00000000_2131FC20
    +000048  EXITUNGETC:00000000_00000000        OSIOBLK:00000000_2135A5C8
    +000058  NEWLINEPTR:00000000_00000000        RECLENGTH:00000000 00001800
    +000068  FLAGS:01800000

      OSIO:  00000000_2135A5C8
    +000000  OSIO_EYE:OSIO     DCBW:00000000     DCBRU:00007A00
    +00000C  JFCB:00007A68     CURRMBUF:00000000       MBUFCOUNT:00000001
    +000018  READMAX:00000000        CURBLKNUM:FFFFFFFF
    +000020  LASTBLKNUM:FFFFFFFE     BLKSPERTRK:0000   OSIO_ACCESS_METHOD:02
    +000027  OSIO_NOSEEK_TO_SEEK:00  FIRSTPOS:00000000
    +00002C  LASTPOS:00000000        NEWPOS:00000000   READFUNCNUM:00000003
    +000038  WRITEFUNCNUM:00000004   FCB:00000001_0000A2D8   PARENT:2135A5C8
    +00004C  FLAGS1:90000000   DCBERU:2135A638   DCBEW:00000000
    +000058  OSIO_VOLSEQ:0000  OSIO_NEWVOLSEQ:0000     OSIO_EXT:00000000
    +000060  OSIO_HIGHVOL:0000       APPENDEDLASTVOLSEQ:0000
    +000064  OSIO_JFCBX:00000000

       DCB:  00000000_00007A00
    +000000  DCBRELAD:2135A638       DCBFDAD:00000000 00000000
    +000014  DCBBUFNO:05       DCBSRG1:40  DCBEODAD:000000   DCBRECFM:C0
    +000025  DCBEXLSA:0077D8   DCBDDNAM:.u......       DCBMACR1:CD
    +000033  DCBMACR2:9A       DCBSYNAD:000000   DCBBLKSI:1800     DCBNCP:00
    +000052  DCBLRECL:0000
```

Figure 209. Example of formatted C/C++ output from LEDATA VERBEXIT (AMODE 64) (Part 6 of 10)

The following is part seven of the example of formatted C/C++ output from LEDATA VERBEXIT (AMODE 64)

```
   DCBE:  00000000_2135A638
 +000000  DCBEID:DCBE       DCBELEN:0038      RESERVED0:0000
 +000008  DCBEDCB:00007A00        DCBERELA:00000000       DCBEFLG1:C0
 +000011  DCBEFLG2:88       DCBENSTR:0000     DCBEFLG3:80
 +000024  DCBESIZE:00000000       DCBEEODA:20E0FE54
 +00002C  DCBESYNA:20E0FDD8       MULTSDN:00

   JFCB:  00000000_00007A68
 +000000  JFCBDSNM:NULLFILE
 +00002C  JFCBELNM:               JFCBTSDM:00       JFCBDSCB:000000
 +000046  JFCBVLSQ:0000     JFCBIND1:00       JFCBIND2:C1
 +000058  JFCBUFNO:00       JFCDSRG1:00       JFCDSRG2:00
 +000064  JFCRECFM:00       JFCBLKSI:0000     JFCLRECL:0000     JFCNCP:00
 +000075  JFCBNVOL:00       JFCBNVOLS:
 +000094  JFCBEXTL:00       JFCBEXAD:000000   JFCFLGS1:00
 +0000AE  JFCBVLCT:01

   FFIL:  00000001_00009F48
 +000000  MARKER1:AFCB      __FP:00000001_00009F70
 +000010  MARKER2:AFCBAFCB        FCBMUTEX:00000001_08FC7268
 +000020  THREADID:2109B260 00000000

  File name: DD:SYSOUT

    FCB:  00000001_00009F70
 +000000  BUFPTR:00000000_2135C45F      COUNTIN:00000000 00000000
 +000010  COUNTOUT:00000000 0000006A    READFUNC:00000000_2131F210
 +000020  WRITEFUNC:00000000_2131FDC0   FLAGS1:9000       DEPTH:0000
 +000030  NAME:00000001_0000A268        _LENGTH:00000000 0000000B
 +000040  _BUFSIZE:00000000 00000048    MEMBER:........   NEXT:00000001_00009C08
 +000058  PREV:00000001_0000A2D8        PARENT:00000001_00009F70
 +000068  CHILD:00000000_00000000       DDNAME:SYSOUT     FD:FFFFFFFF
 +00007D  DEVTYPE:02  FCBTYPE:0043      FSCE:00000001_0000A158
 +000088  UNGETBUF:00000001_0000A158    REPOS:00000000_213206C0
 +000098  GETPOS:00000000_2131FC60      CLOSE:00000000_2131FDE0
 +0000A8  FLUSH:00000000_2131FDB0       UTILITY:00000000_2131FDA0
 +0000B8  USERBUF:00000000_00000000     LRECL:00000000 00000089
 +0000C8  BLKSIZE:00000000 00000372     REALBUFPTR:00000000_00000000
 +0000D8  UNGETCOUNT:00000000 00000000        BUFSIZE:00000000 0000008A
 +0000E8  BUF:00000000_2135C440   CURSOR:00000000_2135C444
 +0000F8  ENDOFDATA:00000000_00000000   SAVEDBUF:00000000_00000000
 +000108  REALCOUNTIN:00000000 00000000
 +000110  REALCOUNTOUT:00000000 00000000      POSMAJOR:00000000 00000000
 +000120  SAVEMAJOR:00000000 00000000   POSMINOR:00000000 00000000
 +000130  SAVEMINOR:00000000 00000000   STATE:0004  SAVESTATE:0000
 +000140  EXITFTELL:00000000_2131FC20   EXITUNGETC:00000000_2131F780
 +000150  DBCSTART:00000000_00000000    UTILITYAREA:00000000_00000000
 +000160  INTERCEPT:00000000_00000000   FLAGS2:42228020 2A188040
 +000170  DBCSSTATE:0000    FCB_CPCB:00000001_00008688
 +0001C0  LLPOSMAJOR:00000000 00000000
 +0001C8  LLSAVEMAJOR:00000000 00000000
 +0001D0  LLPOSMINOR:00000000 00000000
 +0001D8  LLSAVEMINOR:00000000 00000000

   OSNS:  00000001_0000A158
 +000000  OSNS_EYE:OSNS     READ:00000000_2131F210        WRITE:00000000_2131FDC0
 +000018  REPOS:00000000_213206C0       GETPOS:00000000_2131FC60
 +000028  CLOSE:00000000_2131FDE0       FLUSH:00000000_2131FDB0
 +000038  UTILITY:00000000_2131FDA0     EXITFTELL:00000000_2131FC20
 +000048  EXITUNGETC:00000000_2131F780        OSIOBLK:00000000_2135A518
 +000058  NEWLINEPTR:00000000_2135C4C9        RECLENGTH:00000000 00000085
 +000068  FLAGS:84800000
```

Figure 210. Example of formatted C/C++ output from LEDATA VERBEXIT (AMODE 64) (Part 7 of 10)

The following is part eight of the example of formatted C/C++ output from LEDATA VERBEXIT (AMODE 64)

```
  OSIO:  00000000_2135A518
+000000  OSIO_EYE:OSIO     DCBW:000078E0     DCBRU:00000000
+00000C  JFCB:00007948     CURRMBUF:00007B20       MBUFCOUNT:00000001
+000018  READMAX:00000001        CURBLKNUM:FFFFFFFF
+000020  LASTBLKNUM:FFFFFFFF     BLKSPERTRK:0000   OSIO_ACCESS_METHOD:02
+000027  OSIO_NOSEEK_TO_SEEK:00  FIRSTPOS:00000000
+00002C  LASTPOS:00000000        NEWPOS:00000000   READFUNCNUM:00000002
+000038  WRITEFUNCNUM:00000005   FCB:00000001_00009F70   PARENT:2135A518
+00004C  FLAGS1:80000000   DCBERU:00000000   DCBEW:2135A588
+000058  OSIO_VOLSEQ:0000  OSIO_NEWVOLSEQ:0000     OSIO_EXT:00000000
+000060  OSIO_HIGHVOL:0000       APPENDEDLASTVOLSEQ:0000
+000064  OSIO_JFCBX:00000000

   DCB:  00000000_000078E0
+000000  DCBRELAD:2135A588       DCBFDAD:00000000 00000002
+000014  DCBBUFNO:01       DCBSRG1:40  DCBEODAD:000000   DCBRECFM:54
+000025  DCBEXLSA:0077D8   DCBDDNAM:...&....       DCBMACR1:56
+000033  DCBMACR2:00       DCBSYNAD:000000   DCBBLKSI:0372     DCBNCP:21
+000052  DCBLRECL:007D

    DCBE:  00000000_2135A588
+000000  DCBEID:DCBE       DCBELEN:0038      RESERVED0:0000
+000008  DCBEDCB:000078E0        DCBERELA:00000000       DCBEFLG1:C0
+000011  DCBEFLG2:88       DCBENSTR:0000     DCBEFLG3:80
+000024  DCBESIZE:00000000       DCBEEODA:20E0FE54
+00002C  DCBESYNA:20E0FDD8       MULTSDN:00

  JFCB:  00000000_00007948
+000000  JFCBDSNM:HEALY.CELQSAMP.JOB24799.D0000104.?
+00002C  JFCBELNM:               JFCBTSDM:20       JFCBDSCB:000000
+000046  JFCBVLSQ:0000     JFCBIND1:00       JFCBIND2:81
+000058  JFCBUFNO:00       JFCDSRG1:00       JFCDSRG2:00
+000064  JFCRECFM:00       JFCBLKSI:0000     JFCLRECL:0000     JFCNCP:00
+000075  JFCBNVOL:00       JFCBNVOLS:
+000094  JFCBEXTL:00       JFCBEXAD:000000   JFCFLGS1:00
+0000AE  JFCBVLCT:01

  MBUF:  00000000_00007B20
+000000  NEXTMBUF:00007B20_      BUFFER:2135C440_  CHECKRESULT:00000000
+00000C  BLKSIZE:0000007D
+000010  DECB:00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000

  FFIL:  00000001_00009BE0
+000000  MARKER1:AFCB      __FP:00000001_00009C08
+000010  MARKER2:AFCBAFCB        FCBMUTEX:00000001_08FC7268
+000020  THREADID:2109B260 00000000

 File name: DD:SYSPRINT

   FCB:  00000001_00009C08
+000000  BUFPTR:00000000_2135A485      COUNTIN:00000000 00000000
+000010  COUNTOUT:00000000 00000084    READFUNC:00000000_2131F210
+000020  WRITEFUNC:00000000_2131FDC0   FLAGS1:9000       DEPTH:0000
+000030  NAME:00000001_00009F00        _LENGTH:00000000 0000000B
+000040  _BUFSIZE:00000000 00000048    MEMBER:........   NEXT:00000001_00008A08
+000058  PREV:00000001_00009F70        PARENT:00000001_00009C08
+000068  CHILD:00000000_00000000       DDNAME:SYSPRINT   FD:FFFFFFFF
+00007D  DEVTYPE:02  FCBTYPE:0043      FSCE:00000001_00009DF0
+000088  UNGETBUF:00000001_00009DF0    REPOS:00000000_213206C0
+000098  GETPOS:00000000_2131FC60      CLOSE:00000000_2131FDE0
+0000A8  FLUSH:00000000_2131FDB0       UTILITY:00000000_2131FDA0
+0000B8  USERBUF:00000000_00000000     LRECL:00000000 00000089
+0000C8  BLKSIZE:00000000 00000372     REALBUFPTR:00000000_00000000
+0000D8  UNGETCOUNT:00000000 00000000        BUFSIZE:00000000 0000008A
+0000E8  BUF:00000000_2135A480   CURSOR:00000000_2135A484
+0000F8  ENDOFDATA:00000000_00000000   SAVEDBUF:00000000_00000000
+000108  REALCOUNTIN:00000000 00000000
+000110  REALCOUNTOUT:00000000 00000000      POSMAJOR:00000000 00000000
+000120  SAVEMAJOR:00000000 00000000   POSMINOR:00000000 00000000
+000130  SAVEMINOR:00000000 00000000   STATE:0002  SAVESTATE:0000
+000140  EXITFTELL:00000000_2131FC20   EXITUNGETC:00000000_2131F780
+000150  DBCSTART:00000000_00000000    UTILITYAREA:00000000_00000000
+000160  INTERCEPT:00000000_00000000   FLAGS2:43128020 2A188040
+000170  DBCSSTATE:0000    FCB_CPCB:00000001_00008688
```

Figure 211. Example of formatted C/C++ output from LEDATA VERBEXIT (AMODE 64) (Part 8 of 10)

The following is part nine of the example of formatted C/C++ output from LEDATA VERBEXIT (AMODE 64)

```
   +0001C0  LLPOSMAJOR:00000000 00000000
   +0001C8  LLSAVEMAJOR:00000000 00000000
   +0001D0  LLPOSMINOR:00000000 00000000
   +0001D8  LLSAVEMINOR:00000000 00000000

     OSNS:  00000001_00009DF0
   +000000  OSNS_EYE:OSNS     READ:00000000_2131F210        WRITE:00000000_2131FDC0
   +000018  REPOS:00000000_213206C0       GETPOS:00000000_2131FC60
   +000028  CLOSE:00000000_2131FDE0       FLUSH:00000000_2131FDB0
   +000038  UTILITY:00000000_2131FDA0     EXITFTELL:00000000_2131FC20
   +000048  EXITUNGETC:00000000_2131F780        OSIOBLK:00000000_2135A3D0
   +000058  NEWLINEPTR:00000000_2135A509        RECLENGTH:00000000 00000085
   +000068  FLAGS:84800000

     OSIO:  00000000_2135A3D0
   +000000  OSIO_EYE:OSIO     DCBW:00007048     DCBRU:00000000
   +00000C  JFCB:000077F0     CURRMBUF:000078A8       MBUFCOUNT:00000001
   +000018  READMAX:00000001        CURBLKNUM:FFFFFFFF
   +000020  LASTBLKNUM:FFFFFFFF     BLKSPERTRK:0000   OSIO_ACCESS_METHOD:02
   +000027  OSIO_NOSEEK_TO_SEEK:00  FIRSTPOS:00000000
   +00002C  LASTPOS:00000000        NEWPOS:00000000   READFUNCNUM:00000002
   +000038  WRITEFUNCNUM:00000005   FCB:00000001_00009C08   PARENT:2135A3D0
   +00004C  FLAGS1:80000000   DCBERU:00000000   DCBEW:2135A440
   +000058  OSIO_VOLSEQ:0000  OSIO_NEWVOLSEQ:0000     OSIO_EXT:00000000
   +000060  OSIO_HIGHVOL:0000       APPENDEDLASTVOLSEQ:0000
   +000064  OSIO_JFCBX:00000000

      DCB:  00000000_00007048
   +000000  DCBRELAD:2135A440       DCBFDAD:00000000 0000000B
   +000014  DCBBUFNO:01       DCBSRG1:40  DCBEODAD:000000   DCBRECFM:54
   +000025  DCBEXLSA:0077D8   DCBDDNAM:.@.&.. .       DCBMACR1:56
   +000033  DCBMACR2:00       DCBSYNAD:000000   DCBBLKSI:0372     DCBNCP:21
   +000052  DCBLRECL:0016

     DCBE:  00000000_2135A440
   +000000  DCBEID:DCBE       DCBELEN:0038      RESERVED0:0000
   +000008  DCBEDCB:00007048        DCBERELA:00000000       DCBEFLG1:C0
   +000011  DCBEFLG2:88       DCBENSTR:0000     DCBEFLG3:80
   +000024  DCBESIZE:00000000       DCBEEODA:20E0FE54
   +00002C  DCBESYNA:20E0FDD8       MULTSDN:00

     JFCB:  00000000_000077F0
   +000000  JFCBDSNM:HEALY.CELQSAMP.JOB24799.D0000102.?
   +00002C  JFCBELNM:               JFCBTSDM:20       JFCBDSCB:000000
   +000046  JFCBVLSQ:0000     JFCBIND1:00       JFCBIND2:81
   +000058  JFCBUFNO:00       JFCDSRG1:00       JFCDSRG2:00
   +000064  JFCRECFM:00       JFCBLKSI:0000     JFCLRECL:0000     JFCNCP:00
   +000075  JFCBNVOL:00       JFCBNVOLS:
   +000094  JFCBEXTL:00       JFCBEXAD:000000   JFCFLGS1:00
   +0000AE  JFCBVLCT:01

     MBUF:  00000000_000078A8
   +000000  NEXTMBUF:000078A8_      BUFFER:2135A480_  CHECKRESULT:00000000
   +00000C  BLKSIZE:00000016
   +000010  DECB:00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000

 Dummy FCB encountered at location 0000000100008A08
```

Figure 212. Example of formatted C/C++ output from LEDATA VERBEXIT (AMODE 64) (Part 9 of 10)

The following is part ten of the example of formatted C/C++ output from LEDATA VERBEXIT (AMODE 64)

```
     AMRC:  00000000_2135A278
   +000000  CODE:00000000     RBA:00000000      LAST_OP:00000098
   +00000C  FILL_LEN:00000000       MSG_LEN:00000000
   +000014  STR1:..........................................................
   +000050  STR1_CONT:..........................................................
   +00008C  PARM0R0:00000000        PARMR1:00000000
   +00009C  STR2:...............................................................
   +0000DC  RPLFDBWD:00000000       XRBA:00000000 00000000
   +0000E8  AMRC_NOSEEK_TO_SEEK:00

    AMRC2:  00000000_2135A380
   +000000  __ERROR2:00000000 00000000    __FILEPTR:00000000_

    File name: memory.data

[8]     MFCB:  00000001_19A00050
   +000000  FIRSTNEBULA:00000001_19A00120       REFCNT:00000000 00000001
   +000010  RESERVED:00000000 00000000    NEXTMFCB:00000000_00000000
   +000020  WRITEFCB:00000000_2135C0F8    FLAG1:0001  DEPTH:0000
   +000030  NAME:00000001_19A00350        NAMELENGTH:00000000 0000000B
   +000040  NAMEBUFSIZE:00000000 00000048       MEMBER:........
   +000050  NEXTFCB:00000000_00000000     PREVFCB:00000000_00000000
   +000060  PARENTFCB:00000000_2135C0F8   CHILDFCB:00000000_00000000
   +000070  PREVMFCB:00000000_00000000    PARENTMFCB:00000001_19A00050
   +000080  CHILDMFCB:00000000_00000000   HIPERKEY:00000000 00000000
   +000090  CURHSPBYTES:00000000 00000000       LASTBYTE:0000
   +00009A  CREATELEVEL:0000  FLAG2:00000000
   +0000A0  LASTNEBULA:00000001 19A00120        LASTNEBINDEX:0001
   +0000B0  LASTDS:00000000 00000000      MAXHSPBYTES:00000000 00000000
   +0000C0  LASTBLKOFFSET:00000000 00000000     MFCB_CPCB:00000001_00008688

Exiting CRTL I/O Control Blocks
Exiting Language Environment Data
```

Figure 213. Example of formatted C/C++ output from LEDATA VERBEXIT (AMODE 64) (Part 10 of 10)

C/C++-specific sections of the LEDATA output

Table 58 on page 406 describes the contents of the LEDATA output that is specific to C/C++.

Table 58. Contents of C/C++-specific sections of the LEDATA output (AMODE 64)

Section Number and Heading	Contents
[1] CGEN	Formats the C/C++-specific portion of the Language Environment common anchor area (CAA).
[2] CGENE	Formats the extension to the C/C++-specific portion of the Language Environment common anchor area (CAA).
[3] CEDB	Formats the C/C++-specific portion of the Language Environment enclave data block (EDB).
[4] CTHD	Formats the C/C++ thread-level control block (CTHD).
[5] CPCB	Formats the C/C++-specific portion of the Language Environment process control block (PCB).
[6] CIO	Formats the C/C++ IO control block (CIO).

Table 58. Contents of C/C++-specific sections of the LEDATA output (AMODE 64) (continued)

Section Number and Heading	Contents
[7] File Control Blocks	Formats the C/C++ file control block (FCB). The FCB and its related control blocks, which are listed below, represent the information needed by each open stream. **FFIL** Formats the header of the C/C++ file control block (FCB). **FSCE** The file specific category extension control block, which represents the specific type of IO being performed. The following FSCEs may be formatted; other FSCEs will be displayed using a generic overlay. **HFSF** UNIX file system file **HSPF** Hiper-Space file **INTC** Intercept file **MEMF** Memory file **OSNS** OS no seek **OSFS** OS fixed text **OSVF** OS variable text **OSUT** OS undefined format text **TDQF** CICS Transient Data Queue file **TERM** Terminal file **VSAM** VSAM file **OSIO** The OS IO interface control block. **OSIOE** The OS IO extended interface control block. **DCB** The data control block. **DCBE** The data control block extension. **JFCB** The job file control block (JFCB); for more information, see *z/OS MVS Data Areas* in z/OS Internet library (www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosInternetLibrary). **JFCBX** The job file control block extension (JFCBX). **MBUF** The message buffer control block (MBUF).
[8] Memory File Control Blocks	Formats the C/C++ memory file control block (MFCB).

Understanding the PL/I-specific LEDATA output

The Language Environment IPCS VERBEXIT LEDATA generates formatted output of PL/I-specific control blocks from a system dump when the ALL parameter is specified and PL/I is active in the dump. Figure 214 on page 408 illustrates the PL/I-specific output produced. The system dump being formatted was obtained by specifying the TERMTHDACT(UADUMP) runtime option. "PL/I-specific sections of the LEDATA output" on page 413 describes the information contained in the formatted output. For easy reference, the sections of the dump are numbered to correspond with the description of each section that follows.

```
****************************************************************
                 ENTERPRISE PLI(64)+ ENVIRONMENT DATA
****************************************************************
[1]   PCB:  00000050_08727C70
   +000000  PCB_EYE:IBMPLPCB  BUILDDATE:20160621      VERSION:0001
   +000020  PCB_RCB:00000000_00000000     PCB_FCO:00000000_00000000
   +0000C0  PCB_DYNALLST:00000000_00000000
-------------------- Dynamic File Allocation Info --------------------

[2]DYNLST:  00000050_08730A90
   +000000  LEPTR:00000000_00000000       LBPTR:00000000_00000000
   +000010  LFLGS:00    LDDNL:00000006    LDDN:QSAM01       LENVL:00000027
   DSN(J43PLI.PK74015.NEWPDS(NEWMEM3)),SHR [3]

      TCA:  00000050_086012F8
   +000000  PREV:00000000_00000000  FLAGS:00000000    APPTYPE:00000000
   +000010  INITADDR:00000050_08601600    INITSTOR:0000048F
   +00001C  BEL_HEAPID:00000000     MAXPATHLEN:00000000     HEAPID:00000000
   +000028  FECB_ADDR:00000050_086015B0   MIT:00000000_00000000
   +000038  FILES_ADDR:00000050_08601578  TABTAB:00000050_00171BA0
   +000048  DDMDLL:00000000   IOFLGS:00000000   DDT:00000000_00000000
   +000058  TWC:00000000_00000000   PFO_ANC:00000000_00000000
   +000068  DDB:00000000_00000000   CONV_FCO:00000000_00000000
   +000078  SCB_PTR:00000000_00000000     DMY_OCA:00000050_08601A8F
   +000088  LAST_OCA:00000050_08601BD3    DEF_BIF_STR:0000  DEF_ONCHR:40
   +000098  ASEM_HAND:00000000_00000000   DSEM_HAND:00000000_00000000
   +0000A8  OSEM_HAND:00000000_00000000   FSEM_HAND:00000000_00000000
   +0000B8  XML_CHAIN:00000000_00000000   XML_EXIT:00000000_00000000
   +0000D0  CTL_LIST:00000000_00000000    SYSPRT_FCO:00000000_00000000
   +0000E0  FLUSH_RTN:00000000_00000000   STDOUT_HAND:00000000
   +0000F0  PARENT:00000000_00000000      IO_MOD:00000000_00000000
   +000108  BTRV_RTN:00000000_00000000    ISAM_RTN:00000000_00000000
   +000118  CONV_RTN:00000000_00000000    DEC_VALID:00000000_00000000
   +000128  HEX_TRANS:00000000_00000000   NLS_BLOCK:00000000_00000000
   +000138  DBCS_MAP:00000000_00000000    CCS_CASE:00000000_00000000
   +000148  RAND_SEED:00000001      RETCODE:00000000
   +000150  DBG_TERM:00000000_00000000    DBG_FETCH:00000000_00000000
   +000160  DBG_EXCEP:00000000_00000000   SEM_HAND:00000000
   +00016C  DBG_FRAME1:00000000_00000000  STMT_HOOK:00000000_00000000
   +00017C  ENTRY_HOOK:00000000_00000000  CALL_PLITEST:00000000_00000000
   +000190  IBMPEACH:00000000       CICSPPMB:00000000_00000000
```

Figure 214. Example of formatted PL/I output from LEDATA VERBEXIT (AMODE 64) (Part 1 of 6)

The following is part two of the example of formatted PL/I output from LEDATA VERBEXIT (AMODE 64).

```
   +0001A0  ENCL_REC_CNT:00000000   ENCL_CNT:00000000
   +0001A8  DEF_LIB_HP:00000000_00000000  DEF_USR_HP:00000000_00000000
   +0001B8  CUR_USR_HP:00000000_00000000
   +0001C0  ADMVS_GOTO:00000000 00000000 00000000 00000000 00000000
   +0001D8  THD_SPEC_USE:00000000_00000000      STG_TAB:00000000_00000000
   +0001E8  SYSTEM:00000002   ANCH_BASE:00000000_00000000
   +0001F8  API_ADDR:00000000_00000000    PBAS_ADDR:00000000_00000000
   +000208  PDBG_STO:00000000_00000000    ENCINA_RTN:00000000_00000000
   +000218  DCE_RTN:00000000_00000000     SNAP_ID:0000      SNAP_FLGS:0000
   +000228  FETCH_WSA:00000000_00000000   DEF_ONWCHAR:0000
   +000234  MUTEX_ATTR:00000000     IO_OPEN:00000000_00000000
   +000240  IO_CLOSE:00000000_00000000    IO_GET:00000000_00000000
   +000250  IO_PUT:00000000_00000000      IO_PUTX:00000000_00000000
   +000260  ASEM_MUTEX:00000000_00000000  DSEM_MUTEX:00000000_00000000
   +000270  OSEM_MUTEX:00000000_00000000  FSEM_MUTEX:00000000_00000000
   +000280  FILES_AREA:00000050_086030D0  IO_WRDMY:00000000_00000000
   +000290  IO_WRDI:00000000_00000000     IO_WRSF:00000000_00000000
   +0002A0  IO_RDDI:00000000_00000000     IO_RDSF:00000000_00000000
   +0002B0  AMODE_GLUE:00000000_00000000  FECB_AREA:00000000_00000000
   +0002C0  SIG_STR:00000000_00000000     RANDOM_X:00000000_00000001
   +0002D8  HEAP24:00000000_00000000      DSNHLI_EP:00000000_00000000
   +0002E8  DB2_WORKAREA:00000000_00000000      DSNHLI2_EP:00000000_00000000
   +0002F8  DSNHMLTR_EP:00000000_00000000       DSNHLIR_EP:00000000_00000000

 [4]  FECB:  00000050_08601CD0
      FECB:  00000050_08601CD0
   +000000  CHAIN:00000000_00000000       HANDLE:00000000_0FC380A0
   +000010  LDHANDLE:00000000_00000000    COUNT:00000001    FLAGS:00000000
   +000020  MODNMSZ:00000007  MODNAME:FETCHED   PTOKEN:00000000_00000000
   +000038  LANG_LIST:00000000_00000000

 [5]   OCA:  00000050_08601BD3
   +000000  EYE:OCA     VERSION:00  PREV:00000050_08601A8F  CID:0C      ERC:FF
   +00000E  SCI:04      HIGH_SCI:FF       COND_QLFR:00000050_08600080
   +00001C  ONCODE:1F9E       VAL_FLAGS:0030    FLAGS:00000000
   +000024  ONCOUNT:00000000  SLD_ONFILE:00000000 0F10157E 02020000 00000006
   +000038  SLD_ONCHAR:00000000 00000000 00000000 00000000
   +000048  SLD_ONSOURCE:00000000 00000000 00000000 00000000
   +000058  SLD_ONKEY:00000050 08601388 02020000 00000000
   +000068  SLD_DATAFIELD:00000000 00000000 00000000 00000000
   +000078  SLD_ONGSOURCE:00000000 00000000 00000000 00000000
   +000088  SLD_ONWSOURCE:00000000 00000000 00000000 00000000
   +000098  SLD_ONWCHAR:00000000 00000000 00000000 00000000
   +0000A8  SLD_ONAREA:00000000 00000000 00000000 00000000
   +0000B8  SLD_ONLOC:00000000 0F10179E 02020000 00000007
   +0000CC  RES_EBP:00000050_082E9DA0     RES_EIP:00000000_00000000
   +0000DC  TRCBK_EBP:00000000_00000000   TRCBK_EIP:00000000_00000000
   +0000EC  EXIT_LABEL:00000000_00000000  RETRY_EBP:00000000_00000000
   +0000FC  RETRY_EIP:00000000_00000000   RETRY_ESP:00000000_00000000
   +00010C  EBP_HAND:00000000_00000000    PLISRTX_RC:00000000
   +000118  UNDEF_SUBC1:00000000    UNDEF_SUBC2:00000000
   +000124  TOKEN:000300C6 59C3C5C5 00000000 00000000
   +000134  AMODE_SWC_PTR:00000000_00000000     ONOFFSET:000001AE
   +000140  ONLINE:00000000

       OCA:  00000050_08601A8F
   +000000  EYE:OCA     VERSION:00  PREV:00000000_00000000  CID:00      ERC:00
   +00000E  SCI:00      HIGH_SCI:FF       COND_QLFR:00000000_00000000
   +00001C  ONCODE:0000       VAL_FLAGS:FFFF    FLAGS:00000000
   +000024  ONCOUNT:00000000  SLD_ONFILE:00000050 08601388 02040000 00000000
   +000038  SLD_ONCHAR:00000050 0860138A 02020000 00000001
   +000048  SLD_ONSOURCE:00000050 08601388 02040000 00000000
   +000058  SLD_ONKEY:00000050 08601388 02040000 00000000
   +000068  SLD_DATAFIELD:00000050 08601388 02040000 00000000
   +000078  SLD_ONGSOURCE:00000050 08601388 02040000 00000000
   +000088  SLD_ONWSOURCE:00000050 08601388 020D0000 00000000
   +000098  SLD_ONWCHAR:00000050 08601528 020D0000 00000001
   +0000A8  SLD_ONAREA:00000050 08601388 02040000 00000000
```

Figure 215. Example of formatted PL/I output from LEDATA VERBEXIT (AMODE 64) (Part 2 of 6)

The following is part three of the example of formatted PL/I output from LEDATA VERBEXIT (AMODE 64).

```
   +0000B8  SLD_ONLOC:00000050 08601388 02040000 00000000
   +0000CC  RES_EBP:00000000_00000000     RES_EIP:00000000_00000000
   +0000DC  TRCBK_EBP:00000000_00000000   TRCBK_EIP:00000000_00000000
   +0000EC  EXIT_LABEL:00000000_00000000  RETRY_EBP:00000000_00000000
   +0000FC  RETRY_EIP:00000000_00000000   RETRY_ESP:00000000_00000000
   +00010C  EBP_HAND:00000000_00000000    PLISRTX_RC:00000000
   +000118  UNDEF_SUBC1:00000000    UNDEF_SUBC2:00000000
   +000124  TOKEN:00000000 00000000 00000000 00000000
   +000134  AMODE_SWC_PTR:00000000_00000000     ONOFFSET:00000000
   +000140  ONLINE:00000000

 +--------------------- start of data for file 1 ---------------

            FILENAME:VSAMA
     FNAME:  00000050_0860343C
   +000000  NAMELEN:0005

 [6]   PFO:  00000050_0860340C
   +000000  ANCHOR:00000050_08603434      DECLARED:00840801
   +00000C  INVALIDS:00600602       NAMEPTR:00000050_0860343C
   +000018  ENVPTR:00000000_0F1007F0      INT_TAG:00000000_00000000

    ATTRS:KEYED EXT SEQ RECORD

    INVLD:PRINT EXCL DIR TRANS STREAM

 [7]
  SHAD_FCO:  00000050_08603310
    +000000  SELF:00000050_08603310  CHAIN:00000050_08602830
    +000010  ANCESTOR:00000050_086029A0    INV_STMT_METH:00000050_00123278
    +000020  STMT_ERR_METH:00000050_001232A8
    +000028  DIAGNOSE_METH:00000050_00123268     DONE_METH:00000050_001232A8
    +000038  OPEN_METH:00000050_00123258   CLOSE_METH:00000050_00123248
    +000048  CONTROL_METH:00000050_00123318      LOCATE_METH:00000050_00123308
   +000058  WRITE_METH:00000050_001232F8  REWRITE_METH:00000050_001232E8
    +000068  DELETE_METH:00000050_001232D8       READ_METH:00000050_001232C8
    +000078  UNLOCK_METH:00000050_001232A8       WAIT_METH:00000050_001232A8
    +000088  PUT_METH:00000050_001232A8    GET_METH:00000050_001232A8
    +000098  FLUSH_METH:00000050_001232B8  FINDUSE_METH:00000050_00123298
    +0000C0  SETTYPE_METH:00000050_00123288      QRYTYPE_METH:00000050_0014A7A0
    +0000D8  PATHNAME:00000000_00000000    SHADOW_PFO:00000050_0860340C
    +0000E8  INIT_PFO:00000000_00000000    INIT_PFO_ANC:00000000_00000000

 [8]   FCO:  00000050_086029A0
   +000000  SELF:00000050_086029A0  CHAIN:00000000_00000000
   +000010  ANCESTOR:00000050_08603310    INV_STMT_METH:00000050_00123278
   +000020  STMT_ERR_METH:00000050_001219F8
   +000028  DIAGNOSE_METH:00000050_00123268     DONE_METH:00000050_001232A8
   +000038  OPEN_METH:00000050_00123258   CLOSE_METH:00000050_00123248
   +000048  CONTROL_METH:00000050_00123278      LOCATE_METH:00000050_001221A8
   +000058  WRITE_METH:00000050_001221A8  REWRITE_METH:00000050_001221A8
   +000068  DELETE_METH:00000050_001221A8       READ_METH:00000050_001221A8
   +000078  UNLOCK_METH:00000050_001232A8       WAIT_METH:00000050_001232A8
   +000088  PUT_METH:00000050_001232A8    GET_METH:00000050_001232A8
   +000098  FLUSH_METH:00000050_001232B8  FINDUSE_METH:00000050_00123298
   +0000C0  SETTYPE_METH:00000050_00123288      QRYTYPE_METH:00000050_0014A7B0
   +0000D8  PATHNAME:00000050_08602CF0    SHADOW_PFO:00000000_00000000
   +0000E8  INIT_PFO:00000000_00000000    INIT_PFO_ANC:00000000_00000000
   +0000FC  VALIDITY:75001200       REQUIRED:00002000       ATTRS:03854801
   +000108  PFO:00000050_0860340C   EHB:00000000_00000000   LENGTH:00000340
   +000120  DCB_ACB:00000000_0FC266B8     IO_BUF:00000050_08603208
   +000130  BLKSIZE:00000000_00000000     BLKXFER:00000000  BUF_OBJ:00000000
   +000140  BUF_LEFT:00000000       PRIOR_REC_L:00000000
   +000148  RECSIZE:00000000_0000005C     BUFSIZE:00000000
   +000158  BIG_IO_BUF:00000000_00000000  DCBE:00000000_00000000  ERR_TYPE:00
   +000169  ERR_CODE:00       ENVIRON:40200000  PLATFORM:34000000
   +000174  FLAGS:000C0000    RETRY:00000000    DELAY:00000000
   +000180  BUFFERS:00000000  CURRPTR:00000000_00000000
```

Figure 216. Example of formatted PL/I output from LEDATA VERBEXIT (AMODE 64) (Part 3 of 6)

The following is part four of the example of formatted PL/I output from LEDATA VERBEXIT (AMODE 64).

```
   +000190  ICOSTATIC:00000050_08603110   ICOFREE:00000050_08603110
   +0001A0  ICOWAITING:00000000_00000000  ICOACTIVE:00000050_08603110
   +0001B0  KEYOFREF:00000050_08603270    KEYLOC:00000057   KEYLEN:0004
   +0001BE  PREFIXLEN:0000    FLAGS:0008  BYTESREM:0000
   +0001C8  RECICD:00000000_00000000      EOB/AMRC:00000000_00000000
   +0001D8  BYTESREAD:00000000      EOFPOS:00000000   PRIORLOCRECLEN:00000000
   +0001E4  STATE:00000018    RIOFLAGS:01800000       BUFOFF:00000000
   +0001F0  INDEXAREA:00000000      NCP:00000000
   +0001F8  RECDATA:00000000 00000000 00000000 00000000 00000000
   +00020C  ------>:00000000 00000000 00000000 00000000 00000000
   +000220  ------>:00000000 00000000 00000000 00000000 00000000
   +0002C4  DD_ACCESS:00000000      DD_BLKSIZE:0000   DD_LRECL:0000
   +0002CC  DD_RETCODE:0000   DD_DDNAME:........      DD_RECFM:00
   +0002D7  DD_DISP:0000      DD_FLAGS:00
   +0002DA  DD_DSNAME:............................................
   +000306  DD_ELNAME:........      DS_BLKSIZE:0000   DS_LRECL:0000
   +000312  DS_RETCODE:0000   DS_RECFM:00       DDNAME:VS
   +000320  LOCKPTR:00000000_00000000     SIG_MUTEX:00000000_00000000

    PATHNAME:CS53583.VP53258A.RLUNG.KSDS

    ATTRS:TITLE FILE KEYED EXT BUF OUTPUT SEQ RECORD

    ENV:INDEXED NONSCVAR UNSET

    ENV(INDEXED BLKSIZE(0) RECSIZE(92) KEYLENGTH(4) KEYLOC(88) KSDS)

    For VSAM information please refer to the VSAM control
    blocks in the 64 BIT CRTL I/O CONTROL BLOCKS section

|                                                                              |
+-------------------------- end of data for file 1 ---------------------------+

+------------------------- start of data for file 2 --------------------------+
|                                                                              |
            FILENAME:SYSPRINT
    FNAME:  00000050_0860295C
   +000000  NAMELEN:0008

      PFO:  00000050_0860292C
    +000000  ANCHOR:00000050_08602954      DECLARED:20444042
    +00000C  INVALIDS:00A3AE01       NAMEPTR:00000050_0860295C
    +000018  ENVPTR:00000000_00000000      INT_TAG:00000000_00000000

     ATTRS:STDSTREAM PRINT EXT OUTPUT SYSPRINT STREAM

     INVLD:KEYED EXCL UNBUF BUF INPUT UPDATE SEQ DIR TRANS RECORD

 SHAD_FCO:  00000050_08602830
   +000000  SELF:00000050_08602830  CHAIN:00000000_00000000
   +000010  ANCESTOR:00000050_08601D20    INV_STMT_METH:00000050_00123278
   +000020  STMT_ERR_METH:00000050_001232A8
   +000028  DIAGNOSE_METH:00000050_00123268     DONE_METH:00000050_001232A8
   +000038  OPEN_METH:00000050_00123258   CLOSE_METH:00000050_00123248
   +000048  CONTROL_METH:00000050_00123318      LOCATE_METH:00000050_00123308
   +000058  WRITE_METH:00000050_001232F8  REWRITE_METH:00000050_001232E8
   +000068  DELETE_METH:00000050_001232D8       READ_METH:00000050_001232C8
   +000078  UNLOCK_METH:00000050_001232A8       WAIT_METH:00000050_001232A8
   +000088  PUT_METH:00000050_001232A8    GET_METH:00000050_001232A8
   +000098  FLUSH_METH:00000050_001232B8  FINDUSE_METH:00000050_00123298
   +0000C0  SETTYPE_METH:00000050_00123288      QRYTYPE_METH:00000050_0014A7A0
   +0000D8  PATHNAME:00000000_00000000    SHADOW_PFO:00000050_0860292C
   +0000E8  INIT_PFO:00000000_00000000    INIT_PFO_ANC:00000000_00000000

      FCO:  00000050_08601D20
   +000000  SELF:00000050_08601D20  CHAIN:00000000_00000000
   +000010  ANCESTOR:00000050_08602830    INV_STMT_METH:00000050_00123278
   +000020  STMT_ERR_METH:00000050_001232A8
```

Figure 217. Example of formatted PL/I output from LEDATA VERBEXIT (AMODE 64) (Part 4 of 6)

The following is part five of the example of formatted PL/I output from LEDATA VERBEXIT (AMODE 64).

```
   +000028  DIAGNOSE_METH:00000050_00123268     DONE_METH:00000050_001232A8
   +000038  OPEN_METH:00000050_00123258   CLOSE_METH:00000050_00123248
   +000048  CONTROL_METH:00000050_00123358      LOCATE_METH:00000050_00123278
   +000058  WRITE_METH:00000050_00123278  REWRITE_METH:00000050_00123278
   +000068  DELETE_METH:00000050_00123278       READ_METH:00000050_00123278
   +000078  UNLOCK_METH:00000050_001232A8       WAIT_METH:00000050_001232A8
   +000088  PUT_METH:00000050_00122298    GET_METH:00000050_001232A8
   +000098  FLUSH_METH:00000050_001232B8  FINDUSE_METH:00000050_00123298
   +0000C0  SETTYPE_METH:00000050_00123288      QRYTYPE_METH:00000050_0014A7B0
   +0000D8  PATHNAME:00000050_08602070    SHADOW_PFO:00000000_00000000
   +0000E8  INIT_PFO:00000000_00000000    INIT_PFO_ANC:00000000_00000000
   +0000FC  VALIDITY:00000000       REQUIRED:00000000       ATTRS:20454842
   +000108  PFO:00000050_0860292C   EHB:00000000_00000000   LENGTH:00000340
   +000120  DCB_ACB:00000050_0010B710     IO_BUF:00000050_08602490
   +000130  BLKSIZE:00000000_00000372     BLKXFER:00000000  BUF_OBJ:00000000
   +000140  BUF_LEFT:00000084       PRIOR_REC_L:00000017
   +000148  RECSIZE:00000000_00000089     BUFSIZE:00000000
   +000158  BIG_IO_BUF:00000000_00000000  DCBE:00000000_00000000  ERR_TYPE:00
   +000169  ERR_CODE:00       ENVIRON:00080150  PLATFORM:20000700
   +000174  FLAGS:000A6080    RETRY:00000000    DELAY:00000000
   +000180  BUFFERS:00000000  CURRPTR:00000050_08602490
   +000190  NORM_BUFF:00000000_00000000   PLWA:00000000_00000000
   +0001A0  XMIT:00000050_00123328  NEXT_BYTE:00000050_08602491
   +0001B0  COPY_BYTE:00000000_00000000   COPY_PFO:00000000_00000000
   +0001C0  SCB:00000050_082FF604   TABTAB:00000050_00171B90
   +0001D0  RECCNT:00000000   BYTESINTO:00000000      BUFLEFTNORM:00000000
   +0001DC  BYTESINTONORM:00000000  PAGENOBIF:00000001      COUNTBIF:00000001
   +0001E8  LINENOBIF:00000005      PAGESIZE:003C     LINESIZE:0084
   +0001F0  SIOFLAGS:08000000       NORMAREASIZE:00000000
   +0001F8  TSONEXTBYTE:00000000_00000000       QSA:00000000_00000000
   +000208  DCB_LEN:00000000  DCBE_LEN:00000000       DD_ACCESS:00000000
   +0002C8  DD_BLKSIZE:0000   DD_LRECL:0000     DD_RETCODE:0000
   +0002CE  DD_DDNAME:........      DD_RECFM:00       DD_DISP:0000
   +0002D9  DD_FLAGS:00
```

Figure 218. Example of formatted PL/I output from LEDATA VERBEXIT (AMODE 64) (Part 5 of 6)

The following is part six of the example of formatted PL/I output from LEDATA VERBEXIT (AMODE 64).

```
   +0002DA  DD_DSNAME:............................................
   +000306  DD_ELNAME:........      DS_BLKSIZE:0000   DS_LRECL:0000
   +000312  DS_RETCODE:0000   DS_RECFM:00       DDNAME:SYSPRINT
   +000320  LOCKPTR:00000000_00000000     SIG_MUTEX:00000000_00000000

[9]   SCB:  00000050_082FF604
   +000000  SKIPLINE:00000001       IOBUFF:00000000_00000000
   +00000C  STR_PTR:00000000_00000000     STR_DSC:00000000_00000000
   +00001C  SYMTAB:00000000_00000000      SRC:00000000_0F100884
   +00002C  SRCDED:00000000_0F100810      SRCDSC:00000000_0F1007E0
   +00003C  TGT:00000000_00000000   TGTDED:00000000_00000000
   +00004C  TGTDSC:00000000_00000000      CMD:4A48    FMTCTL:0100
   +000058  RCODE:01    NESTING:00  FLAGS:0000  FCO:00000050_08601D20
   +000064  CNT/BUFLEFT:00000001    SFI:00000000_00000000
   +000074  EFSE_SP:00000000_00000000     EFSE_PREV:00000000_00000000
   +000084  EFSE_TAB:00000000_00000000    EFSE_ACT:00000000_00000000
   +000094  EFSE_RES:00000000_00000000    EFSE_FET:00000000_00000000
   +0000A4  EFSE_USE:00000000       EFSE_FLGS:00000000
   +0000AC  FMTTAB:00000000_00000000      FET:00000000_00000000

    PATHNAME:CS53583.$P53258B.J0072540.D0000109.?

[10]ATTRS:STDSTREAM PRINT EXT BUF OUTPUT SEQ SYSPRINT STREAM

    ENV:CONSECUTIVEDEF CTLASA LF V B

[11]ENV(CONSECUTIVE VB BLKSIZE(882) RECSIZE(137) LINESIZE(132) PAGESIZE(60) CTLASA)

[12]  DCB:  00000050_0010B710
   +000000  DCBE:00000050_0010B730  KEYCN:AF    FDAD:CBAFCB01_00000000
   +000011  DVTBA:000000      TRBAL:0000  ORBYT:00000000    MTAPE:00000000
   +000020  KEYLE:00    DEVT:000000       BUFCB:00000000_00000000
   +000030  BUFL:0000   DSORG:0000  IOBAD_ODEB:0000006D     BFALN:00
   +000039  EODAD:000000      RECFM:00    EXLSA:000000      DDNAM:........
   +000050  OFLGS:00    IFLG:00     MACR:0050   GPRW:00000000_0000000B
   +000060  OPTCD:00    CHCKA:000000      IOBL:00     SYNA:000000
   +000070  CIND1:00    CIND2:00    BLKSI:0050  WR_CP:00000050
   +00007C  RW_CCW:0010BAB0   IOBA:00000050_0010B730  EOBAD:00000000_00000000
   +000090  RECAD:E2E8E2D7_D9C9D5E3       FLAGS:FFFF  LRECL:FFFF  EROPT:00
   +0000A1  CNTRA:000050      PRECL:0050  EOB:00000000_0FA126A0
   +0000B8  DFBK:00000000_0FA126B0  DYNB:00000000_0FA12FD0
|                                                                         |
+-------------------------- end of data for file 2 -------------------------+
Exiting Enterprise PLI(64)+ Environment Data
```

Figure 219. Example of formatted Pl/I output from LEDATA VERBEXIT (AMODE 64) (Part 6 of 6)

PL/I-specific sections of the LEDATA output

Table 59 on page 413 describes the contents of the LEDATA output that is specific to C/C++.

Table 59. Contents of PL/I-specific sections of the LEDATA output (AMODE 64)

Section Number and Heading	Contents
[1] PCB	This section formats the Enterprise PL/I process-level control block (PCB).
[2] DYNLST	This section formats the Enterprise PL/I process-level dynamic allocation parameter list.
[3] TCA	This section formats the Enterprise PL/I task communication control block (TCA).
[4] FECB	This section formats the PL/I for MVS & VM fetch control block (FECB).
[5] OCA	This section formats the Enterprise PL/I ON communications control block (OCA).
[6] PFO	This section formats the Enterprise PL/I file object control block (PFO).
[7] SHAD_FCO	This section formats the Enterprise PL/I shadow file object control block (shadow FCO).
[8] FCO	This section formats the Enterprise PL/I file control block (FCO).
[9] SCB	This section formats the Enterprise PL/I stream I/O control block (SCB).
[10] ATTRS	This section formats the Enterprise PL/I file attribute map (ATTRS).
[11] ENV	This section formats the Enterprise PL/I environment control block (ENV).
[12] DCB	This section formats the Enterprise PL/I data control block (DCB).

Understanding the AUTH LEDATA output

The Language Environment IPCS VERBEXIT LEDATA generates formatted output of Preinitialized Environments for Authorized Programs-specific control blocks from a system dump when the AUTH parameter is specified. Figure Figure 220 on page 414 illustrates the output produced when the LEDATA VERBEXIT is invoked with the AUTH parameter. Ellipses are used to summarize some sections of the dump. For easy reference, the sections of the dump are numbered to correspond with the description of each section that follows.

```
     ********************************************************************************
                      Authorized Language Environment Control Blocks
     ********************************************************************************

[1]      ALEC:  00000000_7F6F7000
       +000000  ID:ALEC     Ascb:00FBBE00     Flags1:40000000
       +00000C  UseCount:00000001       ASATable@1:7F6E8414
       +000014  ASATable@2:7F6E8754     ASATable@3:00000000
       +00001C  ASATable@4:00000000     MCallRtn:82991A80
       +000024  UCallRtn:82999DB8       LatchSetTok:7F6C0B40 00000074
       +000030  Alei:00000001_001053A0        Ales:00000001_00107CD0
       +000040  StackCPID:7F6C3F00      AROTCB:008FF028   EnvTypeNum:00000000
       +00004C  WorkECB:808E6F10
       +000050  AROTToken:0000006C 00000003 00000003 008FF028
       +000060  WTPE:00000053 023B8240 00000000 00000000        ALELVT:00000001
       +000074  SLELVT:00100140   FuncTable@:00000000_00000000
       +000080  WorkQueue:00000000_00000000   ALESeqNum:00000000 00000027
       +000090  ALESCount:00000000 00000001   SystemRtnCode:00000000
       +00009C  SystemRsnCode:00000000        SystemRtnCodeJr:00000000
       +0000A4  SystemRsnCodeJr:00000000      WorkerTCB:008D8E88
       +0000B0  SystemOCB@:00000000_00000000

[2]  Load Module Control Blocks

      Queue #: 0000000000000000

         ALMI:  00000001_00100F40
       +000000  ID:ALMI     ModuleSize:00000600     ModuleName:CELQDSNF
       +000010  UseCount:00000000 00000001    LoadPoint:00000000 264E3000
       +000020  EntryPoint:00000000 264E3001

         ALMI:  00000001_00100B40
       +000000  ID:ALMI     ModuleSize:0000F000     ModuleName:CDAEQED
       +000010  UseCount:00000000 00000001    LoadPoint:00000000 26396000
       +000020  EntryPoint:00000000 26396001

         ALMI:  00000001_00100540
       +000000  ID:ALMI     ModuleSize:000017AD     ModuleName:CEEMENU3
       +000010  UseCount:00000000 00000000    LoadPoint:00000000 26386298
       +000020  EntryPoint:00000000 26386298

      Queue #: 0000000000000002

         ALMI:  00000001_00101340
       +000000  ID:ALMI     ModuleSize:00000450     ModuleName:EDCUCSNM
       +000010  UseCount:00000000 00000001    LoadPoint:00000000 05F15640
       +000020  EntryPoint:00000000 05F15640

      Queue #: 0000000000000003

         ALMI:  00000001_00100D40
       +000000  ID:ALMI     ModuleSize:00018800     ModuleName:CDAEQDPI
       +000010  UseCount:00000000 00000001    LoadPoint:00000000 26414000
       +000020  EntryPoint:00000000 26414001

         ALMI:  00000001_00100340
       +000000  ID:ALMI     ModuleSize:00000200     ModuleName:ALEM001
       +000010  UseCount:00000000 00000003    LoadPoint:00000000 26384000
       +000020  EntryPoint:00000000 26384001

      Queue #: 0000000000000006

         ALMI:  00000001_00100740
       +000000  ID:ALMI     ModuleSize:00000400     ModuleName:CDIVZERO
       +000010  UseCount:00000000 00000001    LoadPoint:00000000 26393000
       +000020  EntryPoint:00000000 26393001

      Queue #: 0000000000000007

         ALMI:  00000001_00101140
       +000000  ID:ALMI     ModuleSize:00000655     ModuleName:CEL4CTBL
       +000010  UseCount:00000000 00000001    LoadPoint:00000000 264E7D58
       +000020  EntryPoint:00000000 264E7D58

[3]  User Managed Control Blocks
```

Figure 220. Example of formatted AUTH output from LEDATA VERBEXIT (AMODE 64) (Part 1 of 4)

The following is part two of the example of formatted AUTH output from LEDATA VERBEXIT (AMODE 64).

```
[4]      ALEI:  00000001_001053A0
       +000000  ID:ALEI     Flags1:80000000   InstanceNum:00000000 00000025
       +000010  Next:00000000_00000000        Prev:00000000_00000000
       +000020  Flags2:40000000   EnclaveSeq#:00000001    LAA:01ED6498
       +00002C  SavedLAA:7F710E80       Alec:00000000_7F6F7000
       +000038  CallerPSWKey:00000000 00000070      ASAStack:00000000_7F6C4A28
       +000048  ParmListPtr:00000000_7F705D58       ParmListPtrK0:00000000_7F6C42F8
       +000058  RTOPtr:00000001_0050042C      RTOLen:00000000 00000012
       +000068  RTBL@:00000001_001055B8       CallAlri:00000001_00100940
       +000078  EnvAlris:00000000_00000000    SystemRtnCode:00000000
       +000084  SystemRsnCode:00000000        SystemRtnCodeJr:00000000
       +00011C  SystemRsnCodeJr:00000000      ALES:00000000_00000000

[5]  Routine Control Blocks

      Queue #: 0000000000000010

       Routine: CDIVZERO
         ALRI:  00000001_00100940
       +000000  ID:ALRI     Flags:80000000    InstanceNum:00000000 00000026
       +000010  NEXT:00000000_00000000        ALEC:00000000_7F6F7000
       +000020  AleiAddress:00000001_001053A0       AleiInstanceNum:00000000_00000025
       +000030  DllName:........  RoutineNamePtr:00000001_00100B20
       +000040  RoutineNameLen:00000000 00000008    RoutineAddr:00000000_26393178
       +000050  QSTRTAddr:00000000_26393000   DllKeyPtr:00000000_00000000
       +000060  DllKeyLen:00000000 00000000   ParmLen:00000000
       +00006C  EnvFlags:40000000       FuncEnv:00000000_00000010
       +000078  FuncEntry:00000000_26393178   MasterAlri:00000000_00000000
       +0000E8  Ales:00000000_00000000        LUAlri:00000000 00000000
       +0000F8  EnvType:00000000        EnclaveSeq#:00000001
       +000100  NextEnvAlri:00000000_00000000

      Queue #: 0000000000000015

       Routine: CDIVZERO
         ALRI:  00000001_00100940
       +000000  ID:ALRI     Flags:80000000    InstanceNum:00000000 00000026
       +000010  NEXT:00000000_00000000        ALEC:00000000_7F6F7000
       +000020  AleiAddress:00000001_001053A0       AleiInstanceNum:00000000_00000025
       +000030  DllName:........  RoutineNamePtr:00000001_00100B20
       +000040  RoutineNameLen:00000000 00000008    RoutineAddr:00000000_26393178
       +000050  QSTRTAddr:00000000_26393000   DllKeyPtr:00000000_00000000
       +000060  DllKeyLen:00000000 00000000   ParmLen:00000000
       +00006C  EnvFlags:40000000       FuncEnv:00000000_00000010
       +000078  FuncEntry:00000000_26393178   MasterAlri:00000000_00000000
       +0000E8  Ales:00000000_00000000        LUAlri:00000000 00000000
       +0000F8  EnvType:00000000        EnclaveSeq#:00000001
       +000100  NextEnvAlri:00000000_00000000

[6]  System Managed Control Blocks

[7]      ALES:  00000001_00107CD0
       +000000  ID:ALES     UseCount:00000000
       +000008  InstanceNum:00000000 00000000       Next:00000000_00000000
       +000018  ENVID:RTOTCB5A    Flags1:00000000 00000000      Alec:00000000_7F6F7000
       +000030  NumEnvType:00000000 00000003        CPPtr:00000001_001082C8
       +000040  AllocSize:00000000 00000B48   SystemRtnCode:00000000
       +00004C  SystemRsnCode:00000000        SystemRtnCodeJr:00000000
       +000054  SystemRsnCodeJr:00000000      DiagRtn:00000000_00000000
       +000060  DiagTkn:00000000 00000000

[8]   ETINDEX: 00000001

      ALESETE:  00000001_00107E18
       +000000  Flags:00000000    ALEI:00000001_0010E0D8
       +000010  WTime:00000000 00000000       InitNum:00000000 0000000A
       +000020  IncrNum:00000000 00000005     MaxNum:00000000 00000014
       +000030  CurNum:00000000 0000000A      RTOPtr:00000001_00207CD0
       +000040  RTOLen:00000000 00000400
```

Figure 221. Example of formatted AUTH output from LEDATA VERBEXIT (AMODE 64) (Part 2 of 4)

The following is part three of the example of formatted AUTH output from LEDATA VERBEXIT (AMODE 64).

```
[9]  Routine Control Blocks

      Queue #: 0000000000000017

       Routine: ALEM001
         ALRI:  00000001_00200140
       +000000  ID:ALRI     Flags:88000000    InstanceNum:00000000 00000022
       +000010  NEXT:00000001_00200340        ALEC:00000000_7F6F7000
       +000020  AleiAddress:00000000_00000000       AleiInstanceNum:00000000_00000000
       +000030  DllName:........  RoutineNamePtr:00000001_00200320
       +000040  RoutineNameLen:00000000 00000008    RoutineAddr:00000000_263840C0
       +000050  QSTRTAddr:00000000_26384000   DllKeyPtr:00000000_00000000
       +000060  DllKeyLen:00000000 00000000   ParmLen:00000000
       +00006C  EnvFlags:00000000       FuncEnv:00000000_00000000
       +000078  FuncEntry:00000000_00000000   MasterAlri:00000000_00000000
       +0000E8  Ales:00000001_00107CD0        LUAlri:00000001 00200340
       +0000F8  EnvType:00000001        EnclaveSeq#:00000000
       +000100  NextEnvAlri:00000000_00000000

       Routine: ALEM001
         ALRI:  00000001_00200140
       +000000  ID:ALRI     Flags:88000000    InstanceNum:00000000 00000022
       +000010  NEXT:00000001_00200340        ALEC:00000000_7F6F7000
       +000020  AleiAddress:00000000_00000000       AleiInstanceNum:00000000_00000000
       +000030  DllName:........  RoutineNamePtr:00000001_00200320
       +000040  RoutineNameLen:00000000 00000008    RoutineAddr:00000000_263840C0
       +000050  QSTRTAddr:00000000_26384000   DllKeyPtr:00000000_00000000
       +000060  DllKeyLen:00000000 00000000   ParmLen:00000000
       +00006C  EnvFlags:00000000       FuncEnv:00000000_00000000
       +000078  FuncEntry:00000000_00000000   MasterAlri:00000000_00000000
       +0000E8  Ales:00000001_00107CD0        LUAlri:00000001 00200340
       +0000F8  EnvType:00000001        EnclaveSeq#:00000000
       +000100  NextEnvAlri:00000000_00000000

[10]     ALEI:  00000001_0010E0D8
       +000000  ID:ALEI     Flags1:00000000   InstanceNum:00000000 0000000A
       +000010  Next:00000001_0010DEC0        Prev:00000000_00000000
       +000020  Flags2:00000000   EnclaveSeq#:00000002    LAA:01ED8E18
       +00002C  SavedLAA:7F710E80       Alec:00000000_7F6F7000
       +000038  CallerPSWKey:00000000 00000070      ASAStack:00000000_7F6C4AC0
       +000048  ParmListPtr:00000000_7F704AA8       ParmListPtrK0:00000000_7F6C4348
       +000058  RTOPtr:00000001_0000042C      RTOLen:00000000 00000401
       +000068  RTBL@:00000000_00000000       CallAlri:00000001_00200340
       +000078  EnvAlris:00000001_00200340    SystemRtnCode:00000000
       +000084  SystemRsnCode:00000000        SystemRtnCodeJr:00000000
       +00011C  SystemRsnCodeJr:00000000      ALES:00000001_00107CD0

       Routine: ALEM001
[11]     ALRI:  00000001_00200340
       +000000  ID:ALRI     Flags:80000000    InstanceNum:00000000 00000022
       +000010  NEXT:00000000_00000000        ALEC:00000000_7F6F7000
       +000020  AleiAddress:00000001_0010E0D8       AleiInstanceNum:00000000_00000000
       +000030  DllName:........  RoutineNamePtr:00000001_00200320
       +000040  RoutineNameLen:00000000 00000008    RoutineAddr:00000000_263840C0
       +000050  QSTRTAddr:00000000_26384000   DllKeyPtr:00000000_00000000
       +000060  DllKeyLen:00000000 00000000   ParmLen:00000010
       +00006C  EnvFlags:40000000       FuncEnv:00000000_00000010
       +000078  FuncEntry:00000000_263840C0   MasterAlri:00000001_00200140
       +0000E8  Ales:00000001_00107CD0        LUAlri:00000000 00000000
       +0000F8  EnvType:00000001        EnclaveSeq#:00000001
       +000100  NextEnvAlri:00000000_00000000

[10]     ALEI:  00000001_0010DEC0
       +000000  ID:ALEI     Flags1:00000000   InstanceNum:00000000 00000009
       +000010  Next:00000001_0010DCA8        Prev:00000000_00000000
       +000020  Flags2:80000000   EnclaveSeq#:00000000    LAA:01ED8C98
       +00002C  SavedLAA:00000000       Alec:00000000_7F6F7000
       +000038  CallerPSWKey:00000000 00000070      ASAStack:00000000_00000000
       +000048  ParmListPtr:00000000_00000000       ParmListPtrK0:00000000_00000000
       +000058  RTOPtr:00000001_00207CD0      RTOLen:00000000 00000400
       +000068  RTBL@:00000000_00000000       CallAlri:00000000_00000000
       +000078  EnvAlris:00000000_00000000    SystemRtnCode:00000000
       +000084  SystemRsnCode:00000000        SystemRtnCodeJr:00000000
       +00011C  SystemRsnCodeJr:00000000      ALES:00000001_00107CD0
```

Figure 222. Example of formatted AUTH output from LEDATA VERBEXIT (AMODE 64) (Part 3 of 4)

The following is part four of the example of formatted AUTH output from LEDATA VERBEXIT (AMODE 64).

```
[10]     ALEI:  00000001_0010DCA8
       +000000  ID:ALEI     Flags1:00000000   InstanceNum:00000000 00000008
       +000010  Next:00000001_0010DA90        Prev:00000000_00000000
       +000020  Flags2:80000000   EnclaveSeq#:00000000    LAA:01ED8B18
       +00002C  SavedLAA:00000000       Alec:00000000_7F6F7000
       +000038  CallerPSWKey:00000000 00000070      ASAStack:00000000_00000000
       +000048  ParmListPtr:00000000_00000000       ParmListPtrK0:00000000_00000000
       +000058  RTOPtr:00000001_00207CD0      RTOLen:00000000 00000400
       +000068  RTBL@:00000000_00000000       CallAlri:00000000_00000000
       +000078  EnvAlris:00000000_00000000    SystemRtnCode:00000000
       +000084  SystemRsnCode:00000000        SystemRtnCodeJr:00000000
       +00011C  SystemRsnCodeJr:00000000      ALES:00000001_00107CD0
⋮
[8]   ETINDEX: 00000002

      ALESETE:  00000001_00107FA8
       +000000  Flags:00000000    ALEI:00000001_001102F0
       +000010  WTime:00000000 00000000       InitNum:00000000 0000000B
       +000020  IncrNum:00000000 00000006     MaxNum:00000000 00000017
       +000030  CurNum:00000000 0000000B      RTOPtr:00000001_002080D0
       +000040  RTOLen:00000000 00000400
[9]  Routine Control Blocks

      Queue #: 0000000000000017

       Routine: ALEM001
         ALRI:  00000001_00200540
       +000000  ID:ALRI     Flags:88000000    InstanceNum:00000000 00000023
       +000010  NEXT:00000001_00200740        ALEC:00000000_7F6F7000
       +000020  AleiAddress:00000000_00000000       AleiInstanceNum:00000000_00000000
       +000030  DllName:........  RoutineNamePtr:00000001_00200720
       +000040  RoutineNameLen:00000000 00000008    RoutineAddr:00000000_263840C0
       +000050  QSTRTAddr:00000000_26384000   DllKeyPtr:00000000_00000000
       +000060  DllKeyLen:00000000 00000000   ParmLen:00000000
       +00006C  EnvFlags:00000000       FuncEnv:00000000_00000000
       +000078  FuncEntry:00000000_00000000   MasterAlri:00000000_00000000
       +0000E8  Ales:00000001_00107CD0        LUAlri:00000001 00200740
       +0000F8  EnvType:00000002        EnclaveSeq#:00000000
       +000100  NextEnvAlri:00000000_00000000

       Routine: ALEM001
         ALRI:  00000001_00200540
       +000000  ID:ALRI     Flags:88000000    InstanceNum:00000000 00000023
       +000010  NEXT:00000001_00200740        ALEC:00000000_7F6F7000
       +000020  AleiAddress:00000000_00000000       AleiInstanceNum:00000000_00000000
       +000030  DllName:........  RoutineNamePtr:00000001_00200720
       +000040  RoutineNameLen:00000000 00000008    RoutineAddr:00000000_263840C0
       +000050  QSTRTAddr:00000000_26384000   DllKeyPtr:00000000_00000000
       +000060  DllKeyLen:00000000 00000000   ParmLen:00000000
       +00006C  EnvFlags:00000000       FuncEnv:00000000_00000000
       +000078  FuncEntry:00000000_00000000   MasterAlri:00000000_00000000
       +0000E8  Ales:00000001_00107CD0        LUAlri:00000001 00200740
       +0000F8  EnvType:00000002        EnclaveSeq#:00000000
       +000100  NextEnvAlri:00000000_00000000

[10]     ALEI:  00000001_001102F0
       +000000  ID:ALEI     Flags1:00000000   InstanceNum:00000000 00000015
       +000010  Next:00000001_001100D8        Prev:00000000_00000000
       +000020  Flags2:00000000   EnclaveSeq#:00000002    LAA:01ED7018
       +00002C  SavedLAA:7F710E80       Alec:00000000_7F6F7000
       +000038  CallerPSWKey:00000000 00000070      ASAStack:00000000_7F6C4AC0
       +000048  ParmListPtr:00000000_7F705AA8       ParmListPtrK0:00000000_7F6C4348
       +000058  RTOPtr:00000001_0030042C      RTOLen:00000000 00000401
       +000068  RTBL@:00000000_00000000       CallAlri:00000001_00200740
       +000078  EnvAlris:00000001_00200740    SystemRtnCode:00000000
       +000084  SystemRsnCode:00000000        SystemRtnCodeJr:00000000
       +00011C  SystemRsnCodeJr:00000000      ALES:00000001_00107CD0
⋮
[8]   ETINDEX: 00000003

      ALESETE:  00000001_00108138
       +000000  Flags:00000000    ALEI:00000001_00112508
       +000010  WTime:00000000 00000000       InitNum:00000000 0000000C
       +000020  IncrNum:00000000 00000007     MaxNum:00000000 0000001A
       +000030  CurNum:00000000 0000000C      RTOPtr:00000001_002084D0
       +000040  RTOLen:00000000 00000400
⋮
    Exiting Language Environment Data
```

Figure 223. Example of formatted AUTH output from LEDATA VERBEXIT (AMODE 64) (Part 4 of 4)

Sections of the AUTH LEDATA VERBEXIT formatted output

Table 60 on page 418 describes the contents of the AUTH LEDATA VERBEXIT formatted output.

Table 60. Contents of AUTH LEDATA VERBEXIT formatted output (AMODE 64)

Section number and heading	Contents
[1] ALEC	Anchor control block for all other Preinitialized Environments for Authorized Programs control blocks within the address space. The ALEC is located from the ASXB (Address Space Extension Block).
[2] Load Module Control Blocks	Formatted representation of a table of ALMI control blocks. Each ALMI represents a module that was loaded by Preinitialized Environments for Authorized Programs.
[3] User Managed Control Blocks	Control blocks for all user-managed environments. A user-managed environment is initialized when the CELAAUTH macro is invoked with REQUEST=USERINIT.
[4] ALEI	Each ALEI control block represents one environment. This is a control block for one user-managed environment. This section is repeated for each user-managed environment that was initialized.
[5] Routine Control Blocks	Formatted representation of a table of ALRI control blocks. Each ALRI in this section represents a routine that was called by the user-managed environment. Each ALRI appears in the table twice, once for the routine name and once for the routine address. This is a control block for one user-managed environment. This section is repeated for each user-managed environment that was initialized.
[6] System Managed Control Blocks	Control blocks for all system-managed environments. A set of system-managed environments is initialized when the CELAAUTH macro is invoked with REQUEST=MNGDINIT.
[7] ALES	Each ALES represents a set of system-managed environments. This is a control block for one set of system-managed environments that was initialized. This section is repeated for each set of system-managed environment that was initialized.
[8] ETINDEX and ALESETE	The ETINDEX is the environment definition entry index value and the ALESETE represents the environment definition entry. This is a control block for one set of system-managed environments that was initialized. This section is repeated for each set of system-managed environment that was initialized. This is a control block for one environment definition entry. This section is repeated for every environment definition entry (AEDE) that was specified when the set of system-managed environments was initialized.
[9] Routine Control Blocks	Formatted representation of a table of ALRI control blocks. Each ALRI in this section represents a routine that was called in one of the environments associated with the ETINDEX and ALESETE. Each ALRI appears in the table twice, once for the routine name and once for the routine address. This is a control block for one set of system-managed environments that was initialized. This section is repeated for each set of system-managed environment that was initialized. This is a control block for one environment definition entry. This section is repeated for every environment definition entry (AEDE) that was specified when the set of system-managed environments was initialized.

Table 60. Contents of AUTH LEDATA VERBEXIT formatted output (AMODE 64) (continued)

Section number and heading	Contents
[10] ALEI	Each ALEI control block represents one environment. The ALEIs in this section represent system-managed environments. This is a control block for one set of system-managed environments that was initialized. This section is repeated for each set of system-managed environment that was initialized. This is a control block for one environment definition entry. This section is repeated for every environment definition entry (AEDE) that was specified when the set of system-managed environments was initialized. This is a control block for one system-managed environment. This section is repeated for every environment that is associated with the ETINDEX and ALESETE.
[11] ALRI	Contains the ALRI control blocks for each routine that was called in the environment that was identified by the ALEI. This section does not appear if the environment was not used to call a routine. This is a control block for one set of system-managed environments that was initialized. This section is repeated for each set of system-managed environment that was initialized. This is a control block for one environment definition entry. This section is repeated for every environment definition entry (AEDE) that was specified when the set of system-managed environments was initialized. This is a control block for one system-managed environment. This section is repeated for every environment that is associated with the ETINDEX and ALESETE.

Formatting individual control blocks

In addition to the full LEDATA output which contains many formatted control blocks, the IPCS Control block formatter can also format individual Language Environment control blocks. The IPCS CBF command can be invoked from the "IPCS Subcommand Entry" screen, option 6 of the "IPCS PRIMARY OPTION MENU". For more information on using the IPCS CBF command, see the "CBFORMAT subcommand" section in *z/OS MVS IPCS Commands*.

```
►► CBF — address — STRUCTure — ( — cbname — ) ►◄
```

address
The address of the control block in the dump. This is determined by browsing the dump or running the LEDATA VERBEXIT.

cbname
The name of the control block to be formatted. The control blocks that can be individually formatted are listed in Table 61 on page 420. In general, the name of each control block is similar to that used by the LEDATA VERBEXIT and is generally found in the control block's eyecatcher field. However, all control block names are prefixed with CEE to uniquely define the Language Environment control block names to IPCS.

For example, the following command produces the output shown in Figure 224 on page 420.

```
CBF 100007B18 struct(CELCAA)
```

```
CEECAA:  00000001_00007B18
+000288  DLLF:00000000_00000000        INVAR:8000  FLAG0:00
+000304  TORC:00000000     FLAG2:30    LEVEL:15    _PM:04
+000368  DMC:00000000_00000000   CD:00000000       RS:00000000
+000378  ERR:00000001_082FBE00   DDSA:00000001_082FF760
+000388  EDB:00000001_00005340   PCB:00000001_00003CA0   EYEPTR:00000001_00007B00
+0003A0  CAA:00000001_00007B18   SHAB:00000000_00000000
+0003B0  PRGCK:00000000_00000000       URC:00000000      PICICB:00000000_00000000
+0003C8  SIGSCTR:00000000        SIGSFLG:08000000        THDID:253E0190_00000000
+0003D8  RCB:00000001_00003A10   MEMBR:00000001_000084D0
+0003E8  SIGNAL_STATUS:00000000_00000008     HCOM_REG14:00000000_00000000
+0003F8  EDCHPXV:00000000_25546C78     THREADHEAPID:00000000_00000000
+000408  SYS_RTNCODE:00000000    SYS_RSNCODE:00000000    SIGNGPTR:00000001_00007F30
+000418  SIGNG:00000001    AB_STATUS:00      STACKDIRECTION:00
+000420  AB_GR0:00000000_00000000      AB_ICD1:00000000_00000000
+000430  AB_ABCC:00000000_00000000     AB_CRC:00000000_00000000
+000440  USERRTN:00000000_00000000     QINITDSA:00000001_082FF280
+0004E8  IFLAG:0008  TRMRSN:00   DEVH:00000000_00000000
+0004F8  PtatPtr:00000000_00000000     SQELADDR:00000000_257520A0
+000510  VBA:00000001_08913350   TCS:00000001_08FEC450
+000520  CONDWAITDSAREG:00000000_00000000    THDSTATUS:00000000_00000000
+000570  FBTOK:00000000 00000000 00000000 00000000       PTXLPTR:00000000_00000000
+000588  TICB_PTR:00000001_00006AB0    FWD_CHAIN:00000001_114013C8
+0005A0  BKWD_CHAIN:00000001_199013C8        TCB:007FF050
+0007EC  DIA:25752320      DLLFFLAG:00       MCBPTR:00000000_25773DA8
+000838  MAD:00000000_25773048   MFD:00000000_25752998
```

Figure 224. CAA formatted by the CBFORMAT IPCS command

Table 61. Language Environment control blocks that can be individually formatted

Control Block	Description
CELCIB	Condition Information Block
CELCIBH	Condition Information Block Header
CELDLLF	DLL Failure Control Block
CELDSA	Dynamic Storage Area
CELDSATR	XPLINK Transition Area
CELEDB	Enclave Data Block
CELENSQ	Enclave Level Storage Management
CELHNQ31	Heap Anchor Node 31-bit
CELHCOM	CEL Exception Manager Communications Area
CELHPCQ	Thread Level Heap Control Block
CELLAA	Library Anchor Area
CELLCA	Library Communication Area
CELPCB	Process Control Block
CELRCB	Region Control Block
CELSANC	Storage Management Control Block
CELSTSB	Storage Report Statistics Block

Table 62. Preinitalized Environments for Authorized Programs control blocks that can be individually formatted

Control Block	Description
CELALEC	Anchor Block
CELALEI	Environment Information Block
CELALES	System Managed Environment Set Block
CELALMI	Module Information Block
CELALRI	Routine Information Block

Requesting a Language Environment trace for debugging

Language Environment provides an in-storage, wrapping trace facility that can reconstruct the events leading to the point where a dump is taken. Language Environment produces a trace table in its dump report when the TRACE runtime option is set to ON and:

- A thread ends abnormally because of an unhandled condition of severity 2 or greater and the TERMTHDACT runtime option is set to DUMP, UADUMP, TRACE, or UATRACE.
- An application terminates normally and the TRACE runtime option is set to DUMP (the default).

For more information about recording done by the TERMTHDACT runtime option or the TRACE runtime option, see TERMTHDACT and TRACE in *z/OS Language Environment Programming Reference*.

The TRACE runtime option activates Language Environment runtime library tracing and controls the size of the trace buffer, the type of trace events to record, and it determines whether a dump containing only the trace table should be unconditionally taken when the application (enclave) terminates. The trace table contents can be written out either upon demand or at the termination of an enclave.

The contents of the Language Environment dump depend on the values set in the TERMTHDACT runtime option. Table 63 on page 421 summarizes the dump contents that are generated under abnormal termination.

Table 63. TERMTHDACT runtime option settings and dump contents produced (AMODE 64)

TERMTHDACT value	Type of dump generated
TERMTHDACT(QUIET)	Language Environment dump containing the trace table only
TERMTHDACT(MSG)	Language Environment dump containing the trace table only
TERMTHDACT(TRACE)	Language Environment dump containing the trace table and the traceback
TERMTHDACT(DUMP)	Language Environment dump containing thread/enclave/process storage and control blocks; the trace table is included as an enclave control block
TERMTHDACT(UAONLY)	System dump of the user address space and a Language Environment dump that contains the trace table
TERMTHDACT(UATRACE)	Language Environment dump that contains traceback information, and a system dump of the user address space
TERMTHDACT(UADUMP)	Language Environment dump containing thread/enclave/process storage and control blocks (the trace table is included as an enclave control block), and a user address space dump
TERMTHDACT(UAIMM)	System dump of the user address space of the original abend or program interrupt that occurred before the Language Environment condition manager processing the condition. Also contains a Language Environment dump, which contains the trace table. TRAP(ON,NOSPIE) must be in effect. When TRAP(ON,SPIE) is in effect, UAIMM equals UAONLY results. For software raised conditions or signals, UAIMM is the same as UAONLY.

Under normal termination, with the TRACE runtime option set to DUMP, Language Environment generates a dump containing the trace table only, independent of the TERMTHDACT setting.

Language Environment quiesces all threads that are currently running except for the thread that issued the call to `cdump()`. When you call `cdump()` in a multithread environment, only the current thread is dumped. Enclave- and process-related storage could have changed from the time the dump request was issued.

Locating the trace dump

If your application is running under TSO or batch, and a CEEDUMP DD is not specified, Language Environment writes the CEEDUMP to the batch log (SYSOUT=* by default). You can change the SYSOUT class by specifying a CEEDUMP DD, or by setting the environment variable, _CEE_DMPTARG=SYSOUT(*x*), where *x* is the preferred SYSOUT class.

If your application is running under z/OS UNIX and is either running in a child process, or if it is invoked by one of the `exec` family of functions, the dump is written to the z/OS UNIX file system. Language Environment writes the CEEDUMP to one of the following directories in the specified order:

1. The directory in environment variable _CEE_DMPTARG, if found
2. The current working directory, if the directory is not the root directory (/), the directory is writable, and the CEEDUMP path name does not exceed 1024 characters
3. The directory found in environment variable TMPDIR (an environment variable that indicates the location of a temporary directory if it is not /tmp)
4. The `/tmp` directory

The name of this file changes with each dump and uses the following format:

```
/path/CEEDUMP.Date.Time.Pid
```

path
The path determined from the above algorithm.

Date
The date the dump is taken, appearing in the format `YYYYMMDD` (such as 20040918 for September 18, 2004).

Time
The time the dump is taken, appearing in the format `HHMMSS` (such as 175501 for 05:55:01 p.m.).

Pid
The process ID the application is running in when the dump is taken.

Using the Language Environment trace table format in a dump report

The Language Environment trace table is established unconditionally at enclave initialization time if the TRACE runtime option is set to ON. All threads in the enclave share the trace table; there is no thread-specific table, nor can the table be dynamically extended or enlarged.

Understanding the trace table entry (TTE)

Each trace table entry is a fixed-length record consisting of a fixed-format portion (containing such items as the timestamp, thread ID, and member ID) and a member-specific portion. The member-specific portion has a fixed length, of which some (or all) can be unused. For information about how participating products use the trace table entry, see the product-specific documentation. The format of the trace table entry is shown in Figure 225 on page 422.

Time of Day	Thread ID	Member ID and flags	Member entry type	Mbr-specific info up to a maximum of 104 bytes
Char (8)	Char (8)	Char (4)	Char (4)	Char (104)

Figure 225. Format of the trace table entry (AMODE 64)

Time
The 64-bit value obtained from a store clock (STCK).

Thread ID
The 8-byte thread ID of the thread that is adding the trace table entry.

Member ID and Flags
Contains 2 fields:

Member ID
The 1-byte member ID of the member making the trace table entry, as follows:

ID
Name

01
CEL

03
C/C++

08
Reserved

11
Enterprise PL/I

12
Sockets

Flags
24 flags reserved for internal use.

Member Entry Type
A number that indicates the type of the member-specific trace information that follows the field. To uniquely identify the information contained in a specific TTE, you must consider Member ID as well as Member Entry Type.

Member-Specific Information
Based on the member ID and the member entry type, this field contains the specific information for the entry, up to 104 bytes. For C/C++, the entry type of 1 is a record that records an invocation of a base C runtime library function. The entry consists of the name of the invoking function and the name of the invoked function. Entry type 2 is a record that records the return from the base library function. It contains the returned value and the value of errno.

Member-specific information in the trace table entry

Global tracing is activated by using the LE=n suboption of the TRACE runtime option. This requests all Language Environment members to generate trace records in the trace table. The settings for the global trace events are:

Level
Description

0
No global trace

1
Trace all runtime library (RTL) function entry and exits

2
Trace all RTL mutex init/destroy and lock/unlock

3
Trace all RTL function entry and exits, and all mutex init/destroy and lock/unlock

8
Trace all RTL storage allocation/deallocation

When LE=1 is specified

Table 64 on page 424 shows the C/C++ records that may be generated. For a detailed description of these records, see "C/C++ contents of the Language Environment trace tables" on page 449.

Table 64. LE=1 entry records (AMODE 64)

Member ID	Record Type	Description
03	00000001	Base C Library function Entry
03	00000002	Base C Library function Exit
03	00000003	Posix C Library function Entry
03	00000004	Posix C Library function Exit
03	00000005	XPLINK Base or Posix C Library function Entry
03	00000006	XPLINK Base or Posix C Library function Exit

When LE=2 is specified

Table 65 on page 424 shows the Language Environment records that may be generated.

Table 65. LE=2 entry records (AMODE 64)

Member ID	Record Type	Class	Event	Description
01	00000101	LT	A	Latch Acquire
01	00000102	LT	R	Latch Release
01	00000103	LT	W	Latch Wait
01	00000104	LT	AW	Latch Acquire after Wait
01	00000106	LT	I	Latch Increment (Recursive)
01	00000107	LT	D	Latch Decrement (Recursive)
01	000002FC	LE	EUO	Latch unowned (not released)
01	000002FD	LE	EO	Latch already owned (not acquired)
01	00000301	MX	A	Mutex acquire
01	00000302	MX	R	Mutex release
01	00000303	MX	W	Mutex wait
01	00000304	MX	AW	Mutex acquire after wait
01	00000305	MX	B	Mutex busy (Trylock failed)
01	00000306	MX	I	Mutex increment (recursive)
01	00000307	MX	D	Mutex decrement (recursive)
01	00000315	MX	IN	Mutex initialize
01	00000316	MX	DS	Mutex destroy
01	0000031D	MX	BI	Shared memory lock init
01	0000031E	MX	BD	Shared memory lock destroy
01	0000031F	MX	BO	shared memory lock obtain
01	00000320	MX	BC	Shared memory lock obtain on condition
01	00000321	MX	BR	Shared memory lock release
01	00000324	MX	CIN	Call to SMC_INIT
01	00000325	MX	CSD	Call to SMC_DESTROY
01	00000326	MX	CSO	Shared resource obtain
01	00000327	MX	CSR	Shared resource release

Table 65. LE=2 entry records (AMODE 64) (continued)

Member ID	Record Type	Class	Event	Description
01	00000328	MX	CST	Call to SMC_SetupToWait
01	00000329	MX	CSP	Call to SMC_POST
01	000004CC	ME	FFR	Error - Forced release (shared mutex)
01	000004CD	ME	FFD	Error - Forced decrement (shared mutex)
01	000004CE	ME	FBD	Error - BPX_SMC(DESTROY) error return
01	000004CF	ME	FBU	Error - BPX_SMC(fail) returns EBUSY
01	000004D0	ME	FIV	Error - BPX_SMC(fail) returns EINVAL
01	000004D4	ME	FDU	Error - Destroy failed (uninitialized) (shared mutex/CV)
01	000004D5	ME	FP	Error - Program check (shared mutex/CV)
01	000004DB	ME	ESC	Error - BPX1SMC error return
01	000004DE	ME	EDL	Shared memory lock returns deadlock
01	000004DF	ME	EIV	Shared memory lock returns invalid
01	000004E0	ME	EPM	Shared memory lock returns eperm
01	000004E1	ME	EAG	Shared memory lock returns eagain
01	000004E2	ME	EBU	Shared memory lock returns ebusy
01	000004E3	ME	ENM	Shared memory lock returns enomem
01	000004E4	ME	EBR	Shared memory lock release error
01	000004E5	ME	EBC	Shared memory lock obtain condition error
01	000004E6	ME	EBO	Shared memory lock obtain error
01	000004E7	ME	EBD	Shared memory lock destroy error
01	000004E8	ME	EBI	Shared memory lock initialize error
01	000004E9	ME	EFR	Mutex forced release
01	000004EA	ME	EFD	Mutex forced decrement
01	000004EB	ME	EDD	Mutex destroy failed (damage)
01	000004EC	ME	EDB	Mutex destroy failed (busy)
01	000004ED	ME	EIA	Mutex initialize failed (attribute)
01	000004EE	ME	EIS	Mutex initialize failed (storage)
01	000004EF	ME	EF	Mutex release (forced by quiesce)
01	000004F0	ME	EP	Mutex program check
01	000004FA	ME	EDU	Mutex destroy failed (uninitialized)
01	000004FB	ME	EUI	Mutex uninitialized
01	000004FC	ME	EUO	Mutex unowned (not released)
01	000004FD	E	EO	Mutex already owned (not acquired)
01	000004FE	ME	EIN	Mutex initialization failed (duplicate)
01	00000508	CV	MR	CV release mutex
01	00000509	CV	MA	CV reacquire mutex
01	0000050A	CV	MW	CV mutex wait

Member ID	Record Type	Class	Event	Description
01	0000050B	CV	MAW	CV reacquire mutex after wait
01	0000050C	CV	CW	CV condition wait
01	0000050D	CV	CTW	CV condition timeout
01	0000050E	CV	CWP	CV wait posted
01	0000050F	CV	CWI	CV wait interrupted
01	00000510	CV	CTO	CV wait timeout
01	00000511	CV	CSS	CV condition signal success
01	00000512	CV	CSM	CV condition signal miss
01	00000513	CV	CBS	CV condition broadcast success
01	00000514	CV	CBM	CV condition broadcast miss
01	00000515	CV	IN	CV initialize
01	00000516	CV	DS	CV destroy
01	00000522	CV	CIN	Call to SMC_INIT
01	00000523	CV	CSD	Call to SMC_DESTROY
01	00000529	CV	CSP	Call to SMC_POST
01	0000052A	CV	CSB	Call to SMC_POSTALL
01	0000052B	CV	CSW	Call to SMC_WAIT
01	0000052C	CV	DBM	Shared condition broadcast - miss
01	0000052D	CV	DBS	Shared condition broadcast - success
01	0000052E	CV	DDS	Destroy (shared mutex/CV)
01	0000052F	CV	DIN	Initialize (shared mutex/CV)
01	00000530	CV	DSM	Condition signal - miss (shared CV)
01	00000531	CV	DSS	Condition signal - success (shared CV)
01	00000532	CV	DWI	Wait interrupted (shared CV)
01	00000533	CV	DTO	Wait timeout (shared CV)
01	00000534	CV	DWP	Wait posted (shared CV)
01	000006CB	CE	FBT	Error - Invalid system TOD (shared)
01	000006D1	CE	FRM	Error - Recursive mutex (shared)
01	000006D2	CE	FUO	Error - Shared mutex unowned
01	000006D3	CE	FDB	Error - Destroy failed (busy) (shared mutex/CV)
01	000006D4	CE	FDU	Error - Destroy failed (unitialized) (shared mutex/CV)
01	000006D5	CE	FP	Error - Program check (shared mutex/CV)
01	000006D6	CE	FUI	Error - Shared mutex or CV unitialized
01	000006D7	CE	ENV	Error - BPX1SMC(fail) returns EINVAL
01	000006D8	CE	EPE	Error - BPX1SMC(fail) returns EPERM
01	000006D9	CE	EAN	Error - BPX1SMC(fail) returns EAGAIN
01	000006DA	CE	EIB	Error - BPX1SMC failed (EBUSY)

Table 65. LE=2 entry records (AMODE 64) (continued)

Member ID	Record Type	Class	Event	Description
01	000006DB	CE	ESC	Error - BPX1SMC failed
01	000006EB	CE	EDD	CV destroy failed (damage)
01	000006EC	CE	EDB	CV destroy failed (busy)
01	000006ED	CE	EIA	CV initialization failed (attribute)
01	000006EE	CE	EIS	CV initialization failed (storage)
01	000006EF	CE	EF	CV forced by quiesce
01	000006F0	CE	EP	CV program check
01	000006F1	CE	EBT	CV invalid system TOD
01	000006F2	CE	EBN	CV invalid timespec (nanoseconds)
01	000006F3	CE	EBS	CV invalid timespec (seconds)
01	000006F4	CE	EPO	CV condition post callable service fail
01	000006F5	CE	ETW	CV condition timed wait callable service fail
01	000006F6	CE	EWA	CV condition wait callable service fail
01	000006F7	CE	ESE	CV condition setup callable service fail
01	000006F8	CE	ERM	CV recursive mutex
01	000006F9	CE	EWM	CV wrong mutex
01	000006FA	CE	EDU	CV destroy failed (uninitialized)
01	000006FB	CE	EUI	CV mutex or CV uninitialized
01	000006FC	CE	EUO	CV mutex unowned
01	000006FE	CE	EIN	CV initialization failed (duplicate)
01	00000702	RW	R	Release
01	00000704	RW	AW	Acquire after wait
01	00000706	RW	I	Increment (recursive)
01	00000707	RW	D	Decrement (recursive)
01	00000715	RW	IN	Initialize
01	00000716	RW	DS	Destroy
01	00000717	RW	RA	Read acquire
01	00000718	RW	WA	Write acquire
01	00000719	RW	RB	Read busy (tryread failed)
01	0000071A	RW	WB	Write busy (trywrite failed)
01	0000071B	RW	RW	Read wait
01	0000071C	RW	WW	Write wait
01	0000071D	RW	BI	Call to SLK_INIT
01	0000071E	RW	BD	Call to SLK_DESTROY
01	0000071F	RW	BO	Call to SLK_OBTAIN
01	00000720	RW	BC	Call to SLK_OBTAIN_COND
01	00000721	RW	BR	Call to SLK_RELEASE

Table 65. LE=2 entry records (AMODE 64) (continued)

Member ID	Record Type	Class	Event	Description
01	000008DC	RE	EOW	Error - Already owned for write (not acquired)
01	000008DD	RE	EOR	Error - Already owned for read (not acquired)
01	000008DE	RE	EDL	Error - BPX1SLK(fail) returns EDEADLK
01	000008DF	RE	EIV	Error - BPX1SLK(fail) returns EINVAL
01	000008E0	RE	EPM	Error - BPX1SLK(fail) returns EPERM
01	000008E1	RE	EAG	Error - BPX1SLK(fail) returns EAGAIN
01	000008E2	RE	EBS	Error - BPX1SLK(fail) returns EBUSY
01	000008E3	RE	ENM	Error - BPX1SLK(fail) returns ENOMEM
01	000008E4	RE	EBR	Error - BPX1SLK(RELEASE) error return
01	000008E5	RE	EBC	Error - BPX1SLK(OBTAIN_COND) error return
01	000008E6	RE	EBO	Error - BPX1SLK(OBTAIN) error return
01	000008E7	RE	EBD	Error - BPX1SLK(DESTROY) error return
01	000008E8	RE	EBI	Error - BPX1SLK(INIT) error return
01	000008E9	RE	EFR	Error - Forced release
01	000008EA	RE	EFD	Error - Forced decrement
01	000008ED	RE	EIA	Error - Initialization failed (attribute)
01	000008EE	RE	EIS	Error - Initialization failed (storage)
01	000008EF	RE	EF	Error - Forced by quiesce
01	000008F0	RE	EP	Error - Program check
01	000008FB	RE	EUI	Error - Uninitialized
01	000008FC	RE	EUO	Error - Unowned (not released)
01	000008FD	RE	EO	Error - Already owned (not acquired)
01	000008FE	RE	EIN	Error - Initialization failed (duplicate)

Table 66 on page 428 shows the format for the Mutex – Condition Variable – Latch entries in the trace table.

Table 66. Format of the mutex/CV/latch records (AMODE 64)

Record fields							
Class	Source		Event		Object Addr	Name1	Name2
unused							

Class

Two character EBCDIC representation of the trace class.

LT

Latch

LE

Latch Exception

MX

Mutex

ME
Mutex Exception

CV
Condition Variable

CE
Condition Variable Exception

Source
One character EBCDIC representation of the event.

C
C/C++

Blank
Blank character

Event
Two character EBCDIC representation of the event; see Table 65 on page 424.

Object addr
Fullword address of the mutex object.

Name 1
Optional eight character field containing the name of the function or object to be recorded.

Name 2
Optional eight character field containing the name of the function or object to be recorded.

When LE=3 is specified

The trace table will include the records generated by both LE=1 and LE=2.

When LE=8 is specified

As Table 67 on page 429 shows, the trace table will contain only storage allocation records. Currently, this is only supported by C/C++. For a detailed description of these records, see "C/C++ contents of the Language Environment trace tables" on page 449.

Table 67. LE=8 entry records (AMODE 64)

Member ID	Record Type	Description
03	00000005	Storage allocation entry
03	00000006	Storage allocation exit

Sample dump for the trace table entry

Figure 226 on page 430 shows an example of a dump of the trace table when you specify the LE=1 suboption (the library call/return trace).

```
  Language Environment Trace Table:
    Most recent trace entry is at displacement: 002080
        Displacement                        Trace Entry in Hexadecimal                                        Trace Entry in EBCDIC
        ------------ ------------------------------------------------------------------------   --------------------------------
          +000000    Time 22.02.30.389659    Date 2004.04.08    Thread ID... 2548146000000001
          +000010    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
          +000018    94818995 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |main                            |
          +000038    60606E4D F0F0F6C6 5D409799 8995A386  4D5D4040 40404040 40404040 40404040  |-->(006F) printf()              |
          +000058    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
          +000078    40404040 40404040                                                         |                                |

          +000080    Time 22.02.30.389724    Date 2004.04.08    Thread ID... 2548146000000001
          +000090    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
          +000098    4C60604D F0F0F6C6 5D40D9F1 7EF0F0F0  F0F0F0F0 F0F0F0F0 F0F0F0F0 F040D9F2  |<--(006F) R1=0000000000000000 R2|
          +0000B8    7EF0F0F0 F0F0F0F0 F0F2F5F4 C2F2F8C5  F040D9F3 7EF0F0F0 F0F0F0F0 F0F0F0F0  |=00000000254B28E0 R3=00000000000|
          +0000D8    F0F0F0F0 C340C5D9 D9D5D67E F0F0F0F0  F0F0F0F0 40C5D9D9 D5D6F27E F0F0F0F0  |0000C ERRNO=00000000 ERRNO2=0000|
          +0000F8    F0F0F0F0 00000000                                                         |0000....                        |

          +000100    Time 22.02.30.389725    Date 2004.04.08    Thread ID... 2548146000000001
          +000110    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
          +000118    94818995 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |main                            |
          +000138    60606E4D F0F1F7F0 5D408493 93939681  844D5D40 40404040 40404040 40404040  |-->(0170) dllload()             |
          +000158    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
          +000178    40404040 40404040                                                         |                                |

          +000180    Time 22.02.30.409904    Date 2004.04.08    Thread ID... 2548146000000001
          +000190    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
          +000198    4C60604D F0F1F7F0 5D40D9F1 7EF0F0F0  F0F0F0F0 F1F0F8F2 C6C6F4F6 F040D9F2  |<--(0170) R1=00000001082FF460 R2|
          +0001B8    7EF0F0F0 F0F0F0F0 F0F2F5F4 C2F2F8C5  F040D9F3 7EF0F0F0 F0F0F0F0 F1F0F8F9  |=00000000254B28E0 R3=00000001089|
          +0001D8    F4F8C6F1 F040C5D9 D9D5D67E F0F0F0F0  F0F0F0F0 40C5D9D9 D5D6F27E F0F0F0F0  |48F10 ERRNO=00000000 ERRNO2=0000|
          +0001F8    F0F0F0F0 00000000                                                         |0000....                        |

          +000200    Time 22.02.30.409906    Date 2004.04.08    Thread ID... 2548146000000001
          +000210    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
          +000218    94818995 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |main                            |
          +000238    60606E4D F0F0F6C6 5D409799 8995A386  4D5D4040 40404040 40404040 40404040  |-->(006F) printf()              |
          +000258    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
          +000278    40404040 40404040                                                         |                                |

          +000280    Time 22.02.30.409938    Date 2004.04.08    Thread ID... 2548146000000001
          +000290    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
          +000298    4C60604D F0F0F6C6 5D40D9F1 7EF0F0F0  F0F0F0F0 F0F0F0F0 F0F0F0F0 F040D9F2  |<--(006F) R1=0000000000000000 R2|
          +0002B8    7EF0F0F0 F0F0F0F0 F0F2F5F4 C2F2F8C5  F040D9F3 7EF0F0F0 F0F0F0F0 F0F0F0F0  |=00000000254B28E0 R3=00000000000|
          +0002D8    F0F0F0F0 C440C5D9 D9D5D67E F0F0F0F0  F0F0F0F0 40C5D9D9 D5D6F27E F0F0F0F0  |0000D ERRNO=00000000 ERRNO2=0000|
          +0002F8    F0F0F0F0 00000000                                                         |0000....                        |

          +000300    Time 22.02.30.409939    Date 2004.04.08    Thread ID... 2548146000000001
          +000310    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
          +000318    94818995 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |main                            |
          +000338    60606E4D F0F1F6C4 5D408493 9398A485  99A88695 4D5D4040 40404040 40404040  |-->(016D) dllqueryfn()          |
          +000358    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
          +000378    40404040 40404040                                                         |                                |
```

Figure 226. Trace table in dump output (LE=1 suboption)

Requesting a UNIX System Services syscall trace for debugging

Signal SIGTRACE can be sent to a process or process group to start or stop a trace of the z/OS UNIX System Services syscalls made by the application. The signal is implemented as a toggle. With the trace turned on, the z/OS UNIX System Services kernel gathers the syscall trace records for the targeted processes. A system dump of the user address space can be generated by sending signal SIGDUMP to the same processes in order to capture the trace output. See *z/OS UNIX System Services Command Reference* for more information about the SIGTRACE signal.

Chapter 13. Debugging AMODE 64 C/C++ routines

This section provides specific information to help you debug AMODE 64 applications that contain one or more C/C++ routines. It includes the following topics:

- Debugging C/C++ I/O routines
- Using XL C/C++ compiler listings
- Generating a Language Environment dump of a C/C++ routine
- Finding C/C++ information in a Language Environment dump
- Debugging example of C/C++ routines

There are several debugging features that are unique to C/C++ routines. Before examining the C/C++ techniques to find errors, you might want to consider the following areas of potential problems:

- To prevent errors that may result from differences in LP64 default argument types, include function prototypes for all C/C++ function calls. For C/C++ runtime library functions, see Library functions in *z/OS XL C/C++ Runtime Library Reference*.

  Note: `malloc()` is an example of a RTL function which needs this prototype to work correctly in LP64 applications.
- If you are using the `fetch()` function, see fetch() in *z/OS XL C/C++ Programming Guide* to ensure that you are creating the fetchable module correctly.
- If you are using DLLs, see Building and using Dynamic Link Libraries (DLLs) in *z/OS XL C/C++ Programming Guide* to ensure that you are using the DLL correctly.
- Ensure that the entry point of the load module is CELQSTRT.
- If you suspect that you are using uninitialized storage, you may want to use the STORAGE runtime option.
- You should avoid:
  - Incorrect casting
  - Referencing an array element with a subscript outside the declared bounds
  - Copying a string to a target with a shorter length than the source string
  - Declaring but not initializing a pointer variable, or using a pointer to allocated storage that has already been freed

  If a routine exception occurred and you need more information than the condition handler provided, run your routine with the following runtime options, TRAP(ON, NOSPIE) and TERMTHDACT(UAIMM). Setting these runtime options generates a system dump of the user address space of the original abend or program interrupt prior to the Language Environment condition manager processing the condition. After the system dump is taken by the operating system the Language Environment condition manager continues processing.

Debugging C/C++ programs

You can use C/C++ conventions such as `__amrc` and `perror()` when you debug C/C++ programs.

Using the __amrc and __amrc2 structures to debug input/output

`__amrc`, a structure defined in `stdio.h`, can help you determine the cause of errors resulting from an I/O operation, because it contains diagnostic information (for example, the return code from a failed VSAM operation). There are two structures:

- `__amrc` (defined by type `__amrc_type`

- `__amrc2` (defined by type `__amrc2_type`; this structure contains secondary information that C can provide)

Because any I/O function calls, such as `printf()`, can change the value of `__amrc` or `__amrc2`, make sure you save the contents into temporary structures of `__amrc_type` and `__amrc2_type` respectively, before dumping them.

Figure 227 on page 432 shows the structure as it appears in `stdio.h`.

```
    typedef struct __amrctype {

[1]    union {

[2]       int      __error;
          struct {
            unsigned short __syscode,
                           __rc;
[3]       } __abend;
          struct {
             unsigned char __fdbk_fill,
                           __rc,
                           __ftncd,
                           __fdbk;
[4]       } __feedback;
          struct {
             unsigned short __svc99_info,
                            __svc99_error;
[5]       } __alloc;
[1]    } __code;
[6]    unsigned int      __RBA;
[7]    unsigned int      __last_op;
       struct {
        unsigned int   __len_fill; /* __len + 4       */
        unsigned int   __len;
        char           __str[120];
        unsigned int   __parmr0;
        unsigned int   __parmr1;
        unsigned int   __fill2[2];
        char           __str2[64];
[8]    } __msg;
        #if __EDC_TARGET >= 0x22080000
[9]     unsigned char        __rplfdbwd[4];  /*  rpl feedback word */
 #endif                       /*  __EDC_TARGET >= 0x22080000  */
 #if __EDC_TARGET >= 0x41080000
[10] #ifdef  __LP64
   unsigned long        __XRBA; /* 8 byte RBA                 */
 #elif defined(__LL)
   unsigned long long   __XRBA; /* 8 byte RBA                 */
 #else
   unsigned int         __XRBA1;/* high half of 8 byte RBA    */
   unsigned int         __XRBA2;/* low half of 8 byte RBA     */
 #endif
                               /* QSAM to BSAM switch reason  */
[11]   unsigned char        __amrc_noseek_to_seek;
                             /* padding to make amrc 256 bytes */
   char                 __amrc_pad[23];
    } __amrc_type;
```

Figure 227. __amrc structure (AMODE 64)

Figure 228 on page 432 shows the `__amrc2` structure as it appears in `stdio.h`.

```
    struct {
[12]       int        __error2;
                            char       __pad__error2[4];
[13]      FILE      *__fileptr;
[14]      int        __reserved{6};
    }
```

Figure 228. __amrc2 structure (AMODE 64)

[1] union { ... } __code

The error or warning value from an I/O operation is in `__error`, `__abend`, `__feedback`, or `__alloc`. Look at `__last_op` to determine how to interpret the `__code` union.

[2] __error
: A structure that contains error codes for certain macros or services your application uses. Look at `__last_op` to determine the error codes. `__syscode` is the system abend code.

[3] __abend
: A structure that contains the abend code when `errno` is set to indicate a recoverable I/O abend. `__rc` is the return code. For more information about abend codes, see System completion codes in *z/OS MVS System Codes*. (System completion codes are also called *abend codes*.)

[4] __feedback
: A structure that is used for VSAM only. The `__rc` stores the VSAM register 15, `__fdbk` stores the VSAM error code or reason code, and __RBA stores the RBA after some operations.

[5] __alloc
: A structure that contains errors during `fopen` or `freopen` calls when defining files to the system using SVC 99.

[6] __RBA
: The RBA value returned by VSAM after an ESDS or KSDS record is written out. For an RRDS, it is the calculated value from the record number. In AMODE 64 applications, you can no longer use the address of `_amrc._ RBA` as the first argument to `flocate()`. Instead, `_amrc._RBA` must be placed into an unsigned long in order to make it 8 bytes wide, since `flocate()` is updated to indicate that size of (unsigned long) must be specified as the key length (second argument).

[7] __last_op
: A field containing a value that indicates the last I/O operation being performed by C/C++ at the time the error occurred. These values are shown in Table 68 on page 434.

[8] __msg
: May contain the system error messages from read or write operations emitted from the MVS SYNADAF macro instruction. Because the message can start with a hexadecimal address followed by a short integer, it is advisable to start printing at MSG+6 or greater so the message can be printed as a string. Because the message is not null-terminated, a maximum of 114 characters should be printed. This can be accomplished by specifying a `printf` format specifier as %.114s.

[9] __rplfdbwd
: This field contains feedback information related to a VSAM RLS failure. This is the feedback code from the IFGRPL control block.

[10]__XRBA
: This is the 8 byte relative byte address returned by VSAM after an ESDS or KSDS record is written out. For an RRDS, it is the calculated value from the record number. It may be used in subsequent calls to `flocate()`.

[11] __amrc_noseek_to_seek
: This field contains the reason for the switch from QSAM (`noseek`) to BSAM with `NOTE` and `POINT` macros requested (`seek`) by the XL C/C++ Runtime Library. This field is set when system-level I/O macro processing triggers an ABEND condition. The macro name values (defined in `stdio.h`) for this field are as follows:

Macro	Definition
__AM_BSAM_NOSWITCH	No switch was made.
__AM_BSAM_UPDATE	The data set is open for update
__AM_BSAM_BSAMWRITE	The data set is already open for write (or update) in the same C process.
__AM_BSAM_FBS_APPEND	The data set is recfm=FBS and open for append
__AM_BSAM_LRECLX	The data set is recfm=LRECLX (used for VBS data sets where records span the largest blocksize allowed on the device)
__AM_BSAM_PARTITIONED_DIRECTORY	The data set is the directory for a regular or extended partitioned data set

Macro	Definition
__AM_BSAM_PARTITIONED_INDIRECT	The data set is a member of a partitioned data set, and the member name was not specified at allocation

[12] __error2
A secondary error code. For example, an unsuccessful rename or remove operation places its reason code here.

[13] __fileptr
A pointer to the file that caused a SIGIOERR to be raised. Use an `fldata()` call to get the actual name of the file.

[14] __reserved
Reserved for future use.

__last_op values

The `__last_op` field is the most important of the `__amrc` fields. It defines the last I/O operation C/C++ was performing at the time of the I/O error. You should note that the structure is neither cleared nor set by non-I/O operations, so querying this field outside of a `SIGIOERR` handler should only be done immediately after I/O operations. Table 68 on page 434 lists `__last_op` values you could receive and where to look for further information.

Table 68. __last_op values and diagnosis information (AMODE 64)

Value	Further Information
__IO_INIT	Will never be seen by `SIGIOERR` exit value given at initialization.
__BSAM_OPEN	Sets __error with return code from OS OPEN macro.
__BSAM_CLOSE	Sets __error with return code from OS CLOSE macro.
__BSAM_READ	No return code (either __abend (errno == 92) or __msg (errno == 66) filled in).
__BSAM_NOTE	NOTE returned 0 unexpectedly, no return code.
__BSAM_POINT	This will not appear as an error lastop.
__BSAM_WRITE	No return code (either __abend (errno == 92) or __msg (errno == 65) filled in).
__BSAM_CLOSE_T	Sets __error with return code from OS CLOSE TYPE=T.
__BSAM_BLDL	Sets __error with return code from OS BLDL macro.
__BSAM_STOW	Sets __error with return code from OS STOW macro.
__TGET_READ	Sets __error with return code from TSO TGET macro.
__TPUT_WRITE	Sets __error with return code from TSO TPUT macro.
__IO_DEVTYPE	Sets __error with return code from I/O DEVTYPE macro.
__IO_RDJFCB	Sets __error with return code from I/O RDJFCB macro.
__IO_TRKCALC	Sets __error with return code from I/O TRKCALC macro.
__IO_OBTAIN	Sets __error with return code from I/O CAMLST OBTAIN.
__IO_LOCATE	Sets __error with return code from I/O CAMLST LOCATE.
__IO_CATALOG	Sets __error with return code from I/O CAMLST CAT. The associated macro is CATALOG.
__IO_UNCATALOG	Sets __error with return code from I/O CAMLST UNCAT. The associated macro is CATALOG.
__IO_RENAME	Sets __error with return code from I/O CAMLST RENAME.

Table 68. __last_op values and diagnosis information (AMODE 64) (continued)

Value	Further Information
__SVC99_ALLOC	Sets __alloc structure with information and error codes from SVC 99 allocation.
__SVC99_ALLOC_NEW	Sets __alloc structure with information and error codes from SVC 99 allocation of NEW file.
__SVC99_UNALLOC	Sets __unalloc structure with information and error codes from SVC 99 unallocation.
__C_TRUNCATE	Set when C or C++ truncates output data. Usually this is data written to a text file with no newline such that the record fills up to capacity and subsequent characters cannot be written. For a record I/O file this refers to an `fwrite()` writing more data than the record can hold. Truncation is always rightmost data. There is no return code.
__C_FCBCHECK	Set when C or C++ FCB is corrupted. This is due to a pointer corruption somewhere. File cannot be used after this.
__C_DBCS_TRUNCATE	This occurs when writing DBCS data to a text file and there is no room left in a physical record for anymore double byte characters. A new-line is not acceptable at this point. Truncation will continue to occur until an SI is written or the file position is moved. Cannot happen if MB_CUR_MAX is 1.
__C_DBCS_SO_TRUNCATE	This occurs when there is not enough room in a record to start any DBCS string or else when a redundant SO is written to the file before an SI. Cannot happen if MB_CUR_MAX is 1.
__C_DBCS_SI_TRUNCATE	This occurs only when there was not enough room to start a DBCS string and data was written anyways, with an SI to end it. Cannot happen if MB_CUR_MAX is 1.
__C_DBCS_UNEVEN	This occurs when an SI is written before the last double byte character is completed, thereby forcing C or C++ to fill in the last byte of the DBCS string with a padding byte X'FE'. Cannot happen if MB_CUR_MAX is 1.
__C_CANNOT_EXTEND	This occurs when an attempt is made to extend a file that allows writing, but cannot be extended. Typically this is a member of a partitioned data set being opened for update.
__VSAM_OPEN_FAIL	Set when a low level VSAM OPEN fails, sets __rc and __fdbk fields in the __amrc struct.
__VSAM_OPEN_ESDS	Does not indicate an error; set when the low level VSAM OPEN succeeds, and the file type is ESDS.
__VSAM_OPEN_RRDS	Does not indicate an error; set when the low level VSAM OPEN succeeds, and the file type is RRDS.
__VSAM_OPEN_KSDS	Does not indicate an error; set when the low level VSAM OPEN succeeds, and the file type is KSDS.
__VSAM_OPEN_ESDS_PATH	Does not indicate an error; set when the low level VSAM OPEN succeeds, and the file type is ESDS PATH.
__VSAM_OPEN_KSDS_PATH	Does not indicate an error; set when the low level VSAM OPEN succeeds, and the file type is KSDS PATH.
__VSAM_MODCB	Set when a low level VSAM MODCB macro fails, sets __rc and __fdbk fields in the __amrc struct.
__VSAM_TESTCB	Set when a low level VSAM TESTCB macro fails, sets __rc and __fdbk fields in the __amrc struct.
__VSAM_SHOWCB	Set when a low level VSAM SHOWCB macro fails, sets __rc and __fdbk fields in the __amrc struct.
__VSAM_GENCB	Set when a low level VSAM GENCB macro fails, sets __rc and __fdbk fields in the __amrc struct.
__VSAM_GET	Set when the last op was a low level VSAM GET; if the GET fails, sets __rc and __fdbk in the __amrc struct.

Table 68. __last_op values and diagnosis information (AMODE 64) (continued)

Value	Further Information
__VSAM_PUT	Set when the last op was a low level VSAM PUT; if the PUT fails, sets __rc and __fdbk in the __amrc struct.
__VSAM_POINT	Set when the last op was a low level VSAM POINT; if the POINT fails, sets __rc and __fdbk in the __amrc struct.
__VSAM_ERASE	Set when the last op was a low level VSAM ERASE; if the ERASE fails, sets __rc and __fdbk in the __amrc struct.
__VSAM_ENDREQ	Set when the last op was a low level VSAM ENDREQ; if the ENDREQ fails, sets __rc and __fdbk in the __amrc struct.
__VSAM_CLOSE	Set when the last op was a low level VSAM CLOSE; if the CLOSE fails, sets __rc and __fdbk in the __amrc struct.
__QSAM_GET	__error is not set (if abend (errno == 92), __abend is set, otherwise if read error (errno == 66), look at __msg.
__QSAM_PUT	__error is not set (if abend (errno == 92), __abend is set, otherwise if write error (errno == 65), look at __msg.
__QSAM_TRUNC	This is an intermediate operation. You will only see this if an I/O abend occurred.
__QSAM_FREEPOOL	This is an intermediate operation. You will only see this if an I/O abend occurred.
__QSAM_CLOSE	Sets __error to result of OS CLOSE macro.
__QSAM_OPEN	Sets __error to result of OS OPEN macro.
__CMS_OPEN	Sets __error to result of FSOPEN.
__CMS_CLOSE	Sets __error to result of FSCLOSE.
__CMS_READ	Sets __error to result of FSREAD.
__CMS_WRITE	Sets __error to result of FSWRITE.
__CMS_STATE	Sets __error to result of FSSTATE.
__CMS_ERASE	Sets __error to result of FSERASE.
__CMS_RENAME	Sets __error to result of CMS RENAME command.
__CMS_EXTRACT	Sets __error to result of DMS EXTRACT call.
__CMS_LINERD	Sets __error to result of LINERD macro.
__CMS_LINEWRT	Sets __error to result of LINEWRT macro.
__CMS_QUERY	__error is not set.
__HSP_CREATE	Indicates last op was a DSPSERV CREATE to create a hiperspace for a hiperspace memory file. If CREATE fails, stores abend code in __amrc__code__abend__syscode, reason code in __amrc__code__abend__rc.
__HSP_DELETE	Indicates last op was a DSPSERV DELETE to delete a hiperspace for a hiperspace memory file during termination. If DELETE fails, stores abend code in __amrc__code__abend__syscode, reason code in __amrc__code__abend__rc.
__HSP_READ	Indicates last op was a HSPSERV READ from a hiperspace. If READ fails, stores abend code in __amrc__code__abend__syscode, reason code in __amrc__code__abend__rc.
__HSP_WRITE	Indicates last op was a HSPSERV WRITE to a hiperspace. If WRITE fails, stores abend code in __amrc__code__abend__syscode, reason code in __amrc__code__abend__rc.

Table 68. __last_op values and diagnosis information (AMODE 64) (continued)

Value	Further Information
__HSP_EXTEND	Indicates last op was a HSPSERV EXTEND during a write to a hiperspace. If EXTEND fails, stores abend code in __amrc__code__abend__syscode, reason code in __amrc__code__abend__rc.
__LFS_OPEN	Sets __error with reason code from z/OS UNIX services. Reason code from z/OS UNIX services must be broken up. The low order 2 bytes can be looked up in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.
__LFS_CLOSE	Sets __error with reason code from z/OS UNIX. Reason codes from z/OS UNIX services must be broken up. The low order 2 bytes can be looked up in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.
__LFS_READ	Sets __error with reason code from z/OS UNIX. Reason codes from z/OS UNIX services must be broken up. The low order 2 bytes can be looked up in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.
__LFS_WRITE	Sets __error with reason code from z/OS UNIX. Reason codes from z/OS UNIX services must be broken up. The low order 2 bytes can be looked up in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.
__LFS_LSEEK	Sets __error with reason code from z/OS UNIX. Reason codes from z/OS UNIX services must be broken up. The low order 2 bytes can be looked up in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.
__LFS_FSTAT	Sets __error with reason code from z/OS UNIX. Reason codes from z/OS UNIX services must be broken up. The low order 2 bytes can be looked up in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.

Using file I/O tracing to debug C/C++ file I/O problems

You can use file I/O tracing to debug C/C++ file I/O problems. For more information, see Debugging I/O programs in *z/OS XL C/C++ Programming Guide*.

Displaying an error message with the perror() function

To find a failing routine, check the return code of all function calls. After you have found the failing routine, use the `perror()` function after the routine to display the error message. `perror()` displays the string that you pass to it and an error message corresponding to the value of `errno`. `perror()` writes to the standard error stream (`stderr`). By default, the errno2 value will be appended to the end of the perror() string.

If you do not want the errno2 value appended to the `perror()` string, set the _EDC_ADD_ERRNO2 environment variable to 0.

Figure 229 on page 437 is an example of a routine using `perror()`.

```
#include <stdio.h>
int main(void){
   FILE *fp;

   fp = fopen("myfile.dat", "w");
   if (fp == NULL)
      perror("fopen error");
}
```

Figure 229. Example of a routine using perror() (AMODE 64)

Using __errno2() to diagnose application problems

Use the __errno2() function when diagnosing problems in an application program. This function enables z/OS XL C/C++ application programs to access additional diagnostic information, `errno2` (`errnojr`), associated with `errno`. The `__errno2` may be set by the z/OS XL C/C++ runtime library, z/OS UNIX callable services, or other callable services. The `errno2` is intended for diagnostic display purposes only and is not a programming interface.

Note: Not all functions set `errno2` when `errno` is set. In the cases where `errno2` is not set, the __errno2() function may return a residual value. You may use the __err2ad() function to clear `errno2` to reduce the possibility of a residual value being returned.

Figure 230 on page 438 is an example of a routine using __errno2() and Figure 231 on page 438 shows the sample output from that routine.

```
#pragma runopts(posix(on))
#define _EXT
#include <stdio.h>
#include <errno.h>

int main(void) {
  FILE *f;
  f = fopen("testfile.dat", "r")
  if (f==NULL) {
      perror("fopen() failed");
      printf("__errno2 = %08x\n", __errno2());
   }
   return 0;
}
```

Figure 230. Example of a routine using __errno2() (AMODE 64)

```
fopen() failed: EDC5129I No such file or directory. (errno2=0x05620062)
__errno2 = 05620062
```

Figure 231. Sample output of routine using __errno2() (AMODE 64)

Figure 232 on page 438 is an example of a routine using the environment variable _EDC_ADD_ERRNO2 . Figure 233 on page 438 shows the sample output from that routine. For more information about _EDC_ADD_ERRNO2, see _EDC_ADD_ERRNO2 in *z/OS XL C/C++ Programming Guide*.

```
#pragma runopts(posix(on))
#define _EXT
#include <stdio.h>
#include <errno.h>
#include <stdlib.h>

int main(void) {
  FILE *fp;
  /* do NOT add errno2 to perror message */
  setenv("_EDC_ADD_ERRNO2", "0", 1);
  fp = fopen("testfile.dat", "r");
  if (fp == NULL)
      perror("fopen() failed");
  return 0;
}
```

Figure 232. Example of a routine using _EDC_ADD_ERRNO2 (AMODE 64)

```
fopen() failed: EDC5129I No such file or directory.
```

Figure 233. Sample output of a routine using _EDC_ADD_ERRNO2 (AMODE 64)

Figure 234 on page 439 is an example of a routine using __err2ad() in combination with __errno2(). Figure 235 on page 439 shows the sample output from that routine.

For more information about __errno2() and __err2ad(), see __errno2() — Return reason code information and _EDC_ADD_ERRNO2 in *z/OS XL C/C++ Programming Guide* .

```
#pragma runopts(posix(on))
#define _EXT
#include <stdio.h>
#include <errno.h>
#include <stdlib.h>

int main(void) {
  FILE *f;
  setenv("_EDC_ADD_ERRNO2", "0", 1);
  f = fopen("testfile.dat", "r");
  if (f == NULL) {
    perror("fopen() failed");
    printf("__errno2 = %08x\n", __errno2());
  }
  /* reset errno2 to zero */
  *__err2ad() = 0x0;
  printf("__errno2 = %08x\n", __errno2());
  f = fopen(*testfile.dat", "r");

  if (fp == NULL) {
    perror("fopen() failed");
    printf(*__errno2 = %08x\n", __errno2());
  }
  return 0;
}
```

Figure 234. Example of a routine using __err2ad() in combination with __errno2() (AMODE 64)

```
fopen() failed: EDC5129I  No such file or directory.
__errno2 = 05620062
__errno2 = 00000000
fopen() failed: EDC5129I  No such file or directory.
__errno2 = 05620062
```

Figure 235. Sample output of routine using __err2ad() in combination with __errno2() (AMODE 64)

Using C/C++ listings

For a detailed description of available listings, see Listings, messages, and compiler information options in *z/OS XL C/C++ User's Guide*.

Finding variables

You can determine the value of a variable in the routine at the point of interrupt by using the compiled code listing as a guide to its address, then finding this address in the Language Environment dump or system dump. The method you use depends on the storage class of variable.

It is possible for the routine to be interrupted before the value of the variable is placed in the location provided for it. This can explain unexpected values in the dump.

Steps for finding automatic variables

Perform the following steps to find automatic variables in the Language Environment dump or system dump:

1. Determine the name of the automatic variable and the function it is defined in. As an example, we will find the variable aa in the function main from the program cdivzero shown in Figure 69 on page 203.
2. From the compiler listing, locate the variable in the storage offset listing:

```
aa                    5823-0:10       Class = automatic,          Location = 2248(r4),          Length
= 4
```

The location is specified as decimal offset (base register). So variable aa is located at register 4 + 2248 (X'8C8').

3. From the Traceback (in the Language Environment dump or in the formatted output from the IPCS VERBEXIT LEDATA CEEDUMP subcommand for a system dump) locate the function:

```
DSA       Entry       E  Offset  Load Mod  Program Unit  Service  Status
00000004  main        +00000016  CDIVZERO                         Call

DSA       DSA Addr          E  Addr             PU Addr           PU Offset  Comp Date Attributes
00000004  00000001082FF180  00000000251000C0    0000000000000000  ********   20040408  XPLINK  EBCDIC  IEEE
```

If the base register is R4, the register 4 value is always the DSA address for the function.

If the base register is not R4, the register value must be located from saved registers.

If the Status field indicates Exception, use the saved registers from when the condition occurred. In the Language Environment dump, the saved registers can be found in the Condition information associated with the DSA address in the Condition Information for Active Routines section. In the formatted output from the IPCS VERBEXIT LEDATA CM subcommand for a system dump, the saved registers can be found in the CIBH that has the DSA address as the value for the SV1 field.

If the Status field indicates Call, use the saved registers from the DSA address that appears on the line above the function in the Traceback. In the Language Environment dump, the DSAs can be found in the "Control Blocks for Active Routines" section. In the formatted output from the IPCS VERBEXIT LEDATA 'STACK' subcommand for a system dump, the DSAs can be found in the "DSA backchain" section.

Note: Some functions do not save all registers.

4. Add the register value to the offset of the variable to obtain the address of the variable. In the Language Environment dump, the contents of the variable can be read in the DSA Frame section corresponding to the function the variable is contained in. For a system dump, use the IPCS LIST subcommand to display the storage where the variable is located.

   The address for variable aa is X'1082FF080' + X'980' = X'1082FFA00'.

Restriction: The parameter value might never be stored, since the first few parameters might be passed in registers and there might be no need to save them.

Steps for finding C/C++ parameters

The C/C++ parameter list is always located in the caller's DSA at offset 2176 (X'880'). Parameters that are passed in registers are not always stored in the parameter list. The compiler option XPLINK(STOREARGS) can be used to ensure that all parameters are stored in the parameter list.

Perform the following steps to find parameters in the Language Environment dump or system dump:

1. Determine the name of the parameter and the function it is for. As an example, we will find the parameter pp for the function `funcb` from the program `cdivzero` shown in Figure 53. C routine with a divide-by-zero error.
2. From the compiler listing, locate the parameter in the storage offset listing:

```
pp                 5828-0:15       Class = parameter,          Location = 2432(r4),          Length = 8
```

3. From the Traceback (in the Language Environment dump or in the formatted output from the IPCS VERBEXIT LEDATA 'CEEDUMP' subcommand for a system dump) locate the function:

```
    DSA       Entry       E  Offset  Load Mod  Program Unit  Service  Status
    00000003  funcb       +0000002E  CDIVZERO                         Exception

    DSA       DSA Addr          E  Addr             PU Addr           PU Offset  Comp Date Attributes
    00000003  00000001082FF080  0000000025100108    0000000000000000  ********   20040408  XPLINK  EBCDIC  IEEE
```

If the base register is R4, the register 4 value is always the DSA address for the function.

If the base register is not R4, the register value must be located from saved registers.

If the Status field indicates Exception, use the saved registers from when the condition occurred. In the Language Environment dump, the saved registers can be found in the Condition information associated with the DSA address in the "Condition Information for Active Routines" section. In the formatted output from the IPCS VERBEXIT LEDATA 'CM' subcommand for a system dump, the saved registers can be found in the CIBH that has the DSA address as the value for the SV1 field.

If the Status field indicates Call, use the saved registers from the DSA address that appears on the line above the function in the Traceback. In the Language Environment dump, the DSAs can be found in the "Control Blocks for Active Routines" section. In the formatted output from the IPCS VERBEXIT LEDATA 'STACK' subcommand for a system dump, the DSAs can be found in the "DSA backchain" section.

Note: Some functions do not save all registers.

4. Add the register value to the offset of the parameter to obtain the address of the parameter. In the Language Environment dump, the contents of the parameter can be read in the DSA Frame section corresponding to the function that passed the parameter. For a system dump, use the IPCS LIST subcommand to display the storage where the parameter is located.

   The address for parameter pp is X'1082FF080' + X'980' = X'1082FFA00'.

Steps for finding members of aggregates

You can define aggregates in any of the storage classes or pass them as parameters to a called function. The first step is to find the start of the aggregate. You can compute the start of the aggregate as described in previous sections, depending on the type of aggregate used.

The aggregate map provided for each declaration in a routine can further assist in finding the offset of a specific variable within an aggregate. Structure maps are generated using the AGGREGATE compiler option. Figure 236 on page 441 shows an example of an aggregate.

```
typedef struct {
     int asid;
     void *addr;
     asfAmodeType amode;
  } asfTargetRef;
  asfTargetRef  tempTargetRef;
```

Figure 236. Example code for structure variables (AMODE 64)

Figure 237 on page 441 shows an example of aggregate map.

```
===============================================================================
| Aggregate map for: struct with no tag #68            Total size: 24 bytes  |
|.............................................................................|
|asfTargetRef                                                                 |
|=============================================================================|
|      Offset       |      Length       | Member Name                         |
|    Bytes(Bits)    |    Bytes(Bits)    |                                     |
|===================|===================|=====================================|
|        0          |        4          |  asid                               |
|        4          |        4          |  ***PADDING***                      |
|        8          |        8          |  addr                               |
|       16          |        1          |  amode                              |
|       17          |        7          |  ***PADDING***                      |
===============================================================================
```

Figure 237. Example of aggregate map (AMODE 64)

To find the value of variable `tempTargetRef.addr`:

1. Locate the automatic variable `tempTargetRef` in the storage offset listing:

```
tempTargetRef       209-0:209       Class = automatic,          Location = 2264(r4),          Length = 24
```

The variable `tempTargetRef` is located at register 4 + 2264 (X'8D8'). For this example, assume that the register 4 value is X'1082FD3E0'. The result is X'1082FDCB8'(X'1082FD3E0' + X'8D8'). This is the address of the value of the automatic variable `tempTargetRef` in the dump

2. Find the offset of addr in the Aggregate Map, shown in Figure Figure 237 on page 441. The offset is 8. Add the offset from the Aggregate Map to the address of the `tempTargetRef` variable.

   The result is X'1082FDCC0' (X'1082FDCB8' + X'8'). This is the address of the value of `tempTargetRef.addr` in the dump

Generating a Language Environment dump of a C/C++ routine

You can use the `cdump()`, `csnap()`, and `ctrace()` C/C++ functions to generate a Language Environment dump of C/C++ routines.

cdump()

If your routine is running under z/OS, you can generate useful diagnostic information by using the `cdump()` function. `cdump()` produces a main storage dump with the activation stack. When `cdump()` is invoked from a user routine, the C/C++ library issues an OS IEATDUMP macro to obtain a dump of virtual storage. You can use the Interactive Problem Control System (IPCS) to format and analyze IEATDUMP dumps.

The DD definition for CEESNAP must include the desired data set name and DCB information:

```
LRECL=4160,  BLKSIZE=4160, and RECFM=FBS
```

If the data set is not defined, or is not usable for any reason, `cdump()` returns a failure code of 1. This occurs even if the call to CEE3DMP is successful.

Because `cdump()` returns a code of 0 only if the IEATDUMP was successful or 1 if it was unsuccessful, you cannot distinguish whether a failure of `cdump()` occurred in the call to CEE3DMP or IEATDUMP. A return code of 0 is issued only if both IEATDUMP and CEE3DMP are successful.

Support for IEATDUMP dumps using the `_cdump` function is provided only under z/OS. In addition to a IEATDUMP dump, a Language Environment formatted dump is also taken.

csnap()

The `csnap()` function produces a condensed storage dump. To use these functions, you must add `#include <ctest.h>` to your C/C++ code. The dump is directed to output *dumpname*, which is specified in a `//CEEDUMP DD` statement in JCL.

For more information about `csnap()`, see csnap() — Request a condensed dump in *z/OS XL C/C++ Runtime Library Reference*.

ctrace()

The `ctrace()` function produces a traceback and includes the offset addresses from which the calls were made.

Sample C routine that calls cdump()

Figure 238 on page 443 shows a sample C routine that uses the `cdump` function to generate a dump. Figure 244 on page 446 shows the dump output.

```
#include <stdio.h>
#include <signal.h>
#include <stdlib.h>

void hsigfpe(int);
void hsigterm(int);
void atf1(void);

typedef int (*FuncPtr_T)(void);

int st1    =  99;
int st2    = 255;
int xcount =   0;

int main(void) {
  /*
   * 1) Open multiple files
   * 2) Register 2 signals
   * 3) Register 1 atexit function
   * 4) Fetch and execute a module
   */

  FuncPtr_T fetchPtr;
  FILE*     fp1;
  FILE*     fp2;
  int       rc;
  fp1 = fopen("myfile.data", "w");
  if (!fp1) {
    perror("Could not open myfile.data for write");
    exit(101);
  }

  fprintf(fp1, "record 1\n");
  fprintf(fp1, "record 2\n");
  fprintf(fp1, "record 3\n");

  fp2 = fopen("memory.data", "wb,type=memory");
  if (!fp2) {
    perror("Could not open memory.data for write");
    exit(102);
  }
  fprintf(fp2, "some data");
  fprintf(fp2, "some more data");
  fprintf(fp2, "even more data");

  signal(SIGFPE , hsigfpe);
  signal(SIGTERM, hsigterm);

  rc = atexit(atf1);
  if (rc) {
    fprintf(stderr, "Failed on registration of atexit function atf1\n");
    exit(103);
  }
  fetchPtr = (FuncPtr_T) fetch("MODULE1");
  if (!fetchPtr) {
    fprintf(stderr, "Failed to fetch MODULE1\n");
    exit(104);
  }
  fetchPtr();
  return(0);
}
```

Figure 238. Example C routine using cdump() to generate a dump (AMODE 64) (Part 1 of 2)

```
void hsigfpe(int sig) {
  ++st1;
  return;
}

void hsigterm(int sig) {
  ++st2;
  return;
}

void atf1() {
  ++xcount;
}
```

Figure 239. Example C routine using cdump() to generate a dump (AMODE 64) (Part 2 of 2)

Figure 240 on page 444 shows a fetched C module.

```
#include <ctest.h>

#pragma linkage(func1, fetchable)
int func1(void) {
  __cdump("This is a sample dump");
  return(0);
}
```

Figure 240. Fetched module for C routine (AMODE 64)

Sample C++ routine that generates a Language Environment dump

Figure 241 on page 444 shows a sample C++ routine that uses a protection exception to generate a dump.

```
#include <iostream.h>
#include <ctest.h>
#include "stack.h"

int main() {
  cout << "Program starting:\n";
  cerr << "Error report:\n";

  Stack<int> x;
  x.push(1);
  cout << "Top value on stack : " << x.pop() << '\n';
  cout << "Next value on stack: " << x.pop() << '\n';
  return(0);
}
```

Figure 241. Example C++ routine with protection exception generating a dump (AMODE 64)

Figure 242 on page 444 shows the template file stack.c

```
#ifndef __STACK__
  #include "stack.h"
#endif

template <class T> T Stack<T>::pop() {
  T value = head->value;
  head = head->next;

  return(value);
}
template <class T> void Stack<T>::push(T value) {
  Node* newNode  = new Node;
  newNode->value = value;
  newNode->next  = head;
  head = newNode;
}
```

Figure 242. Template file STACK.C (AMODE 64)

Figure 243 on page 445 shows the header file `stack.h`.

```
#ifndef __STACK_
  #define __STACK__
  template <class T> class Stack {
    public:
      Stack() {
        char* badPtr = 0; badPtr -= (0x01010101);
        head = (Node*) badPtr; /* head initialized to 0xFEFEFEFF */
      }
      T pop();
      void push(T);
    private:
      struct Node {
        T value;
        struct Node* next;
      }* head;
  };
#endif
```

Figure 243. Header file STACK.H (AMODE 64)

Sample Language Environment dump with C/C++-specific information

This sample dump was produced by compiling the routines shown in Figure 238 on page 443 and Figure 240 on page 444. They were both compiled using options LP64 and GONUM to produce statement numbers in the CEEDUMP. Notice the sequence of calls in the traceback section - CELQINIT is the Language Environment module that invokes the main entry. `main` calls `fetchPtr()` at statement number 60, which in turn, through @@FECBMODULE1 fetches the user-defined function `func1` shown in Figure 240 on page 444. `func1` calls the library routine `__cdump()` in statement number 5. The complete program unit names for `main` and `func1` are shown in the Fully Qualified Names section along with its load module name.

```
1CEE3DMP V1 R8.0: This is a sample dump                                             Wed Feb 22 21:31:53 2006           Page:    1

 Information for enclave main

   Information for thread 25AC528000000000

   Traceback:
     DSA       Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
     00000001  __cdump     +00000000              CELQLIB                                             HLE7730  Call
     00000002  func1       +00000020  5           MODULE1              func1.c                                 Call
     00000003  @@FECBMODULE1
                           -005F601C                                   ** NoName **                            Call
     00000004  main        +00000284  60          CSAMPLE              FIG142                                  Call
     00000005  CELQINIT    +0000134C              CELQLIB              CELQINIT                       HLE7730  Call

     DSA       DSA Addr          E  Addr             PU Addr           PU Offset   Comp Date Attributes
     00000001  00000001082FEDC0  0000000025C1FFE0    0000000000000000  ********    20060111  XPLINK  EBCDIC  POSIX  IEEE
     00000002  00000001082FEF00  0000000025D8A0D0    0000000000000000  ********    20060222  XPLINK  EBCDIC  POSIX  IEEE
     00000003  00000001082FF000  0000000025D8D058    0000000025D8D048  005F600C              XPLINK  EBCDIC  POSIX  Floating Point
     00000004  00000001082FF180  00000000257000D0    0000000000000000  ********    20060222  XPLINK  EBCDIC  POSIX  IEEE
     00000005  00000001082FF280  0000000025703010    0000000025703010  0000134C    20060111  XPLINK  EBCDIC  POSIX  Floating Point

     Fully Qualified Names
     DSA       Entry       Program Unit                                    Load Module
     00000002  func1       AQMVSOE:/u/alfcar/tools/func1.c                 MODULE1
     00000004  main        PLPSC://'POSIX.CRTL.C(FIG142)'                  CSAMPLE

   Control Blocks for Active Routines:
     DSA for __cdump: 00000001082FF5C0
       +000000  R4....... 00000001082FEF00           R5....... 0000000025D77E10           R6....... 0000000025C1FFE0
       +000018  R7....... 0000000025D8A0F2           R8....... 0000000025796F40           R9....... 0000000025D8A110
       +000030  R10...... 00000001082FF880           R11...... 0000000000000000           R12...... 0000000100007AC0
       +000048  R13...... 00000001082FF180           R14...... 000000010000B238           R15...... 0000000025D8D048
       +000060  reserved. 0000000025AA5FD6           reserved. 0000000000000000           HPTRAN... 0000000025D71580
       +000078  reserved. 0000000100007AC0
     DSA for func1: 00000001082FF700
       +000000  R4....... 00000001082FF000           R5....... 00000001083012E0           R6....... 0000000025D8A0D0
       +000018  R7....... 000000002579703E           R8....... 0000000025796F40           R9....... 00000001082FF800
       +000030  R10...... 00000001082FF880           R11...... 0000000000000000           R12...... 0000000100007AC0
       +000048  R13...... 00000001082FF180           R14...... 000000010000B238           R15...... 0000000025D8D048
       +000060  reserved. 00000000180F58FF           reserved. 001007FF00000000           HPTRAN... 00000001082FF920
       +000078  reserved. 0000000000000000
     DSA for @@FECBMODULE1 : 00000001082FF800
       +000000  R4....... 00000001082FF180           R5....... C0F0FFFFE7AC07FF           R6....... 0000000025D8D058
       +000018  R7....... 0000000025700356           R8....... 0000000000006FE8           R9....... 0000000025700410
       +000030  R10...... 0000000025700620           R11...... 0000000108415310           R12...... 0000000100005300
       +000048  R13...... 0000000000006F50           R14...... 0000000025753360           R15...... 000000000000001F
       +000060  reserved. 0000000700006FE8           reserved. 0000000025700410           HPTRAN... 0000000100002000
       +000078  reserved. 0000000108415310
     DSA for main: 00000001082FF980
       +000000  R4....... 00000001082FF280           R5....... 0000000108300090           R6....... 00000000257000D0
       +000018  R7....... 000000002570435E           R8....... 0000000000006FE8           R9....... 0000000025701548
       +000030  R10...... 0000000025700620           R11...... 0000000108415310           R12...... 0000000100005300
       +000048  R13...... 0000000000006F50           R14...... 0000000025753360           R15...... 000000000000001F
       +000060  reserved. 0000000000000000           reserved. 0000000000000000           HPTRAN... 0000000000000000
       +000078  reserved. 0000000000000000
     DSA for CELQINIT: 00000001082FFA80
       +000000  R4....... 00000001082FF760           R5....... 0000000000000000           R6....... 0000000025703010
       +000018  R7....... 00000000257044F8           R8....... 0000000000000000           R9....... 0000000000000000
       +000030  R10...... 0000000000000000           R11...... 0000000000000000           R12...... 0000000000000000
       +000048  R13...... 0000000000000000           R14...... 0000000000000000           R15...... 0000000000000000
       +000060  reserved. 0000000000000000           reserved. 0000000000000000           HPTRAN... 0000000000000000
       +000078  reserved. 0000000000000000

   Storage for Active Routines:

     DSA frame(00000001082FEDC0)
       +0800 00000001082FF5C0  00000001 082FEF00 00000000 25D77E10  |.............P=.|
       +0810 00000001082FF5D0  00000000 25C1FFE0 00000000 25D8A0F2  |.....A.......Q.2|
       +0820 00000001082FF5E0  00000000 25796F40 00000000 25D8A110  |......? .....Q..|
       +0830 00000001082FF5F0  00000001 082FF880 00000000 00000000  |......8.........|
       +0840 00000001082FF600  00000001 00007AC0 00000001 082FF180  |......:.......1.|
       +0850 00000001082FF610  00000001 0000B238 00000000 25D8D048  |.............Q..|
       +0860 00000001082FF620  00000000 25AA5FD6 00000000 00000000  |......^O........|
       +0870 00000001082FF630  00000000 25D71580 00000001 00007AC0  |.....P........:.|
       +0880 00000001082FF640  00000001 082FF6A0 00000000 25C20719  |......6......B..|
       +0890 00000001082FF650  00000001 082FF690 00000000 00000000  |......6.........|
```

Figure 244. Example dump from sample C routine (AMODE 64) (Part 1 of 4)

The following is part two of the example dump from sample C routine (AMODE 64).

```
     +08A0 00000001082FF660  00000000 00000000 00000000 00000000  |................|
     +08B0 00000001082FF670  00000000 00000000 00000001 082FF75C  |..............7*|
     +08C0 00000001082FF680  00000000 25D8D0E0 00000000 25D8D0C8  |.....Q.......Q.H|
     +08D0 00000001082FF690  00010C7B 49C3C5C5 00000000 00000000  |...#.CEE........|
     +08E0 00000001082FF6A0  E38889A2 4089A240 8140A281 94979385  |This is a sample|
     +08F0 00000001082FF6B0  4084A494 97404040 40404040 40404040  | dump           |
     +0900 00000001082FF6C0  40404040 40404040 40404040 40404040  |                |
     +0910 00000001082FF6D0 - +00092F 00000001082FF6EF            same as above
     +0930 00000001082FF6F0  00000001 083012D0 00000000 00000020  |................|

   DSA frame(00000001082FEF00)
     +0800 00000001082FF700  00000001 082FF000 00000001 083012E0  |......0.........|
     +0810 00000001082FF710  00000000 25D8A0D0 00000000 2579703E  |.....Q..........|
     +0820 00000001082FF720  00000000 25796F40 00000001 082FF800  |......? ......8.|
     +0830 00000001082FF730  00000001 082FF880 00000000 00000000  |......8.........|
     +0840 00000001082FF740  00000001 00007AC0 00000001 082FF180  |......:.......1.|
     +0850 00000001082FF750  00000001 0000B238 00000000 25D8D048  |.............Q..|
     +0860 00000001082FF760  00000000 180F58FF 001007FF 00000000  |................|
     +0870 00000001082FF770  00000001 082FF920 00000000 00000000  |......9.........|
     +0880 00000001082FF780  00000000 25D8A110 00000001 00007AC0  |.....Q........:.|
     +0890 00000001082FF790  00000001 00007AC0 00000001 082FF85C  |......:.......8*|
     +08A0 00000001082FF7A0  00000001 082FF8E0 00000001 082FF8E8  |......8.......8Y|
     +08B0 00000001082FF7B0  00000001 082FF8F0 00000000 25D67E10  |......80.....O=.|
     +08C0 00000001082FF7C0  00000001 08300070 00000001 0000A5E8  |..............vY|
     +08D0 00000001082FF7D0  00000000 25753360 00000000 0000001F  |.......-........|
     +08E0 00000001082FF7E0  40404040 40404040 00000000 00000001  |        ........|
     +08F0 00000001082FF7F0  00000000 00000000 00000001 00000000  |................|

   DSA frame(00000001082FF000)
     +0800 00000001082FF800  00000001 082FF180 C0F0FFFF E7AC07FF  |......1..0..X...|
     +0810 00000001082FF810  00000000 25D8D058 00000000 25700356  |.....Q..........|
     +0820 00000001082FF820  00000000 00006FE8 00000000 25700410  |......?Y........|
     +0830 00000001082FF830  00000000 25700620 00000001 08415310  |................|
     +0840 00000001082FF840  00000001 00005300 00000000 00006F50  |..............?&|
     +0850 00000001082FF850  00000000 25753360 00000000 0000001F  |.......-........|
     +0860 00000001082FF860  00000007 00006FE8 00000000 25700410  |......?Y........|
     +0870 00000001082FF870  00000001 00002000 00000001 08415310  |................|
     +0880 00000001082FF880  00000001 082FF180 00000000 25D67E10  |......1......O=.|
     +0890 00000001082FF890  00000000 25940F18 00000000 00000019  |.....m..........|
     +08A0 00000001082FF8A0  00000000 00006FE8 00000000 25700410  |......?Y........|
     +08B0 00000001082FF8B0  00000000 25700620 00000000 25D8A000  |.............Q..|
     +08C0 00000001082FF8C0  00000001 08415378 00000000 25D8A000  |.............Q..|
     +08D0 00000001082FF8D0  00000000 25D8A000 00000001 082FF89C  |.....Q........8.|
     +08E0 00000001082FF8E0  00000001 083012D0 00000000 25D8D048  |.............Q..|
     +08F0 00000001082FF8F0  00000000 00000000 00000000 00000000  |................|
     +0900 00000001082FF900  00000000 257003F0 00000000 00000000  |.......0........|
     +0910 00000001082FF910  00000000 00000000 58F0C2B8 58F0FFA4  |.........0B..0.u|
     +0920 00000001082FF920  00000001 08300080 00000000 00000000  |................|
     +0930 00000001082FF930  D4D6C4E4 D3C5F140 00000000 00002000  |MODULE1 ........|
     +0940 00000001082FF940  00000000 00000000 00000000 00000000  |................|
     +0950 00000001082FF950 - +00095F 00000001082FF95F             same as above
     +0960 00000001082FF960  00000000 00000008 00000000 00000000  |................|
     +0970 00000001082FF970  00000000 00000000 00000001 00000000  |................|

   DSA frame(00000001082FF180)
     +0800 00000001082FF980  00000001 082FF280 00000001 08300090  |......2.........|
     +0810 00000001082FF990  00000000 257000D0 00000000 2570435E  |...............;|
     +0820 00000001082FF9A0  00000000 00006FE8 00000000 25701548  |......?Y........|
     +0830 00000001082FF9B0  00000000 25700620 00000001 08415310  |................|
     +0840 00000001082FF9C0  00000001 00005300 00000000 00006F50  |..............?&|
     +0850 00000001082FF9D0  00000000 25753360 00000000 0000001F  |.......-........|
     +0860 00000001082FF9E0  00000000 00000000 00000000 00000000  |................|
     +0870 00000001082FF9F0 - +00087F 00000001082FF9FF             same as above
     +0880 00000001082FFA00  00000000 25D8D170 00000000 00000020  |.....QJ.........|
     +0890 00000001082FFA10  00000000 25D8D178 00000000 00000000  |.....QJ.........|
     +08A0 00000001082FFA20  00000000 00000000 00000000 00000000  |................|
     +08B0 00000001082FFA30 - +0008BF 00000001082FFA3F             same as above
     +08C0 00000001082FFA40  00000000 25D8D178 00000000 25D873D8  |.....QJ......Q.Q|
     +08D0 00000001082FFA50  00000000 25D88750 00000000 00000000  |.....Qg&........|
     +08E0 00000001082FFA60  00000000 00000000 00000000 00000000  |................|
     +08F0 00000001082FFA70 - +0008FF 00000001082FFA7F             same as above
```

Figure 245. Example dump from sample C routine (AMODE 64) (Part 2 of 4)

The following is part three of the example dump from sample C routine (AMODE 64).

```
   DSA frame(00000001082FF280)
     +0800 00000001082FFA80  00000001 082FF760 00000000 00000000  |......7-........|
     +0810 00000001082FFA90  00000000 25703010 00000000 257044F8  |...............8|
     +0820 00000001082FFAA0  00000000 00000000 00000000 00000000  |................|
     +0830 00000001082FFAB0 - +00087F 00000001082FFAFF             same as above
     +0880 00000001082FFB00  00000001 082FFD08 00000001 082FF760  |.............7-|
     +0890 00000001082FFB10  00000001 00007AC0 00000000 00000000  |......:.........|
     +08A0 00000001082FFB20  00000000 00000000 00000000 00000000  |................|
     +08B0 00000001082FFB30 - +0009FF 00000001082FFC7F             same as above
     +0A00 00000001082FFC80  00000000 00000000 00000001 082FFD08  |................|
     +0A10 00000001082FFC90  00000000 00000000 00000000 00000000  |................|
     +0A20 00000001082FFCA0 - +000A7F 00000001082FFCFF             same as above
     +0A80 00000001082FFD00  00000000 00000000 00000001 00000000  |................|
     +0A90 00000001082FFD10  00000000 00000000 00000000 00000000  |................|
     +0AA0 00000001082FFD20 - +000ADF 00000001082FFD5F             same as above
     +0AE0 00000001082FFD60  00000001 00003C60 00000001 00005300  |.......-........|
     +0AF0 00000001082FFD70  00000001 00007AC0 00000000 00000000  |......:.........|
     +0B00 00000001082FFD80  00000000 00000000 00000000 00000000  |................|
     +0B10 00000001082FFD90 - +000B4F 00000001082FFDCF             same as above
     +0B50 00000001082FFDD0  00000000 00000000 00000001 08300090  |................|
     +0B60 00000001082FFDE0  00000000 00000000 00000000 00000000  |................|
     +0B70 00000001082FFDF0 - +000BAF 00000001082FFE2F             same as above
     +0BB0 00000001082FFE30  00000000 00000000 00000001 08300090  |................|
     +0BC0 00000001082FFE40  00000000 00000001 00000001 08415320  |................|
     +0BD0 00000001082FFE50  00000001 08413430 00000001 082FF280  |.............2.|
     +0BE0 00000001082FFE60  00000000 25704444 00000000 257000D0  |................|
     +0BF0 00000001082FFE70  00000000 00000098 00000000 00000000  |.......q........|
     +0C00 00000001082FFE80  00000000 00000000 00000000 00000000  |................|
     +0C10 00000001082FFE90 - +000CDF 00000001082FFF5F             same as above

Control Blocks Associated with the Thread:
   CAA(0000000100007AC0)
     +0000 0000000100007AC0  00000000 00000000 00000000 00000000  |................|
     +0010 0000000100007AD0 - +0002AF 0000000100007D6F             same as above
     +02B0 0000000100007D70  00008000 00000000 00000000 00000000  |................|
     +02C0 0000000100007D80  00000000 00000000 00000000 00000000  |................|
     +02D0 0000000100007D90 - +00030F 0000000100007DCF             same as above
     +0310 0000000100007DD0  00000001 0000B918 00000000 00000000  |................|
     +0320 0000000100007DE0  00000001 00005558 00000000 00000000  |................|
     +0330 0000000100007DF0  00000001 00008E58 00000000 25D8D048  |.............Q..|
     +0340 0000000100007E00  00000001 00008630 00000001 0000A498  |......f.......uq|
     +0350 0000000100007E10  00000000 00000000 00000001 00008828  |.............h.|
     +0360 0000000100007E20  03030210 15040000 00000000 257D2FC6  |.............'.F|
     +0370 0000000100007E30  00000000 00000000 00000001 00007668  |................|
     +0380 0000000100007E40  00000001 082FF760 00000001 00005300  |......7-........|
     +0390 0000000100007E50  00000001 00003C60 00000001 00007AA8  |.......-......:y|
     +03A0 0000000100007E60  00000001 00007AC0 00000000 00000000  |......:.........|
     +03B0 0000000100007E70  00000000 00000004 00000000 00000000  |................|
     +03C0 0000000100007E80  00000000 00000000 00000000 00000000  |................|
     +03D0 0000000100007E90  25AC5280 00000000 00000001 000039D0  |................|
     +03E0 0000000100007EA0  00000001 00008478 00000000 00000000  |......d.........|
     +03F0 0000000100007EB0  00000000 00000000 00000000 25770FE0  |................|
     +0400 0000000100007EC0  00000000 00000000 00000000 00000000  |................|
     +0410 0000000100007ED0  00000001 00007ED8 00000001 00000000  |......=Q........|
     +0420 0000000100007EE0  00000000 00000000 00000000 00000000  |................|
     +0430 0000000100007EF0 - +0004BF 0000000100007F7F             same as above
   MATH PARAMETERS:(0000000025D82AD0)
     +0000 0000000025D82AD0  00000000 00000000 00000000 00000000  |................|
     +0010 0000000025D82AE0 - +00001F 0000000025D82AEF             same as above
   Thread Synchronization Queue Element (SQEL)(0000000025D820A0)
     +0000 0000000025D820A0  00000000 00000000 00000000 00000000  |................|
     +0010 0000000025D820B0 - +00002F 0000000025D820CF             same as above
     +0030 0000000025D820D0  00000000 00000000 00000001 00007AC0  |.............:.|
     +0040 0000000025D820E0  00000000 00000000 00000000 00000000  |................|
     +0050 0000000025D820F0 - +00006F 0000000025D8210F             same as above
   DUMMY DSA: 00000001082FFF60
     +000000  R4....... 0000000000000000           R5....... 0000000000000000           R6....... 0000000000000000
     +000018  R7....... 1111111111111111           R8....... 0000000000000000           R9....... 0000000000000000
     +000030  R10...... 0000000000000000           R11...... 0000000000000000           R12...... 0000000000000000
     +000048  R13...... 0000000000000000           R14...... 0000000000000000           R15...... 0000000000000000
     +000060  reserved. 0000000000000000           reserved. 0000000000000000           HPTRAN... 0000000000000000
     +000078  reserved. 0000000000000000
 CEE3DMP called by program unit  (entry point __cdump) at offset +000000000.

 Registers on Entry to CEE3DMP:
   PM....... 0100
   GPR0..... ****************  GPR1..... ****************  GPR2..... ****************  GPR3..... ****************
   GPR4..... 00000001082FEDC0  GPR5..... 00000000257D07CC  GPR6..... 00000000257CCB80  GPR7..... 0000000025C20124
   GPR8..... 0000000025D77E10  GPR9..... 00000001082FF6A0  GPR10.... 0000000025D8A110  GPR11.... 0000000000000001
   GPR12.... 0000000100007AC0  GPR13.... 00000001082FF180  GPR14.... 000000010000B238  GPR15.... 0000000025D8D048
```

Figure 246. Example dump from sample C routine (AMODE 64) (Part 3 of 4)

The following is part four of the example dump from sample C routine (AMODE 64).

```
GPREG STORAGE:
Storage around GPR0  is invalid.
Storage around GPR1  is invalid.
Storage around GPR2  is invalid.
Storage around GPR3  is invalid.

Storage around GPR4 (00000001082FEDC0)
  +0800 00000001082FF5C0  00000001 082FEF00 00000000 25D77E10  |..............P=.|
  +0810 00000001082FF5D0  00000000 25C1FFE0 00000000 25D8A0F2  |.....A.......Q.2|
  +0820 00000001082FF5E0  00000000 25796F40 00000000 25D8A110  |......? .....Q..|
  +0830 00000001082FF5F0  00000001 082FF880 00000000 00000000  |......8.........|
  +0840 00000001082FF600  00000001 00007AC0 00000001 082FF180  |......:.......1.|
  +0850 00000001082FF610  00000001 0000B238 00000000 25D8D048  |.............Q..|
Storage around GPR5 (00000000257D07CC)
  -0020 00000000257D07AC  00000000 00000000 00000000 00000000  |................|
  -0010 00000000257D07BC - +FFFFFF 00000000257D07CB             same as above
  +0000 00000000257D07CC  257CCB80 00000F38 00000F38 00000000  |.@..............|
  +0010 00000000257D07DC  257D0880 00000000 257D0874 00000000  |.'.......'......|
  +0020 00000000257D07EC  257D0850 00000000 257D0850 00000000  |.'.&.....'.&....|
  +0030 00000000257D07FC - +00003F 00000000257D080B             same as above
Storage around GPR6 (00000000257CCB80)
  -0020 00000000257CCB60  F0F9F0F0 0005C4F1 F9F0F200 00000000  |0900..D1902.....|
  -0010 00000000257CCB70  00C300C5 00C500F1 00003DE8 00000740  |.C.E.E.1...Y... |
  +0000 00000000257CCB80  EB134880 0024B904 0004A74B F8C0EB5F  |..........x.8..^|
  +0010 00000000257CCB90  48080024 E3040800 00244190 4FFFEB13  |....T.......|...|
  +0020 00000000257CCBA0  49800024 E38004B8 0017E380 80580004  |....T.....T.....|
  +0030 00000000257CCBB0  E3C08008 0004A788 00504080 4C6C1F88  |T.....xh.& .<%.h|
Storage around GPR7 (0000000025C20124)
  -0020 0000000025C20104  C0600000 024E4470 6060C070 00000249  |.-...+..--......|
  -0010 0000000025C20114  EB568000 00044130 48D04120 71790D76  |................|
  +0000 0000000025C20124  07004800 48D0B914 0000A70E 0003A784  |..........x...xd|
  +0010 0000000025C20134  FF75A70E 0005A784 FF7112BB A774FF6E  |..x...xd....x..>|
  +0020 0000000025C20144  A7390000 EB4B4800 000447F0 70020000  |x..........0....|
  +0030 0000000025C20154  00000000 00C300C5 00C500F1 00000838  |.....C.E.E.1....|

Storage around GPR8 (0000000025D77E10)
  -0020 0000000025D77DF0  00000000 25D78EB0 00000000 25C2ED28  |.....P.......B..|
  -0010 0000000025D77E00  00000000 25D76E20 00000000 25BBADC8  |.....P>........H|
  +0000 0000000025D77E10  00000000 257D07CC 00000000 257CCB80  |.....'.......@..|
  +0010 0000000025D77E20  00000000 25BB7E98 00000000 25BB7E98  |......=q......=q|
  +0020 0000000025D77E30  00000000 257D69BC 00000000 257D6560  |.....'.......'.-|
  +0030 0000000025D77E40  0001018F 49C3C5C5 00000000 00000000  |.....CEE........|
Storage around GPR9 (00000001082FF6A0)
  -0020 00000001082FF680  00000000 25D8D0E0 00000000 25D8D0C8  |.....Q.......Q.H|
  -0010 00000001082FF690  00010C7B 49C3C5C5 00000000 00000000  |...#.CEE........|
  +0000 00000001082FF6A0  E38889A2 4089A240 8140A281 94979385  |This is a sample|
  +0010 00000001082FF6B0  4084A494 97404040 40404040 40404040  | dump           |
  +0020 00000001082FF6C0  40404040 40404040 40404040 40404040  |                |
  +0030 00000001082FF6D0 - +00003F 00000001082FF6DF             same as above
Storage around GPR10(0000000025D8A110)
  -0020 0000000025D8A0F0  0D760700 A7390000 E3704818 0004EB89  |....x...T......i|
  -0010 0000000025D8A100  48200004 41404100 47F07002 00000000  |..... ...0......|
  +0000 0000000025D8A110  E38889A2 4089A240 8140A281 94979385  |This is a sample|
  +0010 0000000025D8A120  4084A494 97000000 02CE07C0 00000068  | dump...........|
  +0020 0000000025D8A130  80800281 00000503 0000003C 01000000  |...a............|
  +0030 0000000025D8A140  000586A4 9583F140 FFFFFF98 00000000  |..func1 ...q....|
Storage around GPR11(0000000000000001)
  -0001 0000000000000000  Inaccessible storage.
  +000F 0000000000000010  Inaccessible storage.
  +001F 0000000000000020  Inaccessible storage.
  +002F 0000000000000030  Inaccessible storage.
  +003F 0000000000000040  Inaccessible storage.
  +004F 0000000000000050  Inaccessible storage.
Storage around GPR12(0000000100007AC0)
  -0020 0000000100007AA0  00000000 00000000 C3C5C5C3 C1C14040  |........CEECAA  |
  -0010 0000000100007AB0  00000000 00000000 00000000 00000000  |................|
  +0000 0000000100007AC0 - +00003F 0000000100007AFF             same as above
Storage around GPR13(00000001082FF180)
  -0020 00000001082FF160  00000001 00000000 00000000 25853F8C  |.............e..|
  -0010 00000001082FF170  00000000 25D88AC0 00000000 25C20719  |.....Q.......B..|
  +0000 00000001082FF180  084134F0 25D82118 082FE740 25853F44  |...0.Q....X .e..|
  +0010 00000001082FF190  08413550 00000020 000044E8 25D8218C  |...&.......Y.Q..|
  +0020 00000001082FF1A0  25D8A000 00007AC0 082FF8C8 00000000  |.Q....:...8H....|
  +0030 00000001082FF1B0  00000000 00000000 00000000 00000D90  |................|
Storage around GPR14(000000010000B238)
  -0020 000000010000B218  00000000 00000000 00000000 00000000  |................|
  -0010 000000010000B228 - +00003F 000000010000B277             same as above
Storage around GPR15(0000000025D8D048)
  -0020 0000000025D8D028  00008000 00007E78 00000000 00000000  |......=.........|
  -0010 0000000025D8D038  00000000 00000000 25D8D000 00000128  |.........Q......|
  +0000 0000000025D8D048  00C300C5 00C500F1 00000038 00000184  |.C.E.E.1.......d|
  +0010 0000000025D8D058  EB134880 0024B904 0014EB4F 46800024  |...........|....|
  +0020 0000000025D8D068  A74BFE80 41940800 B90400F6 A7FBFFF0  |x....m.....6x..0|
  +0030 0000000025D8D078  E3806100 001707F8 02CE0FFF 00000024  |T./....8........|
```

Figure 247. Example dump from sample C routine (AMODE 64) (Part 4 of 4)

C/C++ contents of the Language Environment trace tables

Language Environment provides C/C++ trace table entry types 5 and 6, which contain character data.

Trace entry 5 occurs when a C library function is called. The format for trace table entry 5 is:

```
NameOfCallingFunction
-->(xxxx) NameOfCalledFunction<(input_parameters)>
```

or, for called functions calloc, free, malloc, and realloc:

```
NameOfCallingFunction
-->(xxx) NameOfCalledFunction<(input_parameters)>
```

In addition, when the call is due to one of these C++ operators:

```
-new,
-new[],
-delete,
-delete[]
```

then the C++ operator will appear and the format becomes:

```
NameOfCallingFunction
-->(xxx) NameOfCalledFunction<(input_parameters)>

NameOfC++Operator
```

The `input_parameters` and `NameOfC++Operator` only appear for the appropriate functions. The angle brackets (<>) indicate that this information does not always appear.

Trace entry 6 occurs when a C library function returns. The format for trace table entry 6 is:

```
    <--(xxxx)
R1=xxxxxxxxxxxxxxxx R2=xxxxxxxxxxxxxxxx R3=xxxxxxxxxxxxxxxx
ERRNO=xxxxxxxx ERRNO2=xxxxxxxx
```

In the entry types, `(xxx)` and `(xxxx)` are numbers associated with the called library function and are used to associate a specific entry record with its corresponding return record.

For entry types 5 and 6, the number will be the same as the number of the function as seen in the C runtime library definition side-deck, SCEELIB dataset member CELQS003, on the IMPORT statement for that function.

Figure 248 on page 451 shows an XPLINK trace that contains examples of the trace entries 5 and 6. For more information about the Language Environment trace table format, see "Understanding the trace table entry (TTE)" on page 422.

```
Language Environment Trace Table:

   Most recent trace entry is at displacement: 000680

       Displacement                        Trace Entry in Hexadecimal                                Trace Entry in EBCDIC
       ------------ ----------------------------------------------------------------------------   --------------------------------
         +000000    Time 21.58.20.255215    Date 2004.04.20    Thread ID... 8000000000000000
         +000010    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
         +000018    86899385 82A4867A 7A96A585 99869396  A64D8995 A35D4040 40404040 40404040  |filebuf::overflow(int)          |
         +000038    60606E4D F0F1F5F6 5D406D6D 85999995  964D5D40 40404040 40404040 40404040  |-->(0156) __errno()             |
         +000058    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
         +000078    40404040 40404040                                                         |                                |

         +000080    Time 21.58.20.255216    Date 2004.04.20    Thread ID... 8000000000000000
         +000090    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
         +000098    4C60604D F0F1F5F6 5D40D9F1 7EF0F0F0  F0F0F0F0 F1F0F8F7 F1C1C6F8 F040D9F2  |<--(0156) R1=000000010871AF80 R2|
         +0000B8    7EF0F0F0 F0F0F0F0 F0F2F5F5 F2C2F8C2  F840D9F3 7EF0F0F0 F0F0F0F0 F1F0F0F0  |=000000002552B8B8 R3=00000001000|
         +0000D8    F0F7F5F5 F840C5D9 D9D5D67E F0F0F0F0  F0F0F0F0 40C5D9D9 D5D6F27E F0F0F0F0  |07558 ERRNO=00000000 ERRNO2=0000|
         +0000F8    F0F0F0F0 00000000                                                         |0000....                        |

         +000100    Time 21.58.20.255216    Date 2004.04.20    Thread ID... 8000000000000000
         +000110    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
         +000118    86899385 82A4867A 7A96A585 99869396  A64D8995 A35D4040 40404040 40404040  |filebuf::overflow(int)          |
         +000138    60606E4D F0F1F5F6 5D406D6D 85999995  964D5D40 40404040 40404040 40404040  |-->(0156) __errno()             |
         +000158    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
         +000178    40404040 40404040                                                         |                                |

         +000180    Time 21.58.20.255217    Date 2004.04.20    Thread ID... 8000000000000000
         +000190    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
         +000198    4C60604D F0F1F5F6 5D40D9F1 7EF0F0F0  F0F0F0F0 F1F0F8F7 F1C1C6F8 F040D9F2  |<--(0156) R1=000000010871AF80 R2|
         +0001B8    7EF0F0F0 F0F0F0F0 F0F2F5F5 F2C2F8C2  F840D9F3 7EF0F0F0 F0F0F0F0 F1F0F0F0  |=000000002552B8B8 R3=00000001000|
         +0001D8    F0F7F5F5 F840C5D9 D9D5D67E F0F0F0F0  F0F0F0F0 40C5D9D9 D5D6F27E F0F0F0F0  |07558 ERRNO=00000000 ERRNO2=0000|
         +0001F8    F0F0F0F0 00000000                                                         |0000....                        |

         +000200    Time 21.58.20.255218    Date 2004.04.20    Thread ID... 8000000000000000
         +000210    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
         +000218    86899385 82A4867A 7A96A585 99869396  A64D8995 A35D4040 40404040 40404040  |filebuf::overflow(int)          |
         +000238    60606E4D F0F0F7C5 5D4086A6 9989A385  4D5D4040 40404040 40404040 40404040  |-->(007E) fwrite()              |
         +000258    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
         +000278    40404040 40404040                                                         |                                |

         +000280    Time 21.58.20.255242    Date 2004.04.20    Thread ID... 8000000000000000
         +000290    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
         +000298    4C60604D F0F0F7C5 5D40D9F1 7EF0F0F0  F0F0F0F0 F1F0F0F0 F0F8C2F3 F040D9F2  |<--(007E) R1=0000000100008B30 R2|
         +0002B8    7EF0F0F0 F0F0F0F0 F0F2F5F5 F2C2F8C2  F840D9F3 7EF0F0F0 F0F0F0F0 F0F0F0F0  |=000000002552B8B8 R3=00000000000|
         +0002D8    F0F0F0F0 C540C5D9 D9D5D67E F0F0F0F0  F0F0F0F0 40C5D9D9 D5D6F27E F0F0F0F0  |0000E ERRNO=00000000 ERRNO2=0000|
         +0002F8    F0F0F0F0 00000000                                                         |0000....                        |

         +000300    Time 21.58.20.255243    Date 2004.04.20    Thread ID... 8000000000000000
         +000310    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
         +000318    86899385 82A4867A 7A96A585 99869396  A64D8995 A35D4040 40404040 40404040  |filebuf::overflow(int)          |
         +000338    60606E4D F0F0F6F8 5D408686 93A4A288  4D5D4040 40404040 40404040 40404040  |-->(0068) fflush()              |
         +000358    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
         +000378    40404040 40404040                                                         |                                |

         +000380    Time 21.58.20.255244    Date 2004.04.20    Thread ID... 8000000000000000
         +000390    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
         +000398    4C60604D F0F0F6F8 5D40D9F1 7EF0F0F0  F0F0F0F0 F1F0F0F0 F0F8F4F8 F040D9F2  |<--(0068) R1=0000000100008480 R2|
         +0003B8    7EF0F0F0 F0F0F0F0 F0F2F5F5 F2C2F8C2  F840D9F3 7EF0F0F0 F0F0F0F0 F0F0F0F0  |=000000002552B8B8 R3=00000000000|
         +0003D8    F0F0F0F0 F040C5D9 D9D5D67E F0F0F0F0  F0F0F0F0 40C5D9D9 D5D6F27E F0F0F0F0  |00000 ERRNO=00000000 ERRNO2=0000|
         +0003F8    F0F0F0F0 00000000                                                         |0000....                        |

         +000400    Time 21.58.20.255245    Date 2004.04.20    Thread ID... 8000000000000000
         +000410    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
         +000418    86899385 82A4867A 7A96A585 99869396  A64D8995 A35D4040 40404040 40404040  |filebuf::overflow(int)          |
         +000438    60606E4D F0F1F5F6 5D406D6D 85999995  964D5D40 40404040 40404040 40404040  |-->(0156) __errno()             |
         +000458    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |                                |
         +000478    40404040 40404040                                                         |                                |
```

Figure 248. Trace table with XPLINK trace table entries 5 and 6 (AMODE 64)

The following is the second part of the trace table with XPLINK trace table entries 5 and 6 (AMODE 64).

```
          +000480    Time 21.58.20.255245    Date 2004.04.20    Thread ID... 8000000000000000
          +000490    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
          +000498    4C60604D F0F1F5F6 5D40D9F1 7EF0F0F0  F0F0F0F0 F1F0F8F7 F1C1C6F8 F040D9F2  |<--(0156) R1=000000010871AF80
R2|
          +0004B8    7EF0F0F0 F0F0F0F0 F0F2F5F5 F2C2F8C2  F840D9F3 7EF0F0F0 F0F0F0F0 F1F0F0F0  |=000000002552B8B8
R3=00000001000|
          +0004D8    F0F7F5F5 F840C5D9 D9D5D67E F0F0F0F0  F0F0F0F0 40C5D9D9 D5D6F27E F0F0F0F0  |07558 ERRNO=00000000
ERRNO2=0000|
          +0004F8    F0F0F0F0 00000000                                                        |0000....
|

          +000500    Time 21.58.20.255246    Date 2004.04.20    Thread ID... 8000000000000000
          +000510    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
          +000518    86899385 82A4867A 7A96A585 99869396  A64D8995 A35D4040 40404040 40404040  |filebuf::overflow(int)
|
          +000538    60606E4D F0F1F5F6 5D406D6D 85999995  964D5D40 40404040 40404040 40404040  |-->(0156) __errno()
|
          +000558    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |
|
          +000578    40404040 40404040                                                        |
|

          +000580    Time 21.58.20.255247    Date 2004.04.20    Thread ID... 8000000000000000
          +000590    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
          +000598    4C60604D F0F1F5F6 5D40D9F1 7EF0F0F0  F0F0F0F0 F1F0F8F7 F1C1C6F8 F040D9F2  |<--(0156) R1=000000010871AF80
R2|
          +0005B8    7EF0F0F0 F0F0F0F0 F0F2F5F5 F2C2F8C2  F840D9F3 7EF0F0F0 F0F0F0F0 F1F0F0F0  |=000000002552B8B8
R3=00000001000|
          +0005D8    F0F7F5F5 F840C5D9 D9D5D67E F0F0F0F0  F0F0F0F0 40C5D9D9 D5D6F27E F0F0F0F0  |07558 ERRNO=00000000
ERRNO2=0000|
          +0005F8    F0F0F0F0 00000000                                                        |0000....
|

          +000600    Time 21.58.20.255252    Date 2004.04.20    Thread ID... 8000000000000000
          +000610    Member ID.... 03    Flags..... 000000    Entry Type..... 00000005
          +000618    E2A38183 924C8995 A36E7A7A 97A4A288  4D8995A3 5D404040 40404040 40404040  |Stack<int>::push(int)
|
          +000638    60606E4D F0F0F5F6 5D409481 93939683  4DF1F65D 40404040 40404040 40404040  |-->(0056) malloc(16)
|
          +000658    40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040  |
|
          +000678    9585A640 40404040                                                        |new
|

      >>> +000680    Time 21.58.20.255253    Date 2004.04.20    Thread ID... 8000000000000000
          +000690    Member ID.... 03    Flags..... 000000    Entry Type..... 00000006
          +000698    4C60604D F0F0F5F6 5D40D9F1 7EF0F0F0  F0F0F0F0 F1F0F8F3 F0C5C1F5 F040D9F2  |<--(0056) R1=000000010830EA50
R2|
          +0006B8    7EF0F0F0 F0F0F0F0 F0F2F5F5 F2C2F8C2  F840D9F3 7EF0F0F0 F0F0F0F0 F1F0F8F3  |=000000002552B8B8
R3=00000001083|
          +0006D8    F0C5C1F5 F040C5D9 D9D5D67E F0F0F0F0  F0F0F0F0 40C5D9D9 D5D6F27E F0F0F0F0  |0EA50 ERRNO=00000000
ERRNO2=0000|
          +0006F8    F0F0F0F0 00000000                                                        |0000....
|
```

Figure 249. Trace table with XPLINK trace table entries 5 and 6 (AMODE 64)

Debugging examples of C/C++ routines

This section contains examples that demonstrate the debugging process for C/C++ routines. Important areas of the output are highlighted. Data unnecessary to the debugging examples has been replaced by ellipses.

Divide-by-zero error

Figure 250 on page 453 illustrates a C program that contains a divide-by-zero error. The code was compiled with RENT so static and external variables need to be calculated from the WSA field. The code was compiled with LP64, GONUM (to produce statement numbers) and XREF, LIST and OFFSET to generate a listing, which is used to calculate addresses of functions and data. The code was processed by the binder with MAP to generate a binder map, which is used to calculate the addresses of static and external variables. The program was created with the option TERMTHDACT(UADUMP) which produced both a Language environment dump and a system dump.

```
/* C Routine with a Divide-by-Zero Error */
#pragma options(noinline)
#include <stdio.h>
#include <stdlib.h>
#include <errno.h>
int statint = 73;
int fa;
int funcb(int *pp);
int main(void) {
  int aa, bb=1;
  aa = bb;
  aa = funcb(&aa);
  return(aa);
}
int funcb(int *pp) {
  int result;
  fa = *pp;
  result = fa/(statint-73);
  printf("Result = %d\n",result);
  return result;
}
```

Figure 250. C routine with a divide-by-zero error (AMODE 64)

To debug this routine, use the following steps:

1. Locate the Original Condition message in the Condition Information for Active Routines section of the dump. In this example, the message is CEE3209S. The system detected a fixed-point divide exception. This message indicates the error was caused by an attempt to divide by zero. For more information about CEE3209S, see Language Environment runtime messages in *z/OS Language Environment Runtime Messages*.

   The traceback section of the dump indicates that the exception occurred at offset X'52' within function `funcb`. This information is used along with the compiler-generated Pseudo Assembly Listing to determine where the problem occurred.

   If the `GONUMBER` compiler option is specified, statement number information is in the dump. Figure 251 on page 454 shows the generated traceback from the dump.

```
CEE3DMP V1 R8.0: Condition processing resulted in the unhandled condition.        Tue Feb 21 16:50:50 2006           Page:    1

Information for enclave main

  Information for thread 25AC70A000000000

  Traceback:
    DSA       Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    00000001  CEEHDSP     +00000000              CELQLIB              CEEHDSP                        HLE7730  Call
    00000002  CEEOSIGJ    +0000094E              CELQLIB              CEEOSIGJ                       HLE7730  Call
    00000003  CELQHROD    +0000024E              CELQLIB              CELQHROD                       HLE7730  Call
    00000004  CEEOSIGG    -1D58AE60              CELQLIB              CEEOSIGG                       HLE7730  Call
    00000005  CELQHROD    +0000024E              CELQLIB              CELQHROD                       HLE7730  Call
    00000006  funcb       +00000052  18          CDIVZERO             CDIVZERO                                Exception
    00000007  main        +00000026  12          CDIVZERO             CDIVZERO                                Call
    00000008  CELQINIT    +00001340              CELQLIB              CELQINIT                       HLE7730  Call

    DSA       DSA Addr          E  Addr              PU Addr           PU Offset   Comp Date Attributes
    00000001  00000001082FAAC0  0000000025793E88    0000000025793E88  00000000    20060109  XPLINK  EBCDIC  POSIX  Floating Point
    00000002  00000001082FD3E0  000000002588FE28    000000002588FE28  0000094E    20051214  XPLINK  EBCDIC  POSIX  Floating Point
    00000003  00000001082FDDE0  00000000257B50D8    00000000257B50D8  0000024E    20051214  XPLINK  EBCDIC  POSIX  Floating Point
    00000004  00000001082FE020  00000000258894E0    00000000258894E0  1D58AE60    20051214  XPLINK  EBCDIC  POSIX  Floating Point
    00000005  00000001082FEE40  00000000257B50D8    00000000257B50D8  0000024E    20051214  XPLINK  EBCDIC  POSIX  Floating Point
    00000006  00000001082FF080  00000000257080D0    0000000000000000  ********    20060221  XPLINK  EBCDIC  POSIX  IEEE
    00000007  00000001082FF180  0000000025708170    0000000000000000  ********    20060221  XPLINK  EBCDIC  POSIX  IEEE
    00000008  00000001082FF280  000000002570B010    000000002570B010  00001340    20051214  XPLINK  EBCDIC  POSIX  Floating Point

    Fully Qualified Names
    DSA       Entry       Program Unit                                              Load Module
    00000006  funcb       PLPSC://'POSIX.CRTL.C(CDIVZERO)'                          /u/alfcar/tools/CDIVZERO
    00000007  main        PLPSC://'POSIX.CRTL.C(CDIVZERO)'                          /u/alfcar/tools/CDIVZERO

  Condition Information for Active Routines
    Condition Information for PLPSC://'POSIX.CRTL.C(CDIVZERO)' (DSA address 00000001082FF080)
      CIB Address: 00000001082FBE00
      Current Condition:
        CEE0198S The termination of a thread was signaled due to an unhandled condition.
      Original Condition:
        CEE3209S The system detected a fixed-point divide exception (System Completion Code=0C9).
      Location:
        Program Unit: PLPSC://'POSIX.CRTL.C(CDIVZERO)'
        Entry:        funcb Statement: 18 Offset: +00000052
      Machine State:
        ILC..... 0002    Interruption Code..... 0009
        PSW..... 0785240180000000 0000000025708124
        GPR0..... 0000000000000000  GPR1..... 00000001082FFA40  GPR2..... 0000000108414340  GPR3..... 0000000108413430
        GPR4..... 00000001082FF080  GPR5..... 0000000108300060  GPR6..... 0000000000000000  GPR7..... 0000000100000001
        GPR8..... 0000000025700CC8  GPR9..... 00000000257081B8  GPR10.... 0000000025708278  GPR11.... 0000000108414330
        GPR12.... 0000000100005300  GPR13.... 0000000000006F60  GPR14.... 00000000257BF218  GPR15.... 000000000000001F
        FPC...... 00000000
        FPR0..... 4327CCCA  93BCEEF1           FPR1..... 00000000  00000000
        FPR2..... 00000000  00000000           FPR3..... 00000000  00000000
        FPR4..... 3C100000  00000000           FPR5..... 00000000  00000000
        FPR6..... 34100000  00000000           FPR7..... 00000000  00000000
        FPR8..... 00000000  00000000           FPR9..... 00000000  00000000
        FPR10.... 00000000  00000000           FPR11.... 00000000  00000000
        FPR12.... 00000000  00000000           FPR13.... 00000000  00000000
        FPR14.... 00000000  00000000           FPR15.... 00000000  00000000
        VR0...... 4327CCCA 93BCEEF1 00000000 00000000       VR1...... 00000000 00000000 00000000 00000000
        VR2...... 00000000 00000000 00000000 00000000       VR3...... 00000000 00000000 00000000 00000000
        VR4...... 3C100000 00000000 00000000 00000000       VR5...... 00000000 00000000 00000000 00000000
        VR6...... 3C100000 00000000 00000000 00000000       VR7...... 00000000 00000000 00000000 00000000
        VR8...... 00000000 00000000 00000000 00000000       VR9...... 00000000 00000000 00000000 00000000
        VR10..... 00000000 00000000 00000000 00000000       VR11..... 00000000 00000000 00000000 00000000
        VR12..... 00000000 00000000 00000000 00000000       VR13..... 00000000 00000000 00000000 00000000
        VR14..... 00000000 00000000 00000000 00000000       VR15..... 00000000 00000000 00000000 00000000
        VR16..... 00000000 00000000 00000000 00000000       VR17..... 00000000 00000000 00000000 00000000
        VR18..... 00000000 00000000 00000000 00000000       VR19..... 00000000 00000000 00000000 00000000
        VR20..... 00000000 00000000 00000000 00000000       VR21..... 00000000 00000000 00000000 00000000
        VR22..... 00000000 00000000 00000000 00000000       VR23..... 00000000 00000000 00000000 00000000
        VR24..... 00000000 00000000 00000000 00000000       VR25..... 00000000 00000000 00000000 00000000
        VR26..... 00000000 00000000 00000000 00000000       VR27..... 00000000 00000000 00000000 00000000
        VR28..... 00000000 00000000 00000000 00000000       VR29..... 00000000 00000000 00000000 00000000
        VR30..... 00000000 00000000 00000000 00000000       VR31..... 00000000 00000000 00000000 00000000
  Storage dump near condition, beginning at location(0000000025708112)
      +0000 0000000025708112  0004E300 70000014 A70BFFB7 8E600020  |..T.....x....-..|
      +0010 0000000025708122  1D60B904 00075000 48C0E320 48C00014  |.-....&...T.....|

  Parameters, Registers, and Variables for Active Routines:
    funcb (DSA address 00000001082FF080):
      DOWNSTACK DSA
      Saved Registers:
        GPR0..... ****************  GPR1..... ****************  GPR2..... ****************  GPR3..... ****************
        GPR4..... 00000001082FF080  GPR5..... BBBBBBBBBBBBBBBB  GPR6..... 00000000257B50D8  GPR7..... 0000000100000001
        GPR8..... 0000000025700CC8  GPR9..... 00000000257081B8  GPR10.... 0000000025708278  GPR11.... 0000000108414330
        GPR12.... 4040404040404040  GPR13.... 4040404040404040  GPR14.... 4040404040404040  GPR15.... 4040404040404040
```

Figure 251. Sections of the dump from example C/C++ routine (AMODE 64) (Part 1 of 2)

```
    GPREG STORAGE:
      Storage around GPR0  is invalid.
      Storage around GPR1  is invalid.
      Storage around GPR2  is invalid.
      Storage around GPR3  is invalid.
      Storage around GPR4 (00000001082FF080)
        +0800 00000001082FF880  00000001 082FF180 00000001 08300060  |......1.........-|
        +0810 00000001082FF890  00000000 25708170 00000000 2570819A  |......a.......a.|
        +0820 00000001082FF8A0  00000000 25700CC8 00000000 25709138  |.......H......j.|
        +0830 00000001082FF8B0  00000000 25708278 00000001 08414330  |......b.........|
        +0840 00000001082FF8C0  00000001 00005300 00000000 00006F60  |..............?-|
        +0850 00000001082FF8D0  00000000 257BF218 00000000 0000001F  |.....#2.........|
```

Figure 252. Sections of the dump from example C/C++ routine (AMODE 64) (Part 2 of 2)

2. In the traceback, statement number 12, corresponding to DSA 7, refers to line: `aa = funcb(&aa);` in the listing. This is were entry `funcb` is called. Similarly, statement number 18, corresponding to DSA 6, points to line: `result = fa/(statint-73);` in the listing. This line is where the divide by zero exception takes place.
3. Locate the instruction with the divide-by-zero error in the Pseudo Assembly Listing in Figure 253 on page 455.

   The offset (within `funcb`) of the exception from the traceback (X'52') reveals the divide instruction: `DR R6,R0` at that location. Instructions at offsets X'32' through X'58' refer to the `result = fa/(statint-73);` line of the C/C++ routine.

```
 OFFSET OBJECT CODE        LINE#  FILE#    P S E U D O   A S S E M B L Y   L I S T I N G

                           Timestamp and Version Information
 000010  F2F0  F0F6                                  =C'2006'           Compiled Year
 000014  F0F2  F2F1                                  =C'0221'           Compiled Date MMDD
 000018  F1F5  F3F3  F1F5                            =C'153315'         Compiled Time HHMMSS
 00001E  F0F1  F0F8  F0F0                            =C'010800'         Compiler Version
                           Timestamp and Version End

15694A01 V1.8 z/OS XL C                         'POSIX.CRTL.C(CDIVZERO)': funcb              02/21/06 15:33:15   Page   148

 OFFSET OBJECT CODE        LINE#  FILE#    P S E U D O   A S S E M B L Y   L I S T I N G

                           000015 |       *  int funcb(int *pp) {

 000028                                     @2L0     DS    0D
 000028  00C300C5                                          =F'12779717'       XPLink entrypoint marker
 00002C  00C500F1                                          =F'12910833'
 000030  00000108                                          =F'264'
 000034  00000100                                          =F'256'
 000000                    000015 |         funcb    DS    0D
 000000  EB59  4708  0024  000015 |                  STMG  r5,r9,1800(r4)
 000006  A74B  FF00        000015 |                  AGHI  r4,H'-256'
 00000A                    End of Prolog

 00000A  C090  0000  006F  000000 |                  LARL  r9,F'111'
 000010  E310  4980  0024  000015 |                  STG   r1,pp(,r4,2432)
                           000016 |       *    int result;
                           000017 |       *    fa = *pp;
 000016  E360  4980  0004  000017 |                  LG    r6,pp(,r4,2432)
 00001C  E300  6000  0014  000017 |                  LGF   r0,(*)int(,r6,0)
 000022  E360  4808  0004  000017 |                  LG    r6,#Save_ADA_Ptr_2(,r4,2056)
 000028  E360  6000  0004  000017 |                  LG    r6,=A(fa)(,r6,0)
 00002E  5000  6000        000017 |                  ST    r0,fa(,r6,0)
                           000018 |       *    result = fa/(statint-73);
 000032  E360  6000  0014  000018 |                  LGF   r6,fa(,r6,0)
 000038  E370  4808  0004  000018 |                  LG    r7,#Save_ADA_Ptr_2(,r4,2056)
 00003E  E370  7008  0004  000018 |                  LG    r7,=A(statint)(,r7,8)
 000044  E300  7000  0014  000018 |                  LGF   r0,statint(,r7,0)
 00004A  A70B  FFB7        000018 |                  AGHI  r0,H'-73'
 00004E  8E60  0020        000018 |                  SRDA  r6,32
 000052  1D60              000018 |                  DR    r6,r0
 000054  B904  0007        000018 |                  LGR   r0,r7
 000058  5000  48C0        000018 |                  ST    r0,result(,r4,2240)
                           000019 |       *    printf("Result = %d\n",result);
 00005C  E320  48C0  0014  000019 |                  LGF   r2,result(,r4,2240)
 000062  E360  4808  0004  000019 |                  LG    r6,#Save_ADA_Ptr_2(,r4,2056)
 000068  EB56  6010  0004  000019 |                  LMG   r5,r6,=A(printf)(r6,16)
 00006E  B904  0019        000019 |                  LGR   r1,r9
 000072  0D76              000019 |                  BASR  r7,r6
 000074  0700              000019 |                  NOPR  0
                           000020 |       *    return result;
 000076  E330  48C0  0014  000020 |                  LGF   r3,result(,r4,2240)
                           000021 |       *  }
 00007C                    000021 |        @2L3      DS    0H

 00007C                    Start of Epilog
 00007C  E370  4818  0004  000021 |                  LG    r7,2072(,r4)
 000082  EB89  4820  0004  000021 |                  LMG   r8,r9,2080(r4)
 000088  4140  4100        000021 |                  LA    r4,256(,r4)
 00008C  47F0  7002        000021 |                  B     2(,r7)
```

Figure 253. Pseudo assembly listing (AMODE 64) (Part 1 of 3)

The following is part two of the pseudo assembly listing (AMODE 64).

```
                          ***   General purpose registers used: 1111011101000000
                          ***   Floating point  registers used: 1111111100000000
                          ***   Size of register spill area: 128(max) 0(used)
                          ***   Size of dynamic storage: 0
                          ***   Size of executable code: 144


                          000001 |       *  /* C Routine with a Divide-by-Zero Error from LE Debugging Guide */
                          000002 |       *  #pragma options(noinline)
                          000003 |       *  #include <stdio.h>
                          000004 |       *  #include <stdlib.h>
                          000005 |       *  #include <errno.h>
                          000006 |       *  int statint = 73;
                          000007 |       *  int fa;
                          000008 |       *  int funcb(int *pp);
                          000009 |       *  int main(void) {

 0000C8                               @1L0     DS    0D
 0000C8  00C300C5                                    =F'12779717'       XPLink entrypoint marker
 0000CC  00C500F1                                    =F'12910833'
 0000D0  00000090                                    =F'144'
 0000D4  00000100                                    =F'256'
 000000                   000009 |        main     DS    0D
 000000  EB57  4708  0024 000009 |                 STMG  r5,r7,1800(r4)
 000006  A74B  FF00       000009 |                 AGHI  r4,H'-256'
 00000A                   End of Prolog

                          000010 |       *    int aa, bb=1;
 00000A  A709  0001       000010 |                 LGHI  r0,H'1'
 00000E  5000  48C4       000010 |                 ST    r0,bb(,r4,2244)
                          000011 |       *    aa = bb;
 000012  E300  48C4  0014 000011 |                 LGF   r0,bb(,r4,2244)
 000018  5000  48C0       000011 |                 ST    r0,aa(,r4,2240)
                          000012 |       *    aa = funcb(á);
 00001C  4110  48C0       000012 |                 LA    r1,aa(,r4,2240)
 000020  E350  4808  0004 000012 |                 LG    r5,#Save_ADA_Ptr_1(,r4,2056)
 000026  A775  FF9D       000012 |                 BRAS  r7,funcb
 00002A  0701             000012 |                 NOPR  1
 00002C  B904  0003       000012 |                 LGR   r0,r3
 000030  5000  48C0       000012 |                 ST    r0,aa(,r4,2240)
                          000013 |       *    return(aa);
 000034  E330  48C0  0014 000013 |                 LGF   r3,aa(,r4,2240)
                          000014 |       *  }
 00003A                   000014 |        @1L2     DS    0H

 00003A                   Start of Epilog
 00003A  E370  4818  0004 000014 |                 LG    r7,2072(,r4)
 000040  4140  4100       000014 |                 LA    r4,256(,r4)
 000044  47F0  7002       000014 |                 B     2(,r7)

                          ***   General purpose registers used: 1111011100000000
                          ***   Floating point  registers used: 1111111100000000
                          ***   Size of register spill area: 128(max) 0(used)
                          ***   Size of dynamic storage: 0
                          ***   Size of executable code: 72

                          Constant Area
 000000  D985A2A4 93A3407E 406C8415 00          |Result = %d..   |


                          PPA1: Entry Point Constants
 000000  02                                          =AL1(2)            Version
 000001  CE                                          =AL1(206)          CEL signature
 000002  07C0                                        =H'1984'           GPR save mask
 000004  00000090                                    =A(PPA2-PPA1)
 000008  80800281                                    =F'-2139094399'    Flags
 00000C  0002                                        =H'2'              Parm length/4
 00000E  0503                                        =H'1283'           Prol len/2; alloca reg; R4 change offset/2
 000010  00000090                                    =F'144'            Code length
 000014  01000000                                    =F'16777216'       Interface mapping flags
 000018  0005  ****                                  AL2(5),C'funcb'
 000020  FFFFFEF8                                    =F'-264'           Offset to Entry Point Marker
                          PPA1 End
```

Figure 254. Pseudo assembly listing (AMODE 64) (Part 2 of 3)

The following is part three of the pseudo assembly listing (AMODE 64).

```
                          PPA1: Entry Point Constants
 000000  02                                          =AL1(2)            Version
 000001  CE                                          =AL1(206)          CEL signature
 000002  0700                                        =H'1792'           GPR save mask
 000004  00000068                                    =A(PPA2-PPA1)
 000008  80800281                                    =F'-2139094399'    Flags
 00000C  0000                                        =H'0'              Parm length/4
 00000E  0503                                        =H'1283'           Prol len/2; alloca reg; R4 change offset/2
 000010  00000048                                    =F'72'             Code length
 000014  01000000                                    =F'16777216'       Interface mapping flags
 000018  0004  ****                                  AL2(4),C'main'
 000020  FFFFFF70                                    =F'-144'           Offset to Entry Point Marker
                          PPA1 End


                          PPA4: Compile Unit Debug Block
 000000  80000000                                    =F'-2147483648'    Additional Flags
 000004  84060238                                    =F'-2079981000'    Flags
 000008  0000000000000000                            =D'0'              R/O static Offset
 000010  0000000000000000                            =D'0'              R/W static Offset
 000018  0000000000000000                            =D'0'              Symbol Offset Table Offset
 000020  FFFFFFFFFFFFFE80                            =D'-384'           CSECT Start Offset
 000028  0000000000000000                            =D'0'              Code CSECT Size
 000030  FFFFFFFFFFFFFE88                            =D'-376'           No program region
 000038  00000000                                    =F'0'              DWARF File Name
 00003C  ****                                        C''
                          PPA4 End

                          PPA2: Compile Unit Block
 000000  0300  2204                                  =F'50340356'       Flags
 000004  FFFF  FE40                                  =A(CELQSTRT-PPA2)
 000008  FFFF  FFC0                                  =A(PPA4-PPA2)
 00000C  FFFF  FE50                                  =A(TIMESTMP-PPA2)
 000010  0000  0000                                  =F'0'              No primary
 000014  9140  0000                                  =F'-1858076672'    Flags
                          PPA2 End
```

Figure 255. Pseudo assembly listing (AMODE 64) (Part 3 of 3)

4. Verify the value of the divisor `statint`. The procedure specified below is to be used for determining the value of static variables only. If the divisor is an automatic variable, there is a different procedure for finding the value of the variable.

   Because this routine was compiled with the RENT option, find the WSA address in the Enclave Control Blocks section of the dump. In this example, this address is X'108300050'. Figure 256 on page 457 shows the WSA address.

```
  Enclave Control Blocks:
    .
    .
    .
    DLL Information:
    WSA Addr          Module Addr          Thread ID         Use Count  Name
    0000000108300050                                         00000001   main
```

Figure 256. C/C++ CAA information in dump (AMODE 64)

5. Routines compiled with the RENT option must also be processed by the binder. The binder produces the Writable Static Map. Find the offset of `statint` in the Writable Static Map in Figure 257 on page 457. In this example, the offset is X'30'.

```
 ---------------
 CLASS  C_WSA64           LENGTH =       38  ATTRIBUTES = MRG, DEFER , RMODE= 64
                          OFFSET =        0 IN SEGMENT 002       ALIGN = QDWORD
 ---------------

            CLASS
           OFFSET  NAME                TYPE    LENGTH   SECTION
                0  $PRIV000012      PART           10
               10  CDIVZERO#S       PART           20  CDIVZERO#C
               30  statint          PART            4  statint
               34  fa               PART            4  fa
```

Figure 257. Writable static map (AMODE 64)

6. Add the WSA address of X'108300050' to the offset of `statint`. The result is X'108300080'. This is the address of the variable `statint`, which is in the writable static area.
7. Use IPCS to display the writeable static area in the system dump. The value at location X'108300080' is X'49' (that is, `statint` is 73), and hence the fixed-point divide exception.

```
LIST 0000000108300050 LEN(X'00000100')

LIST 01_08300050. ASID(X'0015') LENGTH(X'0100') AREA
_8300050. C36DE6E2 C1F6F440 40404040 40404040 |C_WSA64         |
_8300060. 00000001 08300084 00000001 08300080 |.......d........|
_8300070. 00000000 000000C0 00000000 2548D200 |.......{......K.|
_8300080. 00000049 00000001 00000000 00000000 |................|
_8300090 LENGTH(X'10')==>All bytes contain X'00'
_83000A0. 00000001 08300000 00000000 00000220 |................|
_83000B0. 00000001 083002D0 00000001 083004B8 |.......}........|
_83000C0. 00000001 083004F5 00000001 08300532 |.......5........|
_83000D0. 00000001 0830056F 00000001 083005AC |.......?........|
_83000E0. 00000001 083005E9 00000001 08300626 |.......Z........|
_83000F0. 00000001 08300663 00000001 08300A70 |................|
_8300100. 00000001 08300AAD 00000000 00000000 |................|
_8300110 LENGTH(X'40')==>All bytes contain X'00'
```

Figure 258. IPCS storage display of the writeable static area (AMODE 64)

Calling a nonexistent function

Figure 259 on page 458 demonstrates the error of calling a nonexistent function. This routine was compiled with the compiler options LP64, GONUM, LIST, OFFSET, and RENT and was run with the option TERMTHDACT(UADUMP).

```
/* C/C++ Example of Calling a Nonexistent Subroutine     */
/*       from LE Debugging Guide                          */
#pragma options(noinline)
#include <stdio.h>
#include <stdlib.h>
#include <errno.h>
#include <signal.h>
void funca(int* aa);
int (*func_ptr)(void)=0;
int main(void) {
  int aa;
  funca(&aa);
  printf("result of funca = %d\n",aa);
  return;
}
void funca(int* aa) {
  *aa = func_ptr();
  return;
}
```

Figure 259. C/C++ example of calling a nonexistent subroutine (AMODE 64)

To debug this routine, use the following steps:

1. Locate the Original Condition message in the Condition Information for Active Routines section of the dump, which is shown in Figure 260 on page 459. In this example, the message is as follows:

   `CEE3201S The system detected an operation exception (System Completion Code=0C1).`

   It message suggests that the error was caused by an attempt to branch to an unknown address. For additional information about CEE3201S, see Language Environment runtime messages in *z/OS Language Environment Runtime Messages*.

   The Location section of the dump indicates that the exception occurred at offset X'-209000D0'' within function `funca` and that there might have been a bad branch from statement 17 offset X'+00000036'' within function `funca`. The negative offset indicates that the offset cannot be used to locate the instruction that caused the error. Another indication of bad data is the value of X'00000002' in the instruction address of the PSW shown in the Condition Information section. This address indicates that an instruction in the routine that is branched outside the bounds of the routine.

In the traceback, the statement number that is displayed for entry 'main' points to line 12 in the source code that is shown in Figure 259 on page 458. This line contains the statement "`funca(&aa);`" in which entry '`funca`' is called. As message CEE3841I explains, for entry `funca` no statement number could be displayed. In this example, this problem is caused because `funca` has an invalid offset. For more information about this message, see Language Environment runtime messages in *z/OS Language Environment Runtime Messages*.

```
CEE3DMP V1 R9.0: Condition processing resulted in the unhandled condition.        Mon Jan 22 16:39:06 2007           Page:    1
ASID: 00CC   Job ID: JOB04367   Job name: QEXIST     Step name: STEP1      UserID: HEALY

CEE3845I CEEDUMP Processing started.

Information for enclave main

  Information for thread 8000000000000000

  Traceback:
    DSA   Entry       E  Offset  Statement   Load Mod             Program Unit                   Service  Status
    1     CEEHDSP     +00000000              CELQLIB              CEEHDSP                        D1908    Call
    2     CELQHROD    +0000024E              CELQLIB              CELQHROD                       D1908    Call
    3     funca       -209000D0              EXIST                                                        Exception
    CEE3841I A statement number is not available for this DSA. An internal routine failed with return code 08 and reason code 1C
    4     main        +00000034  12          EXIST                EXIST                                   Call
    5     CELQINIT    +0000134C              CELQLIB              CELQINIT                       D1908    Call

    DSA   DSA Addr          E  Addr              PU Addr            PU Offset   Comp Date Compile Attributes
    1     00000001082FC520  0000000020AB3680    0000000020AB3680  00000000    20061215  CEL       XPLINK  EBCDIC  HFP
    2     00000001082FEE40  0000000020AC6AA0    0000000020AC6AA0  0000024E    20061215  CEL       XPLINK  EBCDIC  HFP
    3     00000001082FF080  00000000209000D0    0000000000000000  ********    20070122  C/C++     XPLINK  EBCDIC  IEEE
    4     00000001082FF180  0000000020900138    0000000000000000  ********    20070122  C/C++     XPLINK  EBCDIC  IEEE
    5     00000001082FF280  0000000020903010    0000000020903010  0000134C    20061215  CEL       XPLINK  EBCDIC  HFP

    Fully Qualified Names
    DSA   Entry       Program Unit                                        Load Module
    4     main        PLPSC://'POSIX.CRTL.C(EXIST)'                       EXIST

  Condition Information for Active Routines
    Condition Information for  (DSA address 00000001082FF080)
      CIB Address: 00000001082FD860
      Current Condition:
        CEE0198S The termination of a thread was signaled due to an unhandled condition.
      Original Condition:
        CEE3201S The system detected an operation exception (System Completion Code=0C1).
      Location:
        Program Unit:  Entry: funca Statement:  Offset: -209000D0
        Possible Bad Branch:  Statement: 17  Offset: +00000036
      Machine State:
        ILC..... 0002    Interruption Code..... 0001
        PSW..... 0785240180000000 0000000000000002
        GPR0..... 0000000108300060  GPR1..... 00000001082FFA40  GPR2..... 0000000108401F60  GPR3..... 0000000108400070
        GPR4..... 00000001082FF080  GPR5..... 000A0000000130E1  GPR6..... 0000000000000000  GPR7..... 0000000020900108
        GPR8..... 00000000209000DC  GPR9..... 00000000209001A0  GPR10.... 00000000209002A8  GPR11.... 0000000108401F50
        GPR12.... 0000000100005340  GPR13.... 0000000000006F58  GPR14.... 0000000020B4E0A0  GPR15.... 000000000000001F

    Storage dump near condition, beginning at location(0000000000000000)
      +0000 0000000000000000  Inaccessible storage.
      +0010 0000000000000010  Inaccessible storage.
    GPREG STORAGE:
      Storage around GPR0 (0000000108300060)
        -0020 0000000108300040  00000001 08300000 00000000 00000060  |...............-|
        -0010 0000000108300050  C36DE6E2 C1F6F440 40404040 40404040  |C_WSA64         |
        +0000 0000000108300060  94818995 0086A495 83810000 00000000  |main.funca......|
        +0010 0000000108300070  00000001 08300090 00000000 209000D0  |................|
        +0020 0000000108300080  00000000 000000C0 00000000 20E71FF8  |.............X.8|
        +0030 0000000108300090  00000000 00000000 00000000 00000000  |................|

     Storage around GPR1 (00000001082FFA40)
        -0020 00000001082FFA20  00000000 00000000 00000000 00000000  |................|
        -0010 00000001082FFA30 - +FFFFFF 00000001082FFA3F             same as above
        +0000 00000001082FFA40  00000000 00000000 00000001 08300060  |...............-|
        +0010 00000001082FFA50  00000000 00000000 00000000 00000000  |................|
        +0020 00000001082FFA60 - +00003F 00000001082FFA7F             same as above
```

Figure 260. Sections of the dump from example C routine (AMODE 64) (Part 1 of 3)

The following is part two of sections of the dump from example C routine (AMODE 64).

```
      Storage around GPR2 (0000000108401F60)
        -0020 0000000108401F40  00000001 08400000 00000000 00000040  |..... ......... |
        -0010 0000000108401F50  00000001 00000020 00000001 08401F60  |............. .-|
        +0000 0000000108401F60  00000001 08401BF0 00000000 00000000  |..... .0........|
        +0010 0000000108401F70  00000000 00000000 00000000 00000000  |................|
        +0020 0000000108401F80  00000001 08400000 00000000 000014E0  |..... ..........|
        +0030 0000000108401F90  C3C4D3C7 6DC8C4D9 00000001 08401FBC  |CDLG_HDR..... ..|
      Storage around GPR3 (0000000108400070)
        -0020 0000000108400050  00000000 00000000 00000000 00000000  |................|
        -0010 0000000108400060  00000001 08400000 00000000 000000C0  |..... ..........|
        +0000 0000000108400070  00000001 084042B0 00000000 00000000  |..... ..........|
        +0010 0000000108400080  00000000 00000000 00000000 20900000  |................|
        +0020 0000000108400090  00000000 00000000 00000001 08300050  |...............&|
        +0030 00000001084000A0  00000000 00000000 00000001 80C00000  |................|
      Storage around GPR4 (00000001082FF080)
        +0800 00000001082FF880  00000001 082FF180 00000001 08300060  |......1........-|
        +0810 00000001082FF890  00000000 209000D0 00000000 2090016E  |...............>|
        +0820 00000001082FF8A0  00000000 20900144 00000000 209001A0  |................|
        +0830 00000001082FF8B0  00000000 209002A8 00000001 08401F50  |.......y..... .&|
        +0840 00000001082FF8C0  00000001 00005340 00000000 00006F58  |....... ......?.|
        +0850 00000001082FF8D0  00000000 20B4E0A0 00000000 0000001F  |................|
      Storage around GPR5 (000A0000000130E1)
        -0020 000A0000000130C1  Inaccessible storage.
        -0010 000A0000000130D1  Inaccessible storage.
        +0000 000A0000000130E1  Inaccessible storage.
        +0010 000A0000000130F1  Inaccessible storage.
        +0020 000A000000013101  Inaccessible storage.
        +0030 000A000000013111  Inaccessible storage.
      Storage around GPR6 (0000000000000000)
        +0000 0000000000000000  Inaccessible storage.
        +0010 0000000000000010  Inaccessible storage.
        +0020 0000000000000020  Inaccessible storage.
        +0030 0000000000000030  Inaccessible storage.
        +0040 0000000000000040  Inaccessible storage.
        +0050 0000000000000050  Inaccessible storage.
      Storage around GPR7 (0000000020900108)
        -0020 00000000209000E8  E3104980 0024E360 48080004 E3606010  |T.....T-....T--.|
        -0010 00000000209000F8  0004E360 60000004 EB566000 00040D76  |..T--.....-.....|
        +0000 0000000020900108  0700B904 0003E360 49800004 50006000  |......T-....&.-.|
        +0010 0000000020900118  47F08040 EB484800 000447F0 70020000  |.0. .......0....|
        +0020 0000000020900128  00C300C5 00C500F1 000000B0 00000100  |.C.E.E.1........|
        +0030 0000000020900138  EB494700 0024A74B FF000D80 C0900000  |......x.........|
⋮
  Enclave Control Blocks:
⋮

    DLL Information:
    WSA Addr          Module Addr         Thread ID         Use Count  Name
    0000000108300050                                        00000001   main
    0000000108301210  000000002105B000    8000000000000000  00000002   CDAEQED
    0000000108306E10  00000000210D0000    8000000000000000  00000001   CDAEQDPI
    000000010830FE90  0000000021194000    8000000000000000  00000001   CELQDSNF
⋮
```

Figure 261. Sections of the dump from example C routine (AMODE 64) (Part 2 of 3)

The following is part three of sections of the dump from example C routine (AMODE 64).

```
⋮
    Process Control Blocks:

    PCB(0000000100003CA0)
      +0000 0000000100003CA0  C3C5C5D7 C3C24040 00000000 00000000  |CEEPCB  ........|
      +0010 0000000100003CB0  00000000 00000000 00000000 00000000  |................|
      +0020 0000000100003CC0 - +0000FF 0000000100003D9F             same as above
      +0100 0000000100003DA0  03030208 00000000 00000000 00000000  |................|
      +0110 0000000100003DB0  00000001 00004048 00000000 00000000  |...... .........|
      +0120 0000000100003DC0  00000000 00000000 00000000 00000000  |................|
      +0130 0000000100003DD0  00000000 00000000 00000001 00003A10  |................|
      +0140 0000000100003DE0  7F800000 00000000 00000000 00000000  |"...............|
      +0150 0000000100003DF0  00000000 00000000 00000000 00000000  |................|
      +0160 0000000100003E00 - +0001BF 0000000100003E5F             same as above
    MEML(0000000100004048)
      +0000 0000000100004048  00000000 00000000 00000000 00000000  |................|
      +0010 0000000100004058 - +00005F 00000001000040A7             same as above
      +0060 00000001000040A8  00000001 00008688 00000000 00000000  |......fh........|
      +0070 00000001000040B8  00000000 00000000 00000000 00000000  |................|
      +0080 00000001000040C8 - +0001AF 00000001000041F7             same as above
CEE3846I CEEDUMP Processing completed.
```

Figure 262. Sections of the dump from example C routine (AMODE 64) (Part 3 of 3)

2. Find the branch instructions for `funca` in the listing in Figure 263 on page 461. Notice the BASR `r7,r6` instruction at offset X'000036'. This branch is part of the instruction `aa=func_ptr();` in statement 17 in Figure 259 on page 458.

```
OFFSET OBJECT CODE        LINE#  FILE#    P S E U D O   A S S E M B L Y   L I S T I N G

                          Timestamp and Version Information
000010  F2F0  F0F7                                         =C'2007'          Compiled Year
000014  F0F1  F2F2                                         =C'0122'          Compiled Date MMDD
000018  F1F6  F2F5  F4F6                                   =C'162546'        Compiled Time HHMMSS
00001E  F0F1  F0F9  F0F0                                   =C'010900'        Compiler Version
                          Timestamp and Version End

OFFSET OBJECT CODE        LINE#  FILE#    P S E U D O   A S S E M B L Y   L I S T I N G

                          000016 |       *  void funca(int* aa) {

000028                                    @2L0     DS      0D
000028  00C300C5                                           =F'12779717'      XPLink entrypoint marker
00002C  00C500F1                                           =F'12910833'
000030  000000F8                                           =F'248'
000034  00000100                                           =F'256'
000000                    000016 |        funca    DS      0D
000000  EB48  4700  0024  000016 |                 STMG    r4,r8,1792(r4)
000006  A74B  FF00        000016 |                 AGHI    r4,H'-256'
00000A  0D80              000016 |                 BASR    r8,0
00000C                    End of Prolog

00000C  E350  4808  0024  000016 |                 STG     r5,#Save_ADA_Ptr_2(,r4,2056)
000012  E350  48C0  0024  000016 |                 STG     r5,#Save_WSA_Ptr_2(,r4,2240)
000018  E310  4980  0024  000016 |                 STG     r1,aa(,r4,2432)
                          000017 |       *    *aa = func_ptr();
00001E  E360  4808  0004  000017 |                 LG      r6,#Save_ADA_Ptr_2(,r4,2056)
000024  E360  6010  0004  000017 |                 LG      r6,=A(func_ptr)(,r6,16)
00002A  E360  6000  0004  000017 |                 LG      r6,func_ptr(,r6,0)
000030  EB56  6000  0004  000017 |                 LMG     r5,r6,&ADA_&EPA(r6,0)
000036  0D76              000017 |                 BASR    r7,r6
000038  0700              000017 |                 NOPR    0
00003A  B904  0003        000017 |                 LGR     r0,r3
00003E  E360  4980  0004  000017 |                 LG      r6,aa(,r4,2432)
000044  5000  6000        000017 |                 ST      r0,(*)int(,r6,0)
                          000018 |       *    return;
000048  47F0  8040        000018 |                 B       @2L3
                          000019 |       *  }
00004C                    000019 |        @2L3     DS      0H

00004C                    Start of Epilog
00004C  EB48  4800  0004  000019 |                 LMG     r4,r8,2048(r4)
000052  47F0  7002        000019 |                 B       2(,r7)

                          ***   General purpose registers used: 1111111110000000
                          ***   Floating point  registers used: 1111111100000000
                          ***   Size of register spill area: 256(max) 0(used)
                          ***   Size of dynamic storage: 0
                          ***   Size of executable code: 86

OFFSET OBJECT CODE        LINE#  FILE#    P S E U D O   A S S E M B L Y   L I S T I N G

                          000001 |       *  /* C/C++ Example of Calling a Nonexistent Subroutine     */
                          000002 |       *  /*       from LE Debugging Guide                         */
                          000003 |       *  #pragma options(noinline)
                          000004 |       *  #include <stdio.h>
                          000005 |       *  #include <stdlib.h>
                          000006 |       *  #include <errno.h>
                          000007 |       *  #include <signal.h>
                          000008 |       *  void funca(int* aa);
                          000009 |       *  int (*func_ptr)(void)=0;
                          000010 |       *  int main(void) {
```

Figure 263. Pseudo assembly listing (AMODE 64) (Part 1 of 2)

```
000090                                    @1L0     DS      0D

000090  00C300C5                                           =F'12779717'  XPLink entrypoint marker      000094  00C500F1                                             =F'12910833'
000098  000000B0                                           =F'176'
00009C  00000100                                           =F'256'
000000                    000010 |        main     DS      0D
000000  EB49  4700  0024  000010 |                 STMG    r4,r9,1792(r4)
000006  A74B  FF00        000010 |                 AGHI    r4,H'-256'
00000A  0D80              000010 |                 BASR    r8,0


00000C                    End of Prolog

00000C  C090  0000  002E  000000 |                 LARL    r9,F'46'
000012  E350  4808  0024  000010 |                 STG     r5,#Save_ADA_Ptr_1(,r4,2056)
000018  E350  48C8  0024  000010 |                 STG     r5,#Save_WSA_Ptr_1(,r4,2248)
                          000011 |       *    int aa;
                          000012 |       *    funca(&aa);
00001E  4110  48C0        000012 |                 LA      r1,aa(,r4,2240)
000022  E350  4808  0004  000012 |                 LG      r5,#Save_ADA_Ptr_1(,r4,2056)
000028  E360  4808  0004  000012 |                 LG      r6,#Save_ADA_Ptr_1(,r4,2056)
00002E  E360  6018  0004  000012 |                 LG      r6,=V(funca)(,r6,24)
000034  0D76              000012 |                 BASR    r7,r6
000036  0700              000012 |                 NOPR    0
                          000013 |       *    printf("result of funca = %d\n",aa);                     000038  E320  48C0  0014  000013 |                 LGF      r2,aa(,r4,2240)
00003E  E360  4808  0004  000013 |                 LG      r6,#Save_ADA_Ptr_1(,r4,2056)
000044  EB56  6020  0004  000013 |                 LMG     r5,r6,=A(printf)(r6,32)
00004A  B904  0019        000013 |                 LGR     r1,r9
00004E  0D76              000013 |                 BASR    r7,r6
000050  0700              000013 |                 NOPR    0
                          000014 |       *    return;
000052  47F0  804A        000014 |                 B       @1L2
                          000015 |       *  }
000056                    000015 |        @1L2     DS      0H

000056                    Start of Epilog
000056  EB49  4800  0004  000015 |                 LMG     r4,r9,2048(r4)
00005C  B909  0033        000015 |                 SGR     r3,r3
000060  47F0  7002        000015 |                 B       2(,r7)

                          ***   General purpose registers used: 1111111111000000
                          ***   Floating point  registers used: 1111111100000000
                          ***   Size of register spill area: 256(max) 0(used)
                          ***   Size of dynamic storage: 0
                          ***   Size of executable code: 100


OFFSET OBJECT CODE        LINE#  FILE#    P S E U D O   A S S E M B L Y   L I S T I N G
000104  0000  0000

                          Constant Area


000000  9985A2A4 93A34096 864086A4 95838140    |result of funca |
000010  7E406C84 1500                          |= %d..          |
```

Figure 264. Pseudo assembly listing (AMODE 64) (Part 2 of 2)

3. Find the offset of `func_ptr` in the Writable Static Map, shown in Figure 265 on page 462.

```
---------------

CLASS  C_WSA64           LENGTH =       48  ATTRIBUTES = MRG, DEFER , RMODE=
64
                         OFFSET =        0 IN SEGMENT 002       ALIGN =
QDWORD
---------------



CLASS
           OFFSET  NAME                TYPE    LENGTH
SECTION
                0  $PRIV000012      PART
10
               10  EXIST#S          PART            30
EXIST#C
               40  func_ptr         PART             8
func_ptr
```

Figure 265. Writable static map (AMODE 64)

4. Add the offset of `func_ptr` (X'40') to the address of WSA (X'108300050') (the WSA address was obtained from the dump report in Figure 263 on page 461). The result (X'108300090') is the address of the function pointer `func_ptr` in the writable static storage area. This value is 0, indicating the variable is uninitialized. Figure 266 on page 462 shows the sections of the dump.

```
 LIST 01_08300050. ASID(X'00CC') LENGTH(X'0100') AREA
 _8300050. C36DE6E2 C1F6F440 40404040 40404040 |C_WSA64         |
 _8300060. 94818995 0086A495 83810000 00000000 |main.funca......|
 _8300070. 00000001 08300090 00000000 209000D0 |..............}|
 _8300080. 00000000 000000C0 00000000 20E71FF8 |.......{.....X.8|
 _8300090 LENGTH(X'10')==>All bytes contain X'00'
 _83000A0. 00000001 08300000 00000000 00000220 |................|
 _83000B0. 00000001 083002D0 00000001 083004B8 |.......}........|
 _83000C0. 00000001 083004F5 00000001 08300532 |.......5........|
 _83000D0. 00000001 0830056F 00000001 083005AC |.......?........|
 _83000E0. 00000001 083005E9 00000001 08300626 |.......Z........|
 _83000F0. 00000001 08300663 00000001 08300A70 |................|
 _8300100. 00000001 08300AAD 00000000 00000000 |................|
 _8300110 LENGTH(X'40')==>All bytes contain X'00'
```

Figure 266. IPCS storage display of the writeable static area (AMODE 64)

Handling dumps written to the z/OS UNIX file system

When a z/OS UNIX C/C++ application program is running in an address space created as a result of a call to `spawnp()`, `vfork()`, or one of the `exec` family of functions, the SYSMDUMP DD allocation information is not inherited. Even though the SYSMDUMP allocation is not inherited, a SYSMDUMP allocation must exist in the parent in order to obtain a storage dump. If the program terminates abnormally while running in this new address space, the kernel causes an unformatted storage dump to be written to a file in the user's working directory. The file is placed in the current working directory or into `/tmp` if the current working directory is not defined. The file name has the following format:

```
/directory/coredump.pid
```

where *directory* is the current working directory or `tmp`, and *pid* is the hexadecimal process ID (PID) for the process that terminated. For details on how to generate the system dump, see "Steps for generating a system dump in a z/OS UNIX shell" on page 357.

To debug the dump, use the Interactive Problem Control System (IPCS). If the dump was written to a z/OS UNIX file, you must allocate a data set that is large enough and has the correct attributes for receiving a copy of the z/OS UNIX file. For example, from the ISPF DATA SET UTILITY panel you can specify a volume serial and data set name to allocate. Doing so brings up the DATA SET INFORMATION panel for specifying characteristics of the data set to be allocated.

Figure 267 on page 463 is a sample filled-in panel that shows the characteristics defined for the URCOMP.JRUSL.COREDUMP dump data set. Fill in the information for your data set as shown, and estimate the number of cylinders required for the dump file you are going to copy.

```
-------------------------  DATA SET INFORMATION  ---------------------
Command ===>

Data Set Name  . . . : URCOMP.JRUSL.COREDUMP

General Data                          Current Allocation
 Management class . . : STANDARD       Allocated cylinders : 30
 Storage class  . . . : OS390          Allocated extents . : 1
  Volume serial . . . : DPXDU1
  Device type . . . . : 3380
 Data class . . . . . :
  Organization  . . . : PS            Current Utilization
  Record format . . . : FB             Used cylinders. . . : 0
  Record length . . . : 4160           Used extents   . . . : 0
  Block size  . . . . : 4160
  1st extent cylinders: 30
  Secondary cylinders : 10
  Data set name type  :

  Creation date . . . : 2001/08/30
  Expiration date . . : ***None***

F1=Help     F2=Split     F3=End       F4=Return     F5=Rfind     F6=Rchange
F7=Up       F8=Down      F9=Swap     F10=Left      F11=Right    F12=Cancel
```

Figure 267. IPCS panel for entering data set information (AMODE 64)

Use the TSO/E OGET or OCOPY command with the BINARY keyword to copy the file into the data set. For example, to copy the memory dump file `coredump.00060007` into the data set URCOMP.JRUSL.COREDUMP just allocated, a user with the user ID URCOMP enters the following command:

```
OGET '/u/urcomp/coredump.00060007' 'urcomp.jrusl.coredump' BINARY
```

After you have copied the memory dump file to the data set, you can use IPCS to analyze the dump. See "Formatting and analyzing system dumps" on page 358 for information about formatting Language Environment control blocks.

Multithreading consideration

Certain control blocks are locked while a dump is in progress. For example, a `csnap()` of the file control block would prevent another thread from using or dumping the same information. An attempt to do so causes the second thread to wait until the first one completes before it can continue.

Understanding C/C++ heap information in storage reports

Storage reports that contain specific C/C++ heap information can be generated in two ways; details on how to request and interpret the reports are provided in the following sections.

- By setting the Language Environment RPTSTG(ON) runtime option for Language Environment created heaps
- By issuing a stand-alone call to the C function `__uheapreport()` for user–created heaps.

Language Environment storage report with heap pools statistics

To request a Language Environment storage report set RPTSTG(ON). If the C/C++ application specified the HEAPPOOLS(ON) or HEAPPOOLS64(ON) runtime option, the storage report displays heap pools statistics. For a sample storage report showing heap pools statistics for a multithreaded C/C++ application, see Figure 157 on page 327. The following sections describe the C/C++ specific heap pools information.

HEAPPOOLS64 storage statistics

The HEAPPOOLS64 runtime option controls usage of the heap pools storage algorithm at the enclave level. The heap pools algorithm allows for the definition of one to twelve heap pools, each consisting of a number of storage cells of a specified length.

Note: The use of an alternative vendor heap manager (VHM) overrides the use of the HEAPPOOLS64 runtime option.

HEAPPOOLS64 statistics

- Pool *p* size: *ssss* Get requests: *gggg*

  p
  : number of the pool. When there are multiple pools for a cell size, the pools are numbered using the format *aa.bbb*

    aa
    : number for the cell size

    bbb
    : number for the pool within the cell size

  ssss
  : cell size specified for the pool

  gggg
  : number of storage requests that were satisfied from this pool

- Successful Get Heap requests: *xxxx-yyyy n*

  xxxx
  : low side of the 8 byte range

  yyyy
  : high side of the 8 byte range

  n
  : number of requests in the 8 byte range

- Requests greater than the largest cell size — the number of storage requests that are not satisfied by heap pools.

Note: Values displayed in the HEAPPOOLS64 statistics report are not serialized when collected; therefore, the values are not necessarily exact.

HEAPPOOLS64 summary

The HEAPPOOLS64 summary displays a report of the HEAPPOOLS64 statistics and provides suggested cell sizes.

Specified Cell Size
: the size of the cell specified in the HEAPPOOLS64 runtime option

Element Size
: the size of the cell plus any additional storage needed for control information or to maintain alignment

Cells Per Extent
: the cell pool count specified by the HEAPPOOLS64 runtime option. When there is more than one pool for a cell size, the count is divided by the number of pools.

Extents Allocated
: the number of times that each pool allocated an extent in order to optimize storage usage. The extents allocated needs to be either one or two. If the number of extents allocated is too high, increase the cell count for the pool.

Maximum Cells Used
: the maximum number of cells used for each pool.

Cells In Use
: the number of cells that were never freed. A large number in this field could indicate a storage leak.

Suggested Cell Sizes
: sizes that are calculated to optimally use storage (assuming that the application will __malloc/__free with the same frequency). The suggested cell sizes are given with no cell counts because the usage of

each new cell pool size is not known. If there are less than 12 cell sizes calculated, then the last pool size is set at 65536.

For more information about stack and heap storage for AMODE64 applications, see *z/OS Language Environment Programming Guide for 64-bit Virtual Addressing Mode*.

HEAPPOOLS storage statistics

The HEAPPOOLS runtime option controls usage of the heap pools storage algorithm at the enclave level. The heap pools algorithm allows for the definition of one to twelve heap pools, each consisting of a number of storage cells of a specified length. HEAPPOOLS runtime option can be used by AMODE 64 applications to manage user heap storage above the 16MB line and below the 2GB bar.

Note: The use of an alternative Vendor Heap Manager (VHM) overrides the use of the HEAPPOOLS runtime option.

HEAPPOOLS statistics

- Pool *p* size: *ssss* Get requests: *gggg*

  p
  number of the pool. When there are multiple pools for a cell size, the pools are numbered using the format *aa.bbb*

  aa
  number for the cell size

  bbb
  number for the pool within the cell size

  ssss
  cell size specified for the pool

  gggg
  number of storage requests that were satisfied from this pool

- Successful Get Heap requests: *xxxx-yyyy n*

  xxxx
  low side of the 8 byte range

  yyyy
  high side of the 8 byte range

  n
  number of requests in the 8 byte range

- Requests greater than the largest cell size — the number of storage requests that are not satisfied by heap pools.

Note: Values displayed in the HEAPPOOLS statistics report are not serialized when collected, therefore the values are not necessarily exact.

HEAPPOOLS summary

The HEAPPOOLS summary displays a report of the HEAPPOOLS statistics and provides suggested percentages for current cell sizes as well as suggested cell sizes.

- Specified Cell Size — the size of the cell specified in the HEAPPOOLS runtime option
- Element Size — the size of the cell plus any additional storage needed for control information or to maintain alignment
- Extent Percent — the cell pool percent specified by the HEAPPOOLS runtime option
- Cells Per Extent — the number of cells per extent. This number is calculated using the following formula, with a minimum of four cells:

```
Initial Heap Size * (Extent Percent/100))/(Element Size)
```

Note: Having a small number of cells per extent is not suggested because the pool can allocate many extents, which causes the HEAPPOOLS algorithm to perform inefficiently.

- Extents Allocated — the number of times that each pool allocated an extent.

  To optimize storage usage, the extents allocated need to be either one or two. If the number of extents allocated is too high, increase the percentage for the pool.

- Maximum Cells Used — the maximum number of cells used for each pool.
- Cells In Use — the number of cells that were never freed.

  A large number in this field can indicate a storage leak.

- Suggested Percentages for current Cell Sizes — percentages calculated to find the optimal size of the cell pool extent. The calculation is based on the following formula:

```
(Maximum Cells Used * (Element Size) * 100) / Initial Heap Size
With a minimum of 1% and a maximum of 90%
```

  Make sure that your cell pool extents are neither too large nor too small. If your percentages are too large then additional, unreferenced virtual storage will be allocated, thereby causing the program to exhaust the region size. If the percentages are too small then the HEAPPOOLS algorithm will run inefficiently.

- Suggested Cell Sizes — sizes that are calculated to optimally use storage (assuming that the application will __malloc/__free with the same frequency).

  Note: The suggested cell sizes are given with no percentages because the usage of each new cell pool size is not known. If there are less than 12 cell sizes calculated and the last calculated cell size is smaller than the largest cell size currently in effect, the largest cell size currently in effect is used for the last suggested cell size.

For more information about stack and heap storage, see Stack and heap storage in *z/OS Language Environment Programming Guide for 64-bit Virtual Addressing Mode*.

C function __uheapreport() storage report

To generate a user-created heap storage report use the C function, `__uheapreport()`. Use the information in the report to assist with tuning your application's use of the user-created heap.

For more information about the `__uheapreport()` function, see __uheapreport() — Produce a storage report for a user-created heap in *z/OS XL C/C++ Runtime Library Reference*.

For tuning tips, see Tuning heap storage in *z/OS Language Environment Programming Guide*.

```
Storage Report for Enclave  Wed Jan 26 20:29:08 2010
Language Environment V01 R13.00

    HeapPools Statistics:
      Pool  1 size:    32
        Successful Get Heap requests:      -                         15
      Pool  2 size:   128
        Successful Get Heap requests:      -                         15
      Pool  3 size:   512
        Successful Get Heap requests:      -                         15
      Pool  4 size:  2048
        Successful Get Heap requests:      -                         15
      Pool  5 size:  8192
        Successful Get Heap requests:      -                         15
      Pool  6 size: 16384
        Successful Get Heap requests:      -                         15
      Requests greater than the largest cell size:                  0
    HeapPools Summary:
      Cell     Cells Per   Extents    Maximum       Cells In
      Size     Extent      Allocated  Cells Used    Use
      ----------------------------------------------------------
         32          15          1          1         15
        128          15          1          1         15
        512          15          1          1         15
       2048          15          1          1         15
       8192          15          1          1         15
      16384          15          1          1         15
      ----------------------------------------------------------
      Suggested Cell Sizes:
        ,32,,128,,512,,2048,,8192,,16384,,0)
End of Storage Report
```

Figure 268. Storage report generated by __uheapreport() (AMODE 64)

User-created HeapPools statistics

- Pool *p* size: *ssss*
  - *p* — the number of the pool
  - *ssss* — the cell size specified for the pool.
- Successful Get Heap requests: *xxxx-yyyy n*
  - *xxxx* — the low side of the range
  - *yyyy* — the high side of the range
  - *n* — the number of requests in the range.
- Requests greater than the largest cell size — the number of storage requests that are not satisfied by heap pools.

Note: Values displayed in the HeapPools statistics report are not serialized when collected, therefore the values are not necessarily exact.

HeapPools summary

The HeapPools summary displays a report of the HeapPool statistics and provides suggested percentages for current cell sizes as well as suggested cell sizes. Figure 268 on page 467 shows a sample storage report generated by `__uheapreport()`.

- Cell Size — the size of the cell specified on the __ucreate() call
- Cells Per Extent — the cell pool count specified on the __ucreate() call
- Extents Allocated — the number of times that each pool allocated an extent in order to optimize storage usage.
- Maximum Cells Used — the maximum number of cells used for each pool.
- Cells In Use — the number of cells that were never freed.

  A large number in this field could indicate a storage leak.
- Suggested Cell Sizes — sizes that are calculated to optimally use storage (assuming that the application will __umalloc/__ufree with the same frequency).

The suggested cell sizes are given with no cell counts because the usage of each new cell pool size is not known. If there are less than 12 cell sizes calculated, then the last pool size is set at 65536.

Part 4. Debugging AMODE 31 Language Environment and AMODE 64 Language Environment interoperability applications

This part provides specific information for debugging applications written to make use of Language Environment AMODE 31 and AMODE 64 interoperability.

Chapter 14. Using Language Environment debugging facilities and Language Environment dumps

This chapter provides information about using the Language Environment dump service, and describes the contents of the Language Environment dump.

Generating a dump for Language Environment AMODE 31 and AMODE 64 interoperability applications

The TERMTHDACT runtime option produces a dump during program checks or abnormal terminations. You can set the runtime option TERMTHDACT in the Language Environment primary environment, and level of information will take effect for both Language Environment primary environment and secondary environment. For more information about the TERMTHDACT runtime option, see "Generating a Language Environment dump with TERMTHDACT" on page 36, and for 64 bit applications see "Generating a Language Environment dump with TERMTHDACT" on page 339

Generating a system dump

A system dump contains the storage information needed to diagnose errors. All methods to generate a system dump take effect in the Language Environment primary environment and only TRAP and the level of information in TERMTHDACT can take effect in the Language Environment secondary environment. For more information about generating a system dump, see "Generating a system dump" on page 81, and for 64 bit applications see "Generating a system dump" on page 356.

Formatting and analyzing the AMODE 31 and AMODE 64 interoperability report in system dumps

The AMODE 31 and AMODE 64 interoperability report in the formatted output is described in Example of formatted output from LEDATA VERBEXIT. The sections of the following dump are numbered to correspond with the descriptions in "Sections of the AMODE 31 and AMODE 64 interoperability report of the Language Environment LEDATA VERBEXIT formatted output" on page 474.

The system dump is generated by the C program CELECA64 shown in C program CELECA64. CELECA64 is an AMODE 31 appliction which calls AMODE 64 DLL CELQCLEE through CEL4RO64 shown in AMODE 64 DLL CELQCLEE. CELQCLEE will call AMODE 31 DLL CELECLEE through CEL4RO64 shown in AMODE 31 DLL CELECLEE.

C program CELECA64:

```
#pragma runopts(TERMTHDACT(UADUMP),POSIX(OFF),DYNDUMP(,DYNAMIC,))
#include <stdio.h>
#include <stdlib.h>

#define MLENGTH    8   /*length of module name string */
#define FLENGTH    8   /*length of function name string */

typedef void cel4ro64_cwi_func(void*);
#pragma linkage (cel4ro64_cwi_func,OS_UPSTACK)
#define CEL4RO64                                             \
    ((cel4ro64_cwi_func*)(*((int*)(((char*)          \
    (*((int*)(((char*)(__gtca()))+1024))))+8))))

/* Fixed length structure RO64_CB */
typedef struct RO64_cb{
    int  version;
    int  length;
    int  flags;
    int  off_module;
    int  off_func;
    int  off_args;
```

```
    char dll_handle[8];
    char func_desc[8];
    char gr_buffer[24];
    int  retcode;
}RO64_cb;

/* Module name to load */
typedef struct RO64_module{
    int length;
    char module_name[MLENGTH];
   }RO64_module;

/* Function name to query */
typedef struct RO64_function{
    int length;
    char function_name[FLENGTH];
   }RO64_function;

int main()
{
    int            return_val;
    RO64_cb*       ro64_info;
    RO64_module*   modulename_p;
    RO64_function* funname_p;

    ro64_info = malloc(sizeof(RO64_cb) + MLENGTH + FLENGTH + 8);
    ro64_info->version = 1;
    ro64_info->flags = 0xE0000000;
    ro64_info->off_module = sizeof(RO64_cb);
    ro64_info->off_func = ro64_info->off_module + MLENGTH + 4;
    ro64_info->off_args = 0;

    modulename_p = (RO64_module*)((char*)(ro64_info)+ro64_info->off_module);
    funname_p = (RO64_function*)((char*)(ro64_info)+ro64_info->off_func);

    strcpy(modulename_p->module_name, "CELQCLEE");
    modulename_p->length = 8;
    strcpy(funname_p->function_name, "CALLEE64");
    funname_p->length = 8;

    printf("Calling to CEL4RO64\n");
    CEL4RO64((void*)ro64_info);
    if(ro64_info->retcode == 0){
        return_val = *((int*)((char*)(ro64_info)+68));
        printf("After calling to CEL4RO64, back to Amode31 Env, return val = %d\n", return_val);
    }else{
        printf("CEL4RO64 failed, back to Amode31 Env, retcode = %d\n", ro64_info->retcode);
    }

    return 0;
}
```

AMODE 64 DLL CELQCLEE:

```
#include <stdio.h>
#include <stdlib.h>

#define MLENGTH    8   /*length of module name string */
#define FLENGTH    8   /*length of function name string */

typedef void cel4ro31_cwi_func(void*);
 #define CEL4RO31                             \
   ((cel4ro31_cwi_func*)((char*)(*(int*)(((char*)(__gtca()))+1096))+8))

/* Fixed length structure RO31_CB */
typedef struct RO31_cb{
    unsigned int version;
    unsigned int length;
    unsigned int flags;
    unsigned int off_module;
    unsigned int off_func;
    unsigned int off_args;
    unsigned int dll_handle;
    unsigned int func_desc;
    unsigned int gr_buffer[5];
    unsigned int retcode;
}RO31_cb;

/* Module name to load */
typedef struct RO31_module{
```

```
    int length;
    char module_name[MLENGTH];
}RO31_module;

/* Function name to query */
typedef struct RO31_function{
    int length;
    char function_name[FLENGTH];
}RO31_function;


int CALLEE64(){
    RO31_cb*           RO31_info;
    RO31_module*       RO31_module_p;
    RO31_function*     RO31_func_p;

    printf("(%d)In AMODE 64 LE environment.\n");
    /* Get below the bar storage */
    RO31_info = __malloc31(sizeof(RO31_cb) + MLENGTH + FLENGTH + 8);

    /* Init the RO31_INFO */
    (*RO31_info).version = 1;
    (*RO31_info).flags = 0xE0000000;
    (*RO31_info).off_module = sizeof(RO31_cb);
    (*RO31_info).off_func = (*RO31_info).off_module + MLENGTH + 4;
    (*RO31_info).off_args = 0;
    (*RO31_info).length = sizeof(RO31_cb) + MLENGTH + FLENGTH + 8;

    RO31_module_p = (RO31_module*)(((int)RO31_info)+(*RO31_info).off_module);
    RO31_func_p = (RO31_function*)(((int)RO31_info)+(*RO31_info).off_func);

    RO31_module_p->length   = 8;
    RO31_func_p->length     = 8;

    memcpy((*RO31_module_p).module_name,"CELECLEE",8);
    memcpy((*RO31_func_p).function_name,"CALLEE31",8);

    printf("(%d)Call cel4ro31 to run target program in AMODE 31\n");

    /* Call CEL4RO31()      */
    CEL4RO31((void*)RO31_info);

    if(RO31_info->retcode == 0){
        printf("After calling to CEL4RO31, back to Amode 64 Env.\n");
    }else{
        printf("CEL4RO31 failed, back to Amode31 Env, retcode = %d\n", RO31_info->retcode);
    }
    return 0;
}
```

AMODE 31 DLL CELECLEE:

```
#include <stdio.h>

int CALLEE31(){
    int i = 0;
    printf("In Amode31 callee.\n");
    i = 1/i;
    return 0;
}
```

Example of formatted output from LEDATA VERBEXIT:

```
...
[1]    SW3164:  26577000
+000000  EYE:SWTH    SW_FLAG:A0000000        SW_TOP_TR31:2654A728
+00000C  SW_CAA31:25D161D8       SW_TOP_TR64:00000050 082FF2E0
+000018  SW_CAA64:00000050 00108398    SW_STATUS:00000000
+000028  SW_PIPI_ENP:00000000 268A6890       SW_RO31DEPTH:00000000
+000038  SW_IPB1_LEN:00000000    SW_IPB1_ADDR:00000000
+000040  SW_IPB2_LEN:00000000    SW_IPB2_ADDR:00000000
+000048  SW_IPB3_LEN:00000000    SW_IPB3_ADDR:00000000
+000050  SW_IPB4_LEN:00000000    SW_IPB4_ADDR:00000000
+000058  SW_IPB5_LEN:00000000    SW_IPB5_ADDR:00000000
+000060  SW_IPB6_LEN:00000000    SW_IPB6_ADDR:00000000
+000068  SW_IPB7_LEN:00000000    SW_IPB7_ADDR:00000000
+000070  SW_IPB8_LEN:00000000    SW_IPB8_ADDR:00000000
```

```
+000078  SW_IPB9_LEN:00000000    SW_IPB9_ADDR:00000000
+000080  SW_IPB10_LEN:00000000   SW_IPB10_ADDR:00000000
```

Sections of the AMODE 31 and AMODE 64 interoperability report of the Language Environment LEDATA VERBEXIT formatted output

Table 69 on page 474 lists the sections of the LEDATA VERBEXIT output, which appear independently of the Language Environment-conforming languages used.

Table 69. Contents of the LEDATA VERBEXIT formatted output

Section number and heading	Contents
[1] SW3164	Formats the contents of the Language Environment SW3164 control block. For a description of the fields in the SW3164, see Language Environment vendor interfaces for AMODE 31 and AMODE 64 interoperability in *z/OS Language Environment Vendor Interfaces*.

Appendix A. Diagnosing problems with Language Environment

This section provides information for diagnosing problems in the Language Environment product. It helps you determine if a correction for a product failure similar to yours has been previously documented. If the problem has not been previously reported, it tells you how to open a problem management record (PMR) to report the problem to IBM, and if the problem is with an IBM product, what documentation you need for an Authorized Program Analysis Report (APAR).

Diagnosis checklist

Step through each of the items in the diagnosis checklist below to see if they apply to your problem. The checklist is designed to either solve your problem or help you gather the diagnostic information required for determining the source of the error. It can also help you confirm that the suspected failure is not a user error; that is, it was not caused by incorrect usage of the Language Environment product or by an error in the logic of the routine.

1. If your failing application contains programs that were changed since they last ran successfully, review the output of the compile or assembly (listings) for any unresolved errors.
2. If there have not been any changes in your applications, check the output (job or console logs, CICS transient (CESE) queues) for any messages from the failing run.
3. Check the message prefix to identify the system or subsystem that issued the message. This can help you determine the cause of the problem. Following are some of the prefixes and their respective origins.

   EDC
   The prefix for C/C++ messages. The following series of messages are from the C/C++ runtime component of Language Environment: 5000 (except for 5500, which are from the DSECT utility), 6000, and 7000.

   IGZ
   The prefix for messages from the COBOL runtime component of Language Environment.

   FOR
   The prefix for messages from the Fortran runtime component of Language Environment.

   IBM
   The prefix for messages from the PL/I runtime component of Language Environment.

   CEE
   The prefix for messages from the common runtime component of Language Environment.

4. For any messages received, check for recommendations in the "Programmer Response" sections of the messages in this information.
5. Verify that abends are caused by product failures and not by program errors. See the appropriate chapters in this manual for a list of Language Environment-related abend codes.
6. Your installation may have received an IBM Program Temporary Fix (PTF) for the problem. Verify that you have received all issued PTFs and have installed them, so that your installation is at the most current maintenance level.
7. The preventive service planning (PSP) bucket, an online database available to IBM customers through IBM service channels, gives information about product installation problems and other problems. Check to see whether it contains information related to your problem.
8. Narrow the source of the error.

   - If a Language Environment dump is available, locate the traceback in the Language Environment dump for the source of the problem.

- For AMODE 64 applications, IBM recommends that you use the IPCS Verbexit lEDATA with the CEEDUMP option to format the traceback. Check the traceback for the source of the problem. For information on how to generate and use a Language Environment or system dump to isolate the cause of the error, see Chapter 3, “Using Language Environment debugging facilities,” on page 33 or Chapter 12, “Using Language Environment AMODE 64 debugging facilities,” on page 339.
- Alternatively, in a non-XPLINK environment, you can follow the save area chain to find out the name of the failing module and whether IBM owns it. For information on finding the routine name, see “Locating the name of the failing routine for a non-XPLINK application” on page 476.

9. After you identify the failure, consider writing a small test case that re-creates the problem. The test case could help you determine whether the error is in a user routine or in the Language Environment product. Do not make the test case larger than 75 lines of code. The test case is not required, but it could expedite the process of finding the problem.

   If the error is not a Language Environment failure, see the diagnosis procedures for the product that failed.
10. Record the conditions and options in effect at the time the problem occurred. Compile your program with the appropriate options to obtain an assembler listing and data map. If possible, obtain the binder or linkage editor output listing. Note any changes from the previous successful compilation or run. For an explanation of compiler options, see the compiler-specific programming guide.
11. If you are experiencing a no-response problem, try to force a dump. For example, CANCEL the program with the dump option.
12. Record the sequence of events that led to the error condition and any related programs or files. It is also helpful to record the service level of the compiler associated with the failing program.

Locating the name of the failing routine for a non-XPLINK application

If a system dump is taken, follow the save area chain to find out the name of the failing routine and whether IBM owns it. Following are the procedures for locating the name of the failing routine, which is the primary entry point name.

1. Find the entry point associated with the current save area. The entry point address (EPA), located in the previous save area at displacement X'10', decimal 16, points to it.
2. Determine the entry point type, of which there are four:

Entry point type is...	If...
Language Environment conforming	The entry point plus 4 is X'00C3C5C5'.
Language Environment conforming OPLINK	The entry point plus 4 is X'01C3C5C5'. OPLINK linkage conventions are used.
C/C++	The entry point plus 5 is X'CE'.
Nonconforming	The entry point is none of the above. Nonconforming entry points are for routines that follow the linking convention in which the name is at the beginning of the routine. X'47F0Fxxx' is the instruction to branch around the routine name.

   For routines with Language Environment-conforming and C/C++ entry points, Language Environment provides program prolog areas (PPAs). PPA1 contains the entry point name and the address of the PPA2; PPA2 contains pointers to the timestamp, where release level keyword information is found, and to the PPA1 associated with the primary entry point of the routine.

   - If the entry point type of the failing routine is Language Environment-conforming, go to step “3” on page 477.
   - If the entry point type is C/C++, go to step “5” on page 477.
   - If the entry point type is nonconforming, go to step “6” on page 478.

3. If the entry point type is Language Environment-conforming, find the entry point name for the Language Environment or COBOL program.
   a. Use an offset of X'C' from the entry point to locate the address of the PPA1.
   b. In the PPA1, locate the offset to the length of the name. If OPLINK, then multiply the offset by 2 to locate the actual offset to the length of the name.

      Note: Enterprise COBOL V5.1 and later releases use OPLINK.
   c. Add this offset to the PPA1 address to find the halfword containing the length of the name, followed by the entry point name.

      The entry point name appears in EBCDIC, with the translated version in the right-hand margin of the system dump.
4. Find the Language Environment or COBOL program name.
   a. Find the address of PPA2 at X'04' from the start of PPA1. For Enterprise COBOL V5.1 or later releases, find a signed offset at X'04' from the start of PPA1, then add this offset to the entry point address to obtain the address of PPA2.
   b. Find the address of the compilation unit's primary entry point at X'10' in the PPA2. For Enterprise COBOL V5.1 and later releases, find a signed offset at X'10' in the PPA2, then add this offset to the address of PPA2 to obtain the compilation unit's primary entry point.
   c. Find the entry point name associated with the primary entry point as described above. The primary entry point name is the routine name.

For more information about	See
The non-XPLINK Language Environment-conforming PPA1 and PPA2	Program flags - PPA1 offset X'02' in *z/OS Language Environment Vendor Interfaces* Member identifiers — PPA2 offsets X'00' and X'01' in *z/OS Language Environment Vendor Interfaces*
The XPLINK Language Environment-conforming PPA1, and the XPLINK PPA1 optional area fields	PPA1 in support of XPLINK in *z/OS Language Environment Vendor Interfaces* PPA1 Optional Area Fields in *z/OS Language Environment Vendor Interfaces*
The non-XPLINK Language Environment PPA2	Member identifiers — PPA2 offsets X'00' and X'01' in *z/OS Language Environment Vendor Interfaces*
The Language Environment PPA2: Compile Unit Block for XPLINK	PPA2 in support of XPLINK in *z/OS Language Environment Vendor Interfaces*
The PPA2 timestamp and version information	Timestamp and Version in *z/OS Language Environment Vendor Interfaces*

5. If the entry point type is C/C++, find the C/C++ routine name.
   a. Use the entry point plus 4 to locate the offset to the entry point name in the PPA1 (see Figure 269 on page 478).
   b. Use this offset to find the length-of-name byte followed by the routine name.

      The routine name appears in EBCDIC, with the translated version in the right-hand margin.

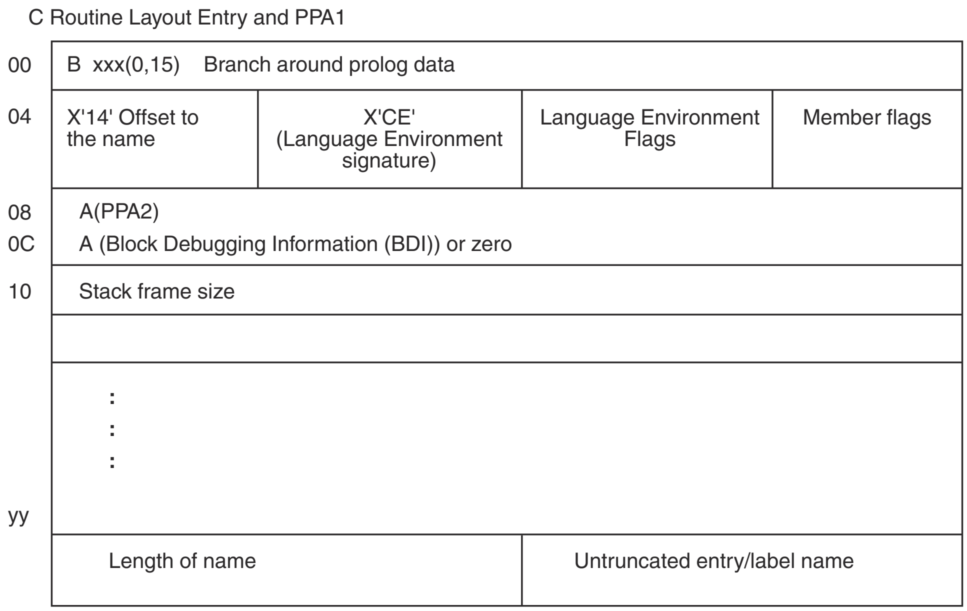


Figure 269. C PPA1

6. If the entry point type is nonconforming, find the PL/I routine name.

   a. Find the one byte length immediately preceding the entry point. This is the length of the routine name.

   b. Go back the number of bytes specified in the name length. This is the beginning of the routine name.

7. If the entry point type is nonconforming, find the name of the routine other than PL/I.

   a. Use the entry point plus 4 as the location of the entry point name.

   b. Use the next byte as the length of the name. The name directly follows the length of name byte. The entry point name appears in EBCDIC with the translated version in the right-hand margin.

Figure 270 on page 478 shows a nonconforming entry point type. Nonconforming entry points that can appear do not necessarily follow this linking convention. The location of data in these save areas can be unpredictable.

```
020000  =  47F0F00C  06D3C9E2  E3C9E300  90ECD00C  E0B |.00..LISTIT.....|
020010  =  18CF41B0  C29850BD  000850DB  000418DB      |....Bq&...&.....|
020020  =  4510C052  E3E8D7D3  C9D54040  01020034      |....TYPLIN  ....|
020030  =  C200001E  C5D5E3C5  D940D5E4  D4C2C5D9      |B...ENTER NUMBER|
020040  =  40D6C640  D9C5C3D6  D9C4E240  D6D940C1      | OF RECORDS OR A|
020050  =  D3D30ACA  00020058  4510C06C  E6C1C9E3      |LL.........%WAIT|
020060  =  D9C44040  010202F0  E4000000  0ACA0002      |RD  ...0U.......|
```

Figure 270. Nonconforming entry point type with sample dump

Searching the IBM Software Support Database

Failures in the Language Environment product can be described through the use of keywords. A keyword is a descriptive word or abbreviation assigned to describe one aspect of a product failure. A set of keywords, called a keyword string, describes the failure in detail. You can use a keyword or keyword string as a search argument against an IBM software support database, such as the Service Information Search (SIS). The database contains keyword and text information describing all current problems reported through APARs and associated PTFs. IBM Support Center personnel have access to the software support database and are responsible for storing and retrieving the information. Using keywords or a keyword string, they will search the database to retrieve records that describe similar known problems.

If you have IBMLink or some other connection to the IBM databases, you can do your own search for previously recorded product failures before calling the IBM Support Center.

If your keyword or keyword string matches an entry in the software support database, the search may yield a more complete description of the problem and possibly identify a correction or circumvention. Such a search may yield several matches to previously reported problems. Review each error description carefully to determine if the problem description in the database matches the failure.

If a match is not found, go to "Preparing documentation for an authorized program analysis report (APAR)" on page 479.

Preparing documentation for an authorized program analysis report (APAR)

This section provides an overview of how to prepare documentation if a problem arises. For more information, see the Software Support Handbook (www.ibm.com/support/customercare/sas/f/handbook/home.html).

Follow these steps before you prepare documentation for an APAR:

- Eliminated user errors as a possible cause of the problem.
- Followed the diagnostic procedures.
- You or your local IBM Support Center has been unsuccessful with the keyword search.

After you meet these criteria, follow these instructions:

1. Report the problem to IBM.

   If you have not already done so, report the problem to IBM by opening a problem management record (PMR).

   If you have IBMLink or some other connection to IBM databases, you can open a PMR yourself. Or, the IBM Software Support Center can open the PMR after they consult with you on the phone. The PMR is used to document your problem and to record the work that the Support Center does on the problem. Be prepared to supply the following information:

   - Customer number
   - PMR number
   - Operating system
   - Operating system release level
   - Your current Language Environment maintenance level (PTF list and list of APAR fixes applied)
   - Keyword strings that you used to search the IBM software support database
   - Processor number (model and serial)
   - A description of how reproducible the error is. Can it be reproduced each time? Can it be reproduced only sometimes? Have you been unable to reproduce it? Supply source files, test cases, macros, subroutines, and input files required to re-create the problem. Test cases are not required, but can often speed the response time for your problem.

   If the IBM Support Center concludes that the problem that is described in the PMR is a problem with the Language Environment product, they will work with you to open an APAR, so the problem can be fixed.
2. Provide APAR documentation. When you submit an APAR, you will need to supply information that describes the failure. Table 70 on page 480 describes how to produce documentation that is required for submission with the APAR.

Table 70. Problem resolution documentation requirements

Item	Materials required	How to obtain materials
1	Machine-readable source program, including macros, subroutines, input files, and any other data that might help to reproduce the problem.	IBM-supplied system utility program
2	Compiler listings: • Source listing • Object listing • Storage map • Traceback • Cross-reference listing • JCL listing and linkage editor listing • Assembler-language expansion	Use appropriate compiler options
3	Dumps • Language Environment dump • System dump	See instructions in Chapter 3, "Using Language Environment debugging facilities," on page 33 (as directed by IBM support personnel).
4	Partition/region size/virtual storage size	
5	List of applied PTFs	System programmer
6	Operating instructions or console log	Application programmer
7	JCL statements that are used to invoke and run the routine, including all runtime options, in machine-readable form	Application programmer
8	System output that is associated with the MSGFILE runtime option.	Specify MSGFILE(SYSOUT)
9	Contents of the applicable catalog	
10	A hardcopy log of the events leading up to the failure.	Print each display.

3. Submit the APAR documentation.

   When you submit material for an APAR to IBM, carefully pack and clearly identify any media containing source programs, job stream data, interactive environment information, data sets, or libraries.

   All magnetic media that is submitted must have the following information attached and visible:

   - The APAR number that is assigned by IBM.
   - A list of data sets on the tape (such as source program, JCL, data).
   - A description of how the tape was made, including the following information:
     - The exact JCL listing or the list of commands that are used to produce the machine-readable source. Include the block size, LRECL, and format of each file. If the file was unloaded from a partitioned data set, include the block size, LRECL, and number of directory blocks in the original data set.
     - Labeling information that is used for the volume and its data sets.
     - The recording mode and density.
     - The name of the utility program that created each data set.
     - The record format and block size that is used for each data set.

   Any printed materials must show the corresponding APAR number.

The IBM service personnel will inform you of the mailing address of the service center nearest you.

If an electronic link with IBM Service is available, use this link to send diagnostic information to IBM Service.

After the APAR is opened and the fix is produced, the description of the problem and the fix will be in the software support database in SIS, accessible through ServiceLink.

Appendix B. Accessibility

Accessible publications for this product are offered through IBM Documentation (www.ibm.com/docs/en/zos).

If you experience difficulty with the accessibility of any z/OS information, send a detailed message to the Contact the z/OS team web page (www.ibm.com/systems/campaignmail/z/zos/contact_z) or use the following mailing address.

IBM Corporation
Attention: MHVRCFS Reader Comments
Department H6MA, Building 707
2455 South Road
Poughkeepsie, NY 12601-5400
United States

Notices

This information was developed for products and services that are offered in the USA or elsewhere.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not grant you any license to these patents. You can send license inquiries, in writing, to:

IBM Director of Licensing
IBM Corporation
North Castle Drive, MD-NC119
Armonk, NY 10504-1785
United States of America

For license inquiries regarding double-byte character set (DBCS) information, contact the IBM Intellectual Property Department in your country or send inquiries, in writing, to:

Intellectual Property Licensing
Legal and Intellectual Property Law
IBM Japan Ltd.
19-21, Nihonbashi-Hakozakicho, Chuo-ku
Tokyo 103-8510, Japan

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law: INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

This information could include missing, incorrect, or broken hyperlinks. Hyperlinks are maintained in only the HTML plug-in output for IBM Documentation. Use of hyperlinks in other output formats of this information is at your own risk.

Any references in this information to non-IBM websites are provided for convenience only and do not in any manner serve as an endorsement of those websites. The materials at those websites are not part of the materials for this IBM product and use of those websites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Licensees of this program who wish to have information about it for the purpose of enabling: (i) the exchange of information between independently created programs and other programs (including this one) and (ii) the mutual use of the information which has been exchanged, should contact:

IBM Corporation
Site Counsel
2455 South Road

Poughkeepsie, NY 12601-5400
USA

Such information may be available, subject to appropriate terms and conditions, including in some cases, payment of a fee.

The licensed program described in this document and all licensed material available for it are provided by IBM under terms of the IBM Customer Agreement, IBM International Program License Agreement or any equivalent agreement between us.

Any performance data contained herein was determined in a controlled environment. Therefore, the results obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurements may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

All statements regarding IBM's future direction or intent are subject to change or withdrawal without notice, and represent goals and objectives only.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs. The sample programs are provided "AS IS", without warranty of any kind. IBM shall not be liable for any damages arising out of your use of the sample programs.

Terms and conditions for product documentation

Permissions for the use of these publications are granted subject to the following terms and conditions.

Applicability

These terms and conditions are in addition to any terms of use for the IBM website.

Personal use

You may reproduce these publications for your personal, noncommercial use provided that all proprietary notices are preserved. You may not distribute, display or make derivative work of these publications, or any portion thereof, without the express consent of IBM.

Commercial use

You may reproduce, distribute and display these publications solely within your enterprise provided that all proprietary notices are preserved. You may not make derivative works of these publications, or reproduce, distribute or display these publications or any portion thereof outside your enterprise, without the express consent of IBM.

Rights

Except as expressly granted in this permission, no other permissions, licenses or rights are granted, either express or implied, to the publications or any information, data, software or other intellectual property contained therein.

IBM reserves the right to withdraw the permissions granted herein whenever, in its discretion, the use of the publications is detrimental to its interest or, as determined by IBM, the above instructions are not being properly followed.

You may not download, export or re-export this information except in full compliance with all applicable laws and regulations, including all United States export laws and regulations.

IBM MAKES NO GUARANTEE ABOUT THE CONTENT OF THESE PUBLICATIONS. THE PUBLICATIONS ARE PROVIDED "AS-IS" AND WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT, AND FITNESS FOR A PARTICULAR PURPOSE.

IBM Online Privacy Statement

IBM Software products, including software as a service solutions, ("Software Offerings") may use cookies or other technologies to collect product usage information, to help improve the end user experience, to tailor interactions with the end user, or for other purposes. In many cases no personally identifiable information is collected by the Software Offerings. Some of our Software Offerings can help enable you to collect personally identifiable information. If this Software Offering uses cookies to collect personally identifiable information, specific information about this offering's use of cookies is set forth below.

Depending upon the configurations deployed, this Software Offering may use session cookies that collect each user's name, email address, phone number, or other personally identifiable information for purposes of enhanced user usability and single sign-on configuration. These cookies can be disabled, but disabling them will also eliminate the functionality they enable.

If the configurations deployed for this Software Offering provide you as customer the ability to collect personally identifiable information from end users via cookies and other technologies, you should seek your own legal advice about any laws applicable to such data collection, including any requirements for notice and consent.

For more information about the use of various technologies, including cookies, for these purposes, see IBM's Privacy Policy at ibm.com®/privacy and IBM's Online Privacy Statement at ibm.com/privacy/details in the section entitled "Cookies, Web Beacons and Other Technologies," and the "IBM Software Products and Software-as-a-Service Privacy Statement" at ibm.com/software/info/product-privacy.

Policy for unsupported hardware

Various z/OS elements, such as DFSMSdfp, JES2, JES3, and MVS, contain code that supports specific hardware servers or devices. In some cases, this device-related element support remains in the product even after the hardware devices pass their announced End of Service date. z/OS may continue to service element code; however, it will not provide service related to unsupported hardware devices. Software problems related to these devices will not be accepted for service, and current service activity will cease if a problem is determined to be associated with out-of-support devices. In such cases, fixes will not be issued.

Minimum supported hardware

The minimum supported hardware for z/OS releases identified in z/OS announcements can subsequently change when service for particular servers or devices is withdrawn. Likewise, the levels of other software products supported on a particular release of z/OS are subject to the service support lifecycle of those products. Therefore, z/OS and its product publications (for example, panels, samples, messages, and product documentation) can include references to hardware and software that is no longer supported.

- For information about software support lifecycle, see: IBM Lifecycle Support for z/OS (www.ibm.com/software/support/systemsz/lifecycle)
- For information about currently-supported IBM hardware, contact your IBM representative.

Programming interface information

This publication documents information NOT intended to be used as a Programming Interface of Language Environment in z/OS.

Trademarks

Index

Special Characters

Numerics

A

B

C

D

E

F

M

N

O

P

Q

R

S

T

U

V

W

X

Z

Product Number: 5650-ZOS

GA32-0908-50