z/OS

IBM

Introduction and Release Guide

Version 2 Release 2

Contents

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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 V2R2 Information Roadmap*.

To find the complete z/OS® library, go to IBM Knowledge Center (http://www.ibm.com/support/knowledgecenter/SSLTBW/welcome).

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.

Summary of changes for z/OS Version 2 Release 2 (V2R2) as updated June 2016

The following changes are made for z/OS V2R2 as updated June 2016.

New

- SMP/E for z/OS new functions to consider:
  - "SMP/E ZONEMERGE enhancements" on page 103
- z/OS System Display and Search Facility (SDSF) new functions to consider:
  - "New panels for system resources and data sets" on page 92.
- z/OS Security Server (RACF) new functions to consider:
  - "IBM Multi-Factor Authentication for z/OS" on page 96.

Summary of changes for z/OS Version 2 Release 2 (V2R2) as updated March 2016

The following changes are made for z/OS V2R2 as updated March 2016.

New

- z/OS UNIX System Services has new functions to consider:
  - "Limiting access to the Write an SMF Record function" on page 109.
- XES List services IXLLIST, IXLLSTE, and IXLLSTC are updated to return both the current in-use number of entries and current in-use elements for a specific list:
  - "Cross-System Coupling Facility (XCF) enhancements for z/OS V2R2" on page 21.

Summary of changes for z/OS Version 2 Release 2 (V2R2) as updated December 2015

The following changes are made for z/OS V2R2 as updated December 2015.

New

- z/OS Network File System (NFS) has new functions to consider:
  - "z/OS NFS Client AMODE64 or LP64" on page 83
  - "z/OS NFS Client mount option for UNSTABLE NFSv4 write" on page 83
  - "Cache for UID/GID name mapping" on page 83
  - "z/OS NFS BPXMTEXT support" on page 83
  - "z/OS NFS Server Ctrace without MODESET SVT" on page 83
  - "z/OS NFS Server persistent filehandle" on page 83
  - "z/OS NFS crosscheck Site Attribute vs Checklist" on page 84

– "Add timestamp to error logs and capability to retain latest error log data" on page 84
  – "Display NFS version 4 domain" on page 84
- BCP (MVS™) has new functions to consider:
  – "Prevent access to LOGR couple data sets" on page 16
  – "Pause on Pause Element Tokens (PETs)" on page 15
  – "Data set optimization configuration" on page 3
  – "Improving region management" on page 18
  – "Manage large SDUMPS" on page 14
- WLM has new functions to consider:
  – "WLM considerations for V2R2" on page 20
- z/OS OpenSSH has new functions to consider:
  – "Support for Kerberos through General Security Service - API" on page 108
  – "zEnterprise Data Compression implementation" on page 108
  – "Support for FIPS 140-2 mode" on page 108

Summary of changes for z/OS V2R2 Introduction and Release Guide

The following changes are made for z/OS Version 2 Release 2 (V2R2).

New

- New system level functions to consider, such as new base elements, optional features, or interfaces are listed in "z/OS system-level new functions to consider" on page 1. The changes include z/OSMF, IBM Knowledge Center for z/OS (customer installation version), z/OS OpenSSH, new publications, and more.
- BCP (MVS) has new Consoles functions to consider. For details, see "Security enhancements for HMCS, SMCS, and MCS consoles" on page 6.
- BCP (MVS) has new generic tracker functions to consider. For details, see "Data persistence and simplified generic tracking services" on page 9.
- BCP (MVS) has new service aids functions to consider. For details, see "Deallocate LOGREC data sets without a system restart" on page 14.
- BCP (MVS) has new SMF functions to consider. For details, see "System Management Facility (SMF) considerations" on page 18.
- BCP (MVS) has new Sysplex functions to consider. For details, see "Cross-System Coupling Facility (XCF) enhancements for z/OS V2R2" on page 21.
- BCP (MVS) has new system logger functions to consider. For details, see "Allocate offload data sets" on page 17.
- Cryptographic Services has new functions to consider.
  – "Enable PKI Services to sign the Online Certificate Status Protocol (OCSP) responses" on page 29
  – "PKI Services 64 bit support" on page 30
  – "PKI Services support NxM authorization" on page 30
  – "System SSL: Cache session identification" on page 30
  – "System SSL: OCSP support and CRL updates" on page 30
  – "System SSL: PKCS #12 certificate store" on page 31
- DFSMS has new functions to consider. For details, see "DFSMS new functions to consider" on page 37.
- Distributed File Service has new functions to consider for zFS:

- – "Improved monitoring of zFS performance" on page 57
- – "Providing support for 64-bit addressing (AMODE64)" on page 57
- Infoprint Server has new functions to consider. For details, see "Infoprint Server new functions to consider" on page 64.
- JES2 has new functions to consider. For details, see "JES2 new functions to consider" on page 71.
- JES3 has new functions to consider. For details, see "JES3 new functions to consider" on page 75.
- IBM Tivoli Directory Server for z/OS has new functions to consider.
  - – "Replication of password policy operational attributes from read-only replica to supplier server" on page 61
  - – "Dynamic group performance and scalability improvements" on page 62
  - – "Activity log enhancements" on page 62
  - – "Server compatibility level upgrade with no downtime" on page 62
- Language Environment has new functions to consider:
  - – "Providing support for delayed debug" on page 78
  - – "Reflecting the WORKING-STORAGE allocation in the storage report produced by Language Environment" on page 78
- Resource Measurement Facility (RMF) new functions to consider:
  - – "New features, functions, and support for z/OS V2R2" on page 85
- Security Server (RACF) new functions to consider:
  - – "Remote sharing enhancements to allow dynamic MAIN switching" on page 96
  - – "Remote sharing enhancements to deny inbound requests" on page 97
  - – "R_admin callable service enhancement to extract RACF remote sharing configuration data" on page 97
  - – "RACF Read-Only Auditor" on page 97
  - – "UNIX Search Authority" on page 98
  - – "RACF RACDCERT granular certificate administration support." on page 98
  - – "Network Authentication Services (NAS) support for Public Key Cryptography for Initial Authentication (PKINIT)" on page 98
  - – "RACF R_datalib enhancement" on page 99
  - – "Enhanced RACF password security" on page 99
  - – "RACF Health Checks" on page 99
- TSO/E has new functions to consider. For details, see "TSO/E new functions to consider" on page 104.
- z/OS UNIX has new functions to consider.
  - – "Enhancements for the kernel and LFS: 64-bit addressing mode and above-the bar stack storage" on page 109
  - – "Increased thread limit in the kernel with the KERNELSTACKS(ABOVE) parmlib option" on page 109
  - – "Providing support for task-level security" on page 109

Changed

- Changed system level functions to consider are listed in "z/OS system-level new functions to consider" on page 1.
  - – HTTP Server for z/OS

- z/OS Softcopy Librarian is enhanced to manage and update the content for IBM Knowledge Center for z/OS.
- Changed optional feature descriptions for Infoprint Server are listed in Chapter 4, "z/OS optional features descriptions," on page 129.

Deleted

All references to HTTP Server (powered by Domino) are removed from the z/OS library. For details, see *z/OS Migration*

Summary of changes as updated February 2015

The summary of changes that are made to z/OS Version 2 Release 1 (V2R1) Introduction and Release Guide, as updated February 2015, in support of IBM z Systems™.

This document contains information that is previously presented in GA32-0887-01, which supports z/OS Version 2 Release 1 (V2R1).

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

New

Multiple elements have new function.
- Cryptographic Services has new functions to consider.
  - "ICSF: AES counter mode encryption support" on page 31
  - "ICSF: CPACF RNG support" on page 31
  - "ICSF: Format preserving encryption" on page 31
  - "ICSF: KDS key archiving" on page 32
  - "ICSF: Key material validity" on page 32
  - "ICSF: New functionality in the Crypto Express5" on page 32
  - "ICSF: Support architecture for greater than 16 domains" on page 33
  - "ICSF: UDX exit support" on page 33
- Language Environment added support for vector registers. See "Providing support for SIMD" on page 80.
- MVS Supervisor added new function for: "Multithreading support" on page 16.
- The z/OS UNIX ptrace callable service supports the reading and writing of vector registers. See "Debugging vector registers" on page 110.
- For dbx, support was added for machine-level debugging of vector-enabled programs. See "Added dbx support of vector-enabled programs" on page 110.
- "Resource Measurement Facility (RMF) new functions to consider" on page 85 lists the new RMF functions.
- Information about the new support for "z/OS Client Web Enablement Toolkit" on page 3 is added to the system level information.

Changed

Multiple elements are changed.
- Communications Server has new functions to consider.

Chapter 1. What is new in z/OS (V2R1 - V2R2)

This topic lists the major enhancements in z/OS that have been introduced in z/OS V2R2 and z/OS V2R1. Some enhancements require customization actions before you can use them. This topic ensures you can locate the documents that describe the customization actions.

Note:
The document lists for each function are not exhaustive; they generally omit links to purely reference books for system messages, system codes, data areas, and the like.

Elements and features with no enhancements in V2R2

The following z/OS elements and features do not have usage information for z/OS V2R2:
- Alternate Library for REXX
- BDT
- BDT File-to-File
- BDT SNA NJE
- BookManager® BUILD
- BookManager READ
- EREP
- ESCON Director Support
- FFST™
- GDDM
- GDDM-PGF
- GDDM-REXX
- High Level Assembler (HLASM)
- High Level Assembler (HLASM) Toolkit
- IBM HTTP Server
- MICR/OCR
- OSA/SF
- TIOC
- 3270 PC File Transfer Program

z/OS system-level new functions to consider

This topic describes z/OS system-level enhancements in V2R2. Also see the topic about "Predictive Failure Analysis considerations" on page 12.

z/OS Management Facility (z/OSMF): base element

Description:
In z/OS V2R2, z/OS Management Facility (z/OSMF) is a base element of z/OS.

Introduced
z/OS V2R2

Reference information:
- See the topic about ""z/OS Management Facility (z/OSMF)" on page 127"
- *z/OS Planning for Installation*

* *z/OS Migration*

z/OS OpenSSH: base element

Description:
> z/OS V2R2 includes z/OS OpenSSH, a base element which provides secure encryption for both remote login and file transfer.

Introduced
> z/OS V2R2

Reference information:
* "z/OS OpenSSH" on page 127
* *z/OS V2R2 OpenSSH User's Guide*

IBM Knowledge Center for z/OS: optional feature

Description:
> z/OS V2R2 includes an SMP/E installable version of IBM Knowledge Center for z/OS. IBM Knowledge Center is the strategic framework for publishing all IBM product documentation on the Internet.

Introduced
> z/OS V2R2

Reference information:
* "IBM Knowledge Center for z/OS" on page 132
* *IBM Knowledge Center for z/OS Configuration and User Guide*

Component-specific diagnosis information

Description:
> There are several new topics containing component specific diagnosis information for z/OS including JES and XCF.

Introduced
> z/OS V2R2

Reference information:
> See the topic about " Diagnosing component specific problems" in *z/OS V2R2 Problem Management*.

This topic describes z/OS system-level enhancements in V2R1. Also see the topic about "Predictive Failure Analysis considerations" on page 12.

z/OS Font Collection: base element

Description:
> *z/OS Font Collection* is a new publication that describes a comprehensive set of fonts for IBM products that were traditionally ordered separately. The fonts include selected object fonts, AFP, and IBM Infoprint fonts.

Introduced
> z/OS V2R1

Reference information:
> See
* The topic about "z/OS Font Collection" on page 126.
* The new publication: *z/OS Font Collection*.
* *z/OS Migration*

Component-specific diagnosis information

Description:
> There are several new topics containing component specific diagnosis information for z/OS DFSMS.

Introduced
> z/OS V2R1

Reference information:
> See the topic about " Diagnosing component specific problems" in *z/OS V2R2 Problem Management*.

z/OS Client Web Enablement Toolkit

This topic describes new z/OS Client Web Enablement Toolkit function in z/OS V2R2:

The z/OS Client Web Enablement Toolkit
> Applications running in traditional z/OS environments may choose to play the client role of a RESTful web application and initiate a request to a web server residing on z/OS or any other platform supporting web applications. In z/OS Version Release 2, the new z/OS Client Web Enablement toolkit enables these applications to more easily participate in this client/server space by providing a built-in:
>
> - z/OS JSON parser to parse JSON text coming from any source and the ability to build new JSON text or add to existing JSON text.
> - z/OS HTTP/HTTPS protocol enabler using interfaces similar in nature to other industry-standard APIs.
>
> The intention of the toolkit is to enable traditional z/OS programs apart from a Java Virtual Machine (JVM) environment to have easy access to these types of services. Programs running as a batch job, as a started procedure or running in almost any address space on a z/OS system now have APIs that they can utilize in a similar manner to any standard z/OS APIs provided by the operating system. Furthermore, programs can invoke these APIs in the programming language of their choice. C/C++, COBOL, PL/I, and Assembler languages are fully supported.

When change was introduced:
> z/OS V2R2.

Reference information:
> *z/OS MVS Programming: Callable Services for High-Level Languages*

BCP (MVS) new functions to consider

This topic describes the new features and function in the base control program (BCP), also called MVS.

Allocation considerations

This topic describes new function for allocation and supervisor in z/OS.

Data set optimization configuration

Description:
> The new parmlib member IEFOPZxx contains statements that define the data set optimization configuration, and specifies which members are to be

processed (optimized). For example, this could provide a list of pairings of an old COBOL load library and the intended new load libraries (one for each desired architecture level).

The IEFOPZ system parameter is added. The SET IEFOPZ and DISPLAY IEFOPZ commands are added. The IEFOPZQ (query) service is added.

When change was introduced:
z/OS V2R2 with APAR OA47689 (PTF UA90982).

Reference information:
- *z/OS MVS Initialization and Tuning Reference*
- *z/OS MVS System Commands*
- *z/OS MVS System Management Facilities (SMF)*
- *z/OS MVS Programming: Authorized Assembler Services Reference EDT-IXG.*

Switch (CUP) Diagnostics

Description: With Switch (CUP) Diagnostics, a new fabric wide diagnostic command channel program is provided to enable z/OS to obtain fabric topology, collect diagnostic information such as performance data, determine the health of the fabric, generate a diagnostic log on the switch, and resolve problems in the fabric.

The diagnostic command is issued as a channel program to a special device called the control unit port (CUP) device, also called the switch or control device. The CUP device is simulated as a special firmware load on the switch that allows z/OS to issue channel programs to it. The CUP device is defined in z/OS as an actual device and brought online.

The control unit definition for the CUP device consists of one or more channel paths attached to the switch with a special destination port of FE. This destination port allows the switch to determine that the request is being routed to the CUP device, rather than a real destination port on the switch.

A switch device also provides an unsolicited unit check that indicates that one or more switches or ports in the fabric is operating at less than optimal capability, called a health summary unit check. This triggers z/OS to retrieve the diagnostic information from the switch to further diagnose the problem. The sense data identifies the source and destination ports to use for the query.

Use of the diagnostic command consists of the following changesin z/OS V2R1:
- Setting the diagnostic interval at device initialization.
- Enhance the D M=DEV command to display the path through the fabric and the health of the fabric and its components.
- Generate a Health Check that is initiated after an error or anomaly is detected, such as a command response time (CMR) or I/O rate discrepancy on a path, or when a diagnostic health check is generated by the switch.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS MVS System Commands*
- *z/OS MVS System Messages, Vol 7 (IEB-IEE)*
- *z/OS MVS System Messages, Vol 9 (IGF-IWM)*

SYSDSN ENQ Downgrade in JCL

Description: MVS Device Allocation has the responsibility of ensuring the integrity of data sets and devices. For data sets, it does this using a GRS ENQ for each data set. When the JCL coder requests DISP=OLD, DISP=NEW or DISP=MOD, Allocation requests an exclusive ENQ with major name SYSDSN and a minor name of the data set. If the JCL coder uses the other disposition, DISP=SHR, Allocation obtains the same ENQ, but with shared control.

Once obtained, the ENQ is not released until the last step in which it is used. So, for a job with five steps, if the first step codes a data set with DISP=NEW and then uses the data set again in step 5 with DISP=SHR, the ENQ is held for all five steps. Further, the ENQ's level of control, initially exclusive in step 1, is never changed, even though step 5 only needs shared control. In this way, Allocation ensures that the data set integrity is not compromised in any way until the job that needed exclusive control gives up the data set or ends. This is the behavior without the new DSENQSHR function.

In the same example but using the new DSENQSHR function, the SYSDSN ENQ would be downgraded from exclusive control to shared control after step 1 since exclusive control is no longer needed for the data set. This allows other jobs which attempt to allocate the data set to have access earlier than the legacy behavior. This parallelism will reduce the IEF099I/IEF861I/IEF863I messages which indicate that a particular job is waiting the data set.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS MVS System Codes*
- *z/OS MVS System Messages, Vol 8 (IEF-IGD)*
- *z/OS MVS JCL Reference*
- *z/OS MVS JCL User's Guide*

Validation of processor type via D M=CONFIG

Description: In z/OS V2.1, the DISPLAY MATRIX=CONFIG and CONFIG CPU commands allow you to validate that the active processors in a configuration are of the type (standard CP, zAAP, zIIP) and number that you expect.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS MVS System Commands*
- *z/OS MVS Initialization and Tuning Reference*

BCPii considerations

This topic describes new BCPii function in z/OS V2R2:
- **BCPii logging of "write" actions in SMF** - In z/OS Version 2 Release 2, z/OS BCPii now logs all successful HWISET and HWICMD API invocations in a new SMF record type. Both of these z/OS BCPii-supplied APIs can perform potentially disruptive actions to a CPC or image, or alter the configuration with updates to an activation profile. The logging of these actions now allows an installation to determine: which applications are making these changes; what the actual changes were; and the user ID associated with the execution of this application. An easy-to-use SMF formatter job is also provided to allow a customized SMF report to be generated without the need to compile a program.

When change was introduced: z/OS V2R2.

Reference information: *z/OS MVS Programming: Callable Services for High-Level Languages* and *z/OS MVS System Management Facilities (SMF)*.

This topic describes new BCPii function in z/OS V2R1:

- **BCPii APIs support applications using the REXX programming language** - Previously, z/OS BCPii APIs supported only applications that were using either the C or assembler programming languages. In z/OS Version 2 Release 1, BCPii provides a new REXX host command environment to allow REXX applications to easily use the BCPii APIs. The z/OS System REXX, TSO/E REXX, and independent software vendor (ISV) provided REXX programming environments are supported.
- **Minimized traffic to the support element (SE)** - Efficiencies are built into the BCPii code to reduce the time it takes to perform queries when multiple attributes are requested on HWIQUERY requests, as well as practically all HWILIST requests.

When change was introduced: z/OS V2R1.

Reference information: *z/OS MVS Programming: Callable Services for High-Level Languages*

Consoles considerations

This topic describes new consoles function in z/OS.

Security enhancements for HMCS, SMCS, and MCS consoles

Description: The following two new console security enhancements are provided:

- The ability to have a user automatically logged off from a console due to inactivity is introduced. A system programmer is able to specify in parmlib member CONSOLxx a timeout value (in minutes) that applies to HMCS, SMCS, or MCS consoles in the system. The consoles are automatically logged off when the timeout intervals are exceeded without any operator input. It is possible to set a specific value for each console. The console's timeout value can be dynamically altered using a VARY CN() command.

  Note: The timeout value is associated with a console name, not the user ID for the LOGON command.
- The ability to have a user concurrently logged on to multiple consoles in the sysplex at one time. This is accomplished by the security administrator defining a security profile, MVS.MULTIPLE.LOGON.CHECK, in the OPERCMDS class. If the profile does not exist, a user ID may only be logged on to one operator console. When the profile exists, an authorized user ID may be concurrently logged on to multiple operator consoles.

  Note: This profile affects all user IDs on the system, not any specific user ID.

When change was introduced: z/OS V2R2.

Reference information:
- *z/OS MVS System Commands*
- *z/OS MVS Initialization and Tuning Reference*
- *z/OS MVS Diagnosis: Reference*

Support for the Integrated 3270 Console

Description: In V2R1, support is added to allow the Hardware Management Console Integrated 3270 Console on System z® and zEnterprise® servers to be used as a z/OS console during and after IPL. This capability is intended to add another backup console and to allow z/OS LPARs to be operated without OSA-ICC 3270 connections when necessary.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS MVS System Commands*
- *z/OS MVS Initialization and Tuning Reference*
- *z/OS MVS Diagnosis: Reference*
- *z/OS MVS System Messages, Vol 4 (CBD-DMO)*
- *z/OS MVS System Messages, Vol 6 (GOS-IEA)*
- *z/OS MVS System Messages, Vol 7 (IEB-IEE)*
- *z/OS MVS Programming: Assembler Services Reference ABE-HSP*
- *z/OS MVS Planning: Operations*

Adding and removing MCS consoles

Description: In V2R1, support enables you to add and remove MCS consoles dynamically when they are being used in distributed mode.
- SET CON command processing is designed to process a CONSOLxx parmlib member and add new consoles, up to the system and sysplex limits for the maximum number of consoles.
- The SETCON command is designed to let you specify a console to be removed.

This support helps you to improve availability by removing another reason for system- and sysplex-wide IPLs.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS MVS System Commands*
- *z/OS MVS System Codes*
- *z/OS MVS Diagnosis: Tools and Service Aids*
- *z/OS MVS Diagnosis: Reference*
- *z/OS MVS System Management Facilities (SMF)*
- *z/OS MVS System Messages, Vol 4 (CBD-DMO)*
- *z/OS MVS System Messages, Vol 6 (GOS-IEA)*
- *IBM Health Checker for z/OS User's Guide*

Synchronous WTOR Processing

Description: There are two enhancements available for synchronous WTOR processing using the disabled consoles communication facility synchronous WTOR:

1. The first is designed to extend the Timed Auto Reply function introduced in z/OS V1.12 to allow it to respond to WTORs displayed through synchronous WTOR.

2. The second is intended to notify all locally attached MCS consoles about the current destination of a WTOR displayed by synchronous WTOR, in order to make it easier and faster to locate the console on which the response may be entered.

These changes are expected to make it easier to automate responses to critical WTORs and to help you respond to unautomated WTORs displayed through synchronous WTORs more quickly.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS MVS Diagnosis: Tools and Service Aids*
- *z/OS MVS System Messages, Vol 4 (CBD-DMO)*
- *z/OS MVS System Messages, Vol 6 (GOS-IEA)*
- *z/OS MVS System Messages, Vol 7 (IEB-IEE)*
- *z/OS MVS Planning: Operations*
- *z/OS Migration*

Specifying the TCB address of a task with FORCE TCB

Description: In V2R1, a new operand is available for the FORCE operator command, to enable you to specify the TCB address of a particular task for the system to terminate. This function is intended to be used to preserve system availability when a task holds resources required by other critical functions when there seems to be no other alternative to IPL.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS MVS System Commands*

Generic Tracker considerations

The following enhancements are made to Generic Tracker considerations.

Generic Tracker Facility introduction

Description: The intended purpose for Generic Tracker is to aid in migration, to allow current use of soon-to-be obsolete interfaces, and to assess exploitation of old and new functions.

The Generic Tracker Facility is a tracking facility that:
- provides a callable tracking service that users can instrument their code with:
  - the caller passes an event address and other related information to the service.
  - the service will resolve the event address to a program name and store it with the other information for later analysis.
- provides a callable "query" service that extracts previously stored track records and tracking facility information.
- provides operator commands to display and maintain tracking facility information and configuration details.
- supports parmlib members for easy reuse of tracking facility configuration statements.
- provides additional tools to aid in the use of the tracking facility and the information it stores.

The Generic Tracker Facility was introduced in z/OS V2R1 and replaces the Console Tracking Facility from previous releases. All Console Tracking Facility operator commands have been removed in V2R1 and only the callable macro service CNZTRKR is still supported. Any information CNZTRKR collects will be stored in the new tracking facility. IBM recommends you do not use the service

CNZTRKR anymore and whenever possible, replace existing CNZTRKR invocations with GTZTRACK invocations.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS MVS System Commands*
- *z/OS MVS System Codes*
- *z/OS MVS Programming: Assembler Services Reference ABE-HSP*
- *z/OS MVS Diagnosis: Tools and Service Aids*
- *z/OS MVS System Messages, Vol 6 (GOS-IEA)*
- *z/OS MVS Initialization and Tuning Reference*
- *z/OS Migration*

Data persistence and simplified generic tracking services

Description:
You can now use the generic tracker service GTZTRACK to provide persisted records of tracked events in new SMF type 117 records. With this function, you can retrieve historical information about tracked events whenever needed. Additionally, new REXX query interface GTZLQRY simplifies the use of generic tracking services.

Release introduced
z/OS V2R2

Reference information:

z/OS MVS Programming: Assembler Services Reference ABE-HSP

z/OS V2R2 MVS Data Areas Volume 2 (IAX - ISG)

z/OS MVS Diagnosis: Tools and Service Aids

z/OS MVS Initialization and Tuning Guide

z/OS MVS System Commands

z/OS MVS System Management Facilities (SMF)

z/OS MVS System Messages, Vol 6 (GOS-IEA)

z/OS Summary of Message and Interface Changes

Global Resource Serialization (GRS)

The following enhancements are made to Global Resource Serialization (GRS) considerations.

GRS FICON CTC Support

Description: Global Resource Serialization (GRS) has added GRS ring support of FICON® CTCs. The configuration recommendation is for GRS Star over GRS Ring and for GRS Ring environments to utilize XCF messaging, which already supports FICON. However, it is still valid to configure a GRS complex that extends outside of a sysplex or to configure a GRS complex with no sysplex at all.

When change was introduced: z/OS V2R1 and is rolled back to z/OS V1R13, z/OS V1R12, and z/OS V1R11 with APAR OA38230.

Reference information:
- *z/OS MVS System Messages, Vol 9 (IGF-IWM)*
- *z/OS Migration*

GRS ISGENQ Change Exclusive to Shared

Description: Global Resource Serialization (GRS) has enhanced ISGENQ Request=Change processing. Currently a resource owner can only change from Shared control to Exclusive, and only when there are no other Shared owners. This enhancement is to allow an owner to change control from Exclusive down to Shared, providing the opportunity for greater parallelism.

The overall purpose of this enhancement is increased throughput, and the initial exploiter is Batch Modernization.

As with other ISGENQ enhancements, this new function is not being integrated with the older ENQ service, which was essentially functionally stabilized in z/OS R6. ENQ RET=CHNG requests will continue to function as-is. Also note that ISGENQ will only support changes of global ENQs from Exclusive to Shared when GRS is running in Star mode.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS MVS Programming: Assembler Services Reference IAR-XCT*
- *z/OS MVS Programming: Authorized Assembler Services Guide*

GRS EQDQ Monitor support and QScan enhancements

Description: With the introduction of GRS SMF 87 Monitoring for ENQs and DEQs, Global Resource Serialization (GRS) now has an option for monitoring ENQ and DEQ requests that produces less overhead than the ISGAUDIT EQDQ monitor. GRS now has its own SMF record type, 87, which was introduced in D-type APAR OA42221 to record generic, global QScans. Further granularity of both ENQ/DEQ and QScan SMF 87 monitoring is provided through new parmlib member GRSMONxx, and the monitoring of STEP level resources, a functionality that was lost with ISGAUDIT, has returned. Incremental performance benefits are realized for Star mode Global Queue Scans (GQSCAN and ISGQUERY macros).

When change was introduced: z/OS V2R2.

Reference information:
- *z/OS MVS Planning: Global Resource Serialization*
- *z/OS MVS Initialization and Tuning Reference*
- *z/OS MVS System Messages, Vol 9 (IGF-IWM)*
- *z/OS MVS System Commands*

Hardware Instrumentation Services (HIS)

Description: In z/OS V2R1, a new authorized HISSERV service provides HIS data gathered from the CPU Measurement Facility available on IBM System z10® and zEnterprise servers to multiple consumers on the same system. It is also designed to provide new software-based counter data. This new service is intended to make it easier to write programs that sample counter data.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS MVS Programming: Authorized Assembler Services Reference EDT-IXG*

IBM Health Checker for z/OS considerations

The following new function is introduced:

- An automatic start of the IBM Health Checker for z/OS at IPL-time.
- A new system parameter HZSPROC to optionally specify the name of the procedure to be used for the automatic start.
- A new system parameter HZS to specify a list of HZSPRMxx parmlib member suffixes.
- Support for more than 100 characters as input to the HZSPRINT utility via exploiting the new PARMDD function.

When change was introduced: z/OS V2R1.

Reference information:

- *IBM Health Checker for z/OS User's Guide*

IOS considerations

This topic describes new function for Input/Output Supervisor in z/OS.

zEnterprise Data Compression (zEDC)

Description: zEnterprise Data Compression (zEDC) allows you to compress and then restore data using zEDC Express®, a System z compression accelerator, to improve the speed of data compression.

When change was introduced: z/OS V2R1.

Reference information: *z/OS MVS Programming: Callable Services for High-Level Languages*

HyperSwap sockets server

Description: z/OS Basic HyperSwap® is enhanced to allow TPC-R to connect to the HyperSwap address space using sockets, in addition to the current interface.

- Enables TPC-R running on z/OS in one sysplex to manage HyperSwap sessions running one or more other sysplexes.
- Allows complete HyperSwap management from TPC-R running on a non-z/OS server (that is, AIX®, Windows, Linux).

This function is available for z/OS V2R1 and z/OS V1R13 with PTFs for APARs OA40866, OA41936, and OA42171.

When change was introduced: z/OS V2R1.

Reference information:

- *z/OS MVS System Commands*
- *z/OS MVS Initialization and Tuning Reference*
- *z/OS MVS System Codes*
- *z/OS MVS Diagnosis: Tools and Service Aids*
- *z/OS MVS Diagnosis: Reference*
- *z/OS MVS Dump Output Messages*
- *z/OS MVS System Messages, Vol 3 (ASB-BPX)*
- *z/OS MVS System Messages, Vol 9 (IGF-IWM)*
- *z/OS MVS System Messages, Vol 1 (ABA-AOM)*
- *IBM Tivoli Storage Productivity Center for Replication for System z V5.2 Installation and Configuration Guide*

Improved z/OS Discovery and Auto Configuration (zDAC) function

Description: z/OS Discovery and Auto Configuration (zDAC) has improved processing of device number-constrained configurations and those with constrained unit addresses for specific channels. It is also enhanced with the capability to allow you to specify switch and CHPID maps to guide path selection and to discover directly attached devices, in addition to those connected to a switch. There is improved toleration of inactive or incapable systems identified in an LPAR group and the discovery policy enhancements allow you to forego automatic device numbering so you can provide your own device numbers. In addition, the policy refresh capability allows some policy options to be dynamically refreshed without requiring a new fabric discovery.

When change was introduced: z/OS V2R1.

Reference information: *z/OS HCD User's Guide*

IOS read diagnostic parameters

Description:

Advances in fiber optic technology allow enterprises to move to faster link speeds in their I/O topology. But faster link speeds are more sensitive to optical signal degradation, as might occur because of twisted or damaged cables, dirty optics, or improperly seated or misaligned connectors. When link errors occur, it can be difficult to determine the source of the problem. For instance, is it a transceiver, connector, or fiber issue, and at which point in the link?

The input/output supervisor (IOS) component of z/OS now provides information to help clients and support personnel to diagnose and resolve issues with fibre channel links. The diagnostic information can help distinguish between errors that occur because of dirty connections and those that occur because of faulty optics.

With this support, IOS provides the following new functions:
- A new LINKINFO parameter on the DISPLAY M=DEV command to display fiber optic link information, which eliminates the need to collect this information from individual channels, switches, and control units in a disruptive manner (such as by connecting a light meter)
- New health checks for IBM Health Checker for z/OS to monitor mismatched link speeds for a control unit and inadequate buffer credits for the path
- SMF record type 124 subtype 1, which contains optical link information

Release introduced:

z/OS V2R1 with APAR OA49089 and supporting processor, DASD, and switch hardware

Reference information:

z/OS MVS System Commands

IBM Health Checker for z/OS User's Guide

z/OS MVS System Management Facilities (SMF)

Predictive Failure Analysis considerations

This topic describes things to consider when using Predictive Failure Analysis (PFA) in z/OS.

When migrating from z/OS V1R12 to V2R1, you are required to run AIRSHREP.sh with either the *new* or *migrate* option. When migrating from z/OS V1R13 to V2R1, you are not required to run AIRSHREP.sh; however, if you want to delete all previous release data, run AIRSHREP.sh with the *new* option. For complete details, see the topic about "Using the *migrate* or *new* parameters when running AIRSHREP.sh" in *z/OS V2R2 Problem Management*

In z/OS V2R1, the minimum level of Java™ is IBM 31-bit SDK for z/OS, Java Technology Edition, V6.0.

The PFA_ENQUEUE_REQUEST_RATE check was updated to produce more granular results.

Program Management (Binder) Considerations

Description: In z/OS V2R2, Program Management has the following enhancements:

- A new binder C/C++ API DLL is provided which supports Language Environment conforming AMODE 64 programs.
- Program Management now provides support for J-con (length constant) RLDs for defining the length of individual parts and pseudoregisters (PR) in GOFF objects. This support is for an RLD built with a Reference Type of R-Length and Referent Type Part. This is supported by the High Level Assembler as in APAR PI07812. In addition to identifying them in the binder SYSPRINT output, AMBLIST is also enhanced to decode and display such RLDs.
- The following RAS items are also added:
  - TSO LINK and LOADGO support to accept the LISTPRIV=INFORM option.
  - Several functional enhancements to the ADDALIAS API, for both creating new and preserving existing aliases.
  - Displaying the ESD RMODE for load module CSECTs in AMBLIST output.

When change was introduced: z/OS V2R2.

Reference information:
- *z/OS MVS Program Management: User's Guide and Reference*
- *z/OS MVS Program Management: Advanced Facilities*
- *z/OS MVS Diagnosis: Tools and Service Aids*

Description: In z/OS V2R1, Program Management has the following enhancements:

- Support is provided for symbol resolution tracing. New binder messages are added to trace the progress of binder symbol resolution processing for a particular symbol. The messages are produced only if requested using a new SYMTRACE binder option.
- Support is provided for more granular alignment within a program. Alignment for elements (sections or classes) is supported for all powers of 2 from doubleword up to a page boundary. Alignment for parts is supported for all powers of 2 from one byte up to a page boundary.
- LONGPARM support is provided, which enables AFP-authorized batch programs to accept more than 100-byte parameters. Programs are enabled by using a new LONGPARM option along with the AC option.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS MVS Program Management: User's Guide and Reference*

- *z/OS MVS Program Management: Advanced Facilities*
- *z/OS MVS Diagnosis: Tools and Service Aids*

Resource Recovery Services (RRS) considerations

The following enhancements are made to Resource Recovery Services (RRS).

Internal Cold Start

Description: Internal Cold Start processing is designed to eliminate the sysplex wide outage when certain problems are detected with the RM Data log. Normally the problem is corrected by cancelling RRS in the entire sysplex, request a cold start of RRS using the ATRCOLD procedure, and then restart RRS on each system in the sysplex. Internal Cold Start, will try to resolve the problem without the outage.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS MVS System Codes*
- *z/OS MVS System Messages, Vol 3 (ASB-BPX)*
- *z/OS MVS Programming: Resource Recovery*
- *z/OS V2R2 Problem Management*

Service aids considerations

The following enhancements are made to service aids.

Manage large SDUMPS

Description:

SDUMPs are continually getting larger, and the critical nature of SDUMP is continually increasing. So, the component trace (CTRACE) service that provides a method for MVS components to collect data about problem events now supports SDUMP. The inclusion of SDUMP in CTRACE assists with diagnosing and debugging SDUMP problems and helps to significantly reduce the amount of time that is required to resolve them.

The following specific enhancements are provided to handle the larger storage capacity:
- Larger SUMDUMP buffer
- SDUMP CTRACE facility
- New SDATA options to limit high virtual common storage in SVC dumps

Release introduced
z/OS V2R2

Reference information:

z/OS MVS Diagnosis: Tools and Service Aids

z/OS MVS System Messages, Vol 6 (GOS-IEA)

z/OS Summary of Message and Interface Changes

Deallocate LOGREC data sets without a system restart

Description:

You can now deallocate LOGREC data sets without restarting the system. This new function provides you with the ability to discontinue the use of a particular LOGREC data set when you switch to either a log stream or a

| different LOGREC data set. Use the updated SETLOGRC command to
| deallocate a LOGREC data set that is in use and specify a new data set
| name.

| **Release introduced**
| z/OS V2R2

| **Reference information:**

| *z/OS MVS Initialization and Tuning Reference*

| *z/OS MVS System Commands*

| *z/OS Summary of Message and Interface Changes*

| *z/OS MVS Diagnosis: Tools and Service Aids*

| *z/OS MVS Installation Exits*

| *z/OS MVS System Messages, Vol 8 (IEF-IGD)*

Limit high virtual CSA storage in an SDUMP

Description:
To limit the amount of high virtual CSA storage in a dump, SDUMP
provides three new options (HCsaByAsid, HCsaNoOwner, and
HCsaSysOwner) on the SDATA keyword. When only the CSA option is
specified, all of the above and below the bar CSA storage is included in the
dump. When you combine any or all of these new options with the CSA
option, though, you can adjust the amount of high virtual CSA storage that
is captured in the dump.

Release introduced
z/OS V2R1

Reference information:
Citation entry goes here. If greater than one, use a list format.
- *z/OS MVS Diagnosis: Tools and Service Aids*
- *z/OS MVS Initialization and Tuning Reference*
- *z/OS MVS Programming: Authorized Assembler Services Reference LLA-SDU*
- *z/OS MVS System Commands*

Supervisor considerations

This topic describes new function for allocation and supervisor in z/OS.

Pause on Pause Element Tokens (PETs)

IEAVPME2 is a callable service that can be used to pause on one or more multiple
PETs. IEA4PME2 is the 64-bit mode (AMODE 64) version of the callable service
and the addresses in the parameter list are 64 bits long. There are also updates to
the IEAVAPE and IEAVAPE2 callable services.

Description:

When change was introduced:
z/OS V2R2.

Reference information:
- *z/OS MVS Programming: Authorized Assembler Services Reference EDT-IXG*

z/OS MVS Programming: Assembler Services Reference IAR-XCT

Multithreading support

Description:
>Multithreading (MT) is a new function that is provided for z/OS to use a core more efficiently when it encounters cache misses. Multithreading allows multiple threads to dispatch a work unit simultaneously to the same core. Multithreading improves the probability that at least one thread has an instruction ready to run (not resolving a cache miss), which increases core throughput.

When change was introduced
>V2R1 (as updated February 2015).

Reference information:
>For more information about multithreading support, see:
>- *z/OS MVS Initialization and Tuning Reference*
>- *z/OS MVS System Management Facilities (SMF)*
>- *z/OS MVS System Commands*
>- *z/OS MVS Programming: Assembler Services Reference IAR-XCT*

Updating the values of system symbols dynamically

z/OS V2R1 supports updating the values of system symbols dynamically. A new keyword on the SETLOAD operator command enables you to specify that the values of local static system symbols are updated using the values from an IEASYMxx member of parmlib.

Description:

When change was introduced:
>z/OS V2R1.

Reference information:
>*z/OS MVS System Commands*

Support for transactional execution

Description: z/OS V2.1 provides full support for the transactional execution facility of zEC12 servers.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS MVS Programming: Assembler Services Guide*
- *z/OS MVS Programming: Assembler Services Reference IAR-XCT*
- *z/OS MVS Programming: Authorized Assembler Services Guide*
- *z/OS MVS Programming: Authorized Assembler Services Reference EDT-IXG*
- *z/OS MVS System Commands*
- *z/OS MVS Diagnosis: Reference*
- *z/OS MVS Diagnosis: Tools and Service Aids*

System logger considerations

The following enhancements are made to system logger.

Prevent access to LOGR couple data sets

Description:
>System logger requires the use of the LOGR couple data set (CDS) to perform its operations. However, certain sysplex configurations can benefit

from a z/OS system that does not maintain any access to the primary or alternative LOGR CDSs. An example of such a system is the K-systems controlling systems in an IBM GDPS®/PPRC, GDPS/MTMM environment. For these situations, logger provides for a SYS1.PARMLIB option that you can specify during a restart of a z/OS image. The option directs system logger and cross-system coupling facility (XCF) to not maintain any access to the LOGR CDSs on that z/OS image.

Release introduced
z/OS V2R2

Reference information:

z/OS MVS Setting Up a Sysplex

z/OS MVS Initialization and Tuning Reference

z/OS MVS System Commands

z/OS MVS System Messages, Vol 10 (IXC-IZP)

z/OS Summary of Message and Interface Changes

Allocate offload data sets

Description:
You can now allocate offload data sets for log streams before moving log data from the interim or primary storage to DASD. Obtaining offload data sets in advance helps to significantly reduce or completely avoid delays that might result from DASD space issues that are encountered when offloading log stream data. Another benefit is to provide a warning if the offload processing for the log streams encounters a DASD allocation inhibitor. The warning provides the installation with enough time to remedy any resource issues before any outage conditions arise.

Release introduced
z/OS V2R2

Reference information:

z/OS MVS Setting Up a Sysplex

z/OS Migration

z/OS MVS Programming: Assembler Services Guide

z/OS MVS Programming: Assembler Services Reference IAR-XCT

z/OS MVS Diagnosis: Reference

z/OS MVS Initialization and Tuning Reference

z/OS MVS System Commands

z/OS MVS System Messages, Vol 10 (IXC-IZP)

z/OS Summary of Message and Interface Changes

System Logger enhancements in z/OS V2R1

Description: System Logger has the following enhancements:

- Enhancements to the system logger component are intended to help you avoid log stream primary storage full conditions that can lead to performance degradation and outages. New function is designed to enable you to specify that warning messages be issued based on thresholds for log stream primary storage consumption above the HIGHOFFLOAD value.

- Multiple log stream offload/data set management tasking as well as separation between coupling facility-based and DASD-only log streams will reduce log stream primary (interim) storage full conditions stemming from interference and delays between competing log stream offload data set allocations and deletions.

This is intended to support higher rates of log stream offload data set allocations, reduce primary storage full conditions, and support higher overall concurrent log stream offload rates. It will aid in overall concurrent log stream offload throughput for log streams with large data bandwidths, such as SMF, IMS™ CQS, and so forth.

- LOGR CDS (couple data set) log stream control info (Ocntl & Pcntl) current for offloads provides a higher level of data reliability and access by reducing potential data loss conditions.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS MVS System Commands*
- *z/OS MVS Programming: Assembler Services Reference IAR-XCT*
- *z/OS MVS Programming: Assembler Services Guide*
- *z/OS MVS System Messages, Vol 10 (IXC-IZP)*
- *z/OS MVS Initialization and Tuning Reference*
- *z/OS MVS Diagnosis: Reference*
- *z/OS MVS Setting Up a Sysplex*

System Management Facility (SMF) considerations

This topic describes new System Management Facility (SMF) functions in z/OS.

Improving region management

Description:

In V2R2, improved region management is supported in JCL. REGIONX is a new JCL keyword available for the JOB and EXEC statements. It allows the JCL coder to explicitly request exact below-the-line and above-the-line storage amounts.

To support improved region management by the installation, a new parmlib member, SMFLIMxx, was introduced to establish rules for setting REGION and MEMLIMIT values, or for canceling the job step. This parmlib member can be used as a replacement for several functions of the IEFUSI exit.

The DISPLAY SMFLIM command displays the in-storage copy of the SMF limit rules, and the SET command updates the in-storage copy of the SMF limit rules.

Release introduced

z/OS V2R2 with APAR OA47062.

Reference information:
- *z/OS MVS Initialization and Tuning Reference*
- *z/OS MVS System Commands*
- *z/OS MVS Installation Exits*.

Digital signatures for SMF records

Description:

To enable the detection of unauthorized alterations to recorded SMF data, digital signatures for SMF records can now be written to log streams. This provides a more trusted repository for the auditing records that are created by a number of z/OS system components, including RACF.

Release introduced
    z/OS V2R2

Reference information:
    z/OS MVS System Management Facilities (SMF)

System REXX considerations

The following enhancements are made to System REXX.

Console Host Command Environment

Description: In V2R1 the installation has the choice of having System REXX use the Terminal Monitor Program (TMP) instead of the TSO Environment Service to process TSO=YES AXREXX requests. The primary benefit of this feature is the ability to use the Console host command environment within an exec to retrieve messages that are not command responses. When using the default TSO Environment Servce, the only means of retrieving messages is through the use of the AXRCMD function which only supports the ability to retrieve command responses. The SUBMIT TSO command is also supported within the TMP, providing an easier means of having an exec submit JCL.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS MVS System Codes*
- *z/OS MVS System Messages, Vol 3 (ASB-BPX)*
- *z/OS MVS Programming: Authorized Assembler Services Guide*

Unicode considerations

This topic describes new Unicode function in z/OS:

- **Case, Collation, Character Conversion, and Normalization services upgraded to Unicode 6.0 standard** - The Case, Collation, Character Conversion, and Normalization services in z/OS Unicode meet the Unicode 6.0 standard in z/OS V2R1.
- **Dynamic Locale Service** - z/OS Unicode Services allows the locales to be created dynamically when needed, based on the information in the open source CLDR repository. z/OS Unicode Services returns the locale data to the caller.
- **Support for Japanese EUC standard** - z/OS Unicode Services added new CCSIDs to support the revised Japanese EUC (Extended Unix Code) standard. The CCSIDs added are: 17338, 21434, and 37818.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS Unicode Services User's Guide and Reference*
- *z/OS MVS System Commands*
- *z/OS MVS Initialization and Tuning Reference*

Dynamic modifications to VLF without restart

Description: In z/OS V2R1, a new MODIFY VLF command lets you specify that the contents of a COFVLFxx parmlib member are used to update VLF classes, update their associated major names, and change the values of MaxVirt and AlertAge for existing VLF classes. This is designed to improve system performance when making these changes to VLF by making it unnecessary to restart VLF.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS MVS System Commands*

WLM considerations

This topic describes new WLM functions in z/OS:

WLM considerations for V2R2

This topic describes new WLM functions in z/OS V2R2:

- **API to make OPT parameters available to monitoring products like RMF and Omegamon**: Provides a new WLM service to provide to make the IEAOPT*xx* parameters available to z/OS monitoring products like RMF and Omegamon.
- **Health Based Routing**: An enhancement to dynamic workload routing, it focuses on further reducing installation impact due to middleware server health issues. The goal is to mask the impact of a component that appears "sick but not dead" by rerouting work to a healthy back end server.
- **Server Management enhancements for large real storage**: Fix large real storage problems in SRM and WLM algorithms. The RSM group currently runs large real storage tests.
- **Mobile pricing**: The ability to classify transactions so that they can benefit from mobile application pricing.

WLM support for V2R1

New WLM functions in z/OS V2R1:

SYSEVENT Macro

The SYSEVNT macro is expanded, and supports `QRYCONT` that can return contention information for one address space or one enclave that consists of:

- The contention request type that was issued by the resource manager.
- The resource manager passed identification (subsystem type and subsystem name).
- The number of identical contention requests.
- A time stamp.

   Note: If there are multiple requests, the oldest time stamp is returned.

Up to five entries are written into the output array which differs in request type and resource manager passed identification.

WLM/SRM Support for Multi-Threading (MT-2)

WLM/SRM provides support for simultaneous multi-threading (MT) support for IBM z13™ with other components, namely supervisor, and z/OS RMF.

SRM Support for 4 TB

Fixes real storage-related problems in SRM and WLM algorithms. It removes no longer needed code in the SRM storage algorithms when there is time for such a cleanup. The code removal reduces the module size and the path length. A shorter path length in SRM also reduces the SRM lock contention, which increases the overall system throughput.

XCF considerations

This topic describes new XES and Cross-System Coupling Facility (XCF) functions in z/OS.

Cross-System Coupling Facility (XCF) enhancements for z/OS V2R2

Description: XCF improvements in z/OS V2R2 include:

- **List services enhancements:** XES List services IXLLIST, IXLLSTE, and IXLLSTC are updated to return both the current in-use number of entries and current in-use elements for a specific list. READ, WRITE, MOVE, and DELETE (IXLLIST and IXLLSTE) and READ_LCONTROLS, MONITOR_LIST, and MONITOR_KEYRANGE requests return both in-use entry and in-use element counts in the List Services Answer Area (IXLYLAA macro). For more information, see *z/OS MVS Programming: Sysplex Services Guide*.

  When change was introduced: z/OS V2R2.

- **Transport Class simplification (Member Isolation):** The XCF member monitors are enhanced to detect ill-behaved members accumulating a large backlog of signals impeding the ability of XCF to send and receive messages on behalf of other XCF group members. When this condition is detected, XCF will "message isolate" the ill-behaved member and not send messages to that member until the backlog of signals is reduced to a reasonable level. The XCF Message-Out service (IXCMSGO, IXCMSGOX) will delay or reject messages targeted to a member that is "message isolated". For more information, see

  When change was introduced: z/OS V2R2.

- **IXCQUERY enhancements:** The IXCQUERY query service is modified to provide function to return information for couple data sets and policy information contained in the couple data sets, if policy data exists. For more information, see *z/OS MVS Programming: Sysplex Services Reference* .

  When change was introduced: z/OS V2R2.

- **CFSite enhancements:** The structure definition in the CFRM policy allows for the specification of a preference list which specifies an ordered list of coupling facility names from which the system is to choose when allocating a structure in a coupling facility. The system attempts to allocate the structure in the first coupling facility in the preference list that meets a specified allocation criteria.

  To help with defining the preference list, especially across duplexed structures, a new keyword is introduced to the CFRM policy for structure definitions. An additional parameter is introduced that indicates how coupling facilities should be chosen based on their specified site for the structure or structures that should be duplexed.

  The DISPLAY XCF and IXCQUERY commands are updated. For more information, see z/OS MVS System Commands. The CFRM Policy Utility, IXCMIAPU, is updated. For more information, see *z/OS MVS Setting Up a Sysplex*.

  When change was introduced: z/OS V2R2.

- **Gain ownership enhancements:** This support will remove prompts for system messages IXC501A and IXC560A to avoid human interaction and prevent an error leading to a sysplex outage. A new keyword, CFRMTAKEOVERCF, is added to the COUPLExx parmlib member. The default is CFRMTAKEOVERCF(NO) and changes the behavior from previous releases. The previous behavior can be achieved by specifying CFRMTAKEOVERCF(PROMPT). For more information, see *z/OS MVS Initialization and Tuning Reference*.

  When change was introduced: z/OS V2R2.

- **64Bit VSCR Support:** Common storage is becoming constrained below the 2GB bar. XES, in support of Virtual Storage Constraint Relief (VSCR) in z/OS V2R2, implements the next step in reducing the usage of 31-bit common storage below 2GB. This support also includes RAS items to assist in providing better analysis for problem determination. For more information on the HVCOMMON system parameter, see *z/OS MVS Initialization and Tuning Reference*.

  In support of VSCR, select XES common storage control blocks are moved to 64-bit common storage above the 2GB bar.

  In support of Serviceability, XES provides enhancements to XES IPCS component trace reports. For more information on requesting SYSXES component tracing reports, see *z/OS MVS Diagnosis: Tools and Service Aids*.

  When change was introduced: z/OS V2R2.

Cross-System Coupling Facility (XCF) enhancements for z/OS V2R1

Description: XCF improvements in z/OS V2R1 include:

- **PCIe-based coupling links are supported:**The IPCS XESDATA FACILITY report formats information about coupling facilities connected to the dumped system and CFs that are peer-connected to those facilities. The report identifies the connecting CHPIDs and CHPID types.

  In z/OS V2R1, the console display output for D CF and the IPCS XESDATA FACILITY report began displaying the enhanced path attributes (path operating mode, degraded condition, round-trip latency, adapter ID, port, and SAP affinity). With this support, the display command and IPCS report will now display the same information for the CS5 CHPID type. For more information, see *z/OS MVS Diagnosis: Reference*

  When change was introduced: z/OS V2R1.
- Coupling facility (CF) error recovery processing and the way structures are processed when CF duplexing is initiated is changed. The new design is intended to improve performance and availability when a large number of structures are rebuilt by rebuilding in a more serial manner, and by enabling you to specify which structures should be recovered first, to rebuild the most important structures for your workloads ahead of other, less critical, structures.

  When change was introduced: z/OS V2R1.
- Connector local cache controls verification is implicitly performed by the system when registration of interest in a cache structure data item is requested. In the event of a verification failure, the system collects diagnostic information and invokes connector termination processing to avoid coupling facility cache corruption.

  When change was introduced: z/OS support exists for exploiting new CFCC function for coupling facility (CF) structures residing in CFs defined on a IBM zEnterprise EC12 (zEC12) processor at CFLEVEL 18 and above and select levels of CFs defined on IBM zEnterprise 114 (z114) and IBM zEnterprise 196 (z196) processors. The z/OS support is available in z/OS V2R1 and in z/OS V1R12 and z/OS V1R13 with the PTFs for APAR OA37550.
- The XCF Note Pad Service is a new application programming interface that allows programs to manipulate notes in an XCF note pad. A note pad is an abstraction layered on top of the existing coupling facility list structure interfaces.

  When change was introduced: z/OS V2R1 and with the PTF for APAR OA38450 for z/OS V1R13.

Reference information:

- *z/OS MVS System Commands*

- *z/OS MVS System Messages, Vol 10 (IXC-IZP)*
- *z/OS MVS Setting Up a Sysplex*
- *z/OS MVS Programming: Sysplex Services Guide*
- *z/OS MVS Programming: Sysplex Services Reference*

Capacity Provisioning new functions to consider

This topic describes new Capacity Provisioning functions in z/OS.

Capacity Provisioning considerations for V2R2

This topic describes new Capacity Provisioning functions in z/OS V2R2:

- **Utilization based Provisioning**: This enhancement allows for capacity provisioning based on the current CPC utilization. Using the total physical CPC utilization as a trigger allows for faster and more proactive provisioning of temporary processor capacity when the utilization is getting closer to 100%. The trade off is that there may be unimportant workloads or system and configuration errors driving up CPU consumption and cause unwanted provisioning of CPU resources. However, there are certain environments where either the WLM set up is not sufficiently tuned to build a reliable Capacity Provisioning policy around WLM service classes or the PI based provisioning is not fast enough to meet the requirements for aggressive CPU provisioning.

  For the provisioning based on CPC utilization the CP policy is extended with a new condition type for utilization conditions in addition to the existing workload and time conditions. Utilization conditions are specified for the CPC wide physical processor utilization, broken down by CPU type.

Common Information Model new functions to consider

Common Information Model (CIM) has no new function that is listed here.

Communications Server new functions to consider

The following section covers Communications Server function by type and support considerations.

Support considerations in V2R2

Description: z/OS V2R2 Communications Server includes the following enhancement for support considerations in V2R2.

Support considerations in V2R2 - Support for the following functions is discontinued.

- Several TCP/IP device drivers
  - Asynchronous Transfer Mode (ATM)
  - Common Link Access To Workstation (CLAW)
  - HYPERChannel
  - Channel Data Link Control (CDLC)
  - SNALINK (both LU0 and LU6.2)
  - X.25

  Note: Support for SNA device drivers is not affected.
- GATEWAY profile statement

When change was introduced: z/OS V2R2

Reference information: See the following topic in *z/OS Communications Server: New Function Summary* for detailed descriptions that include any applicable restrictions, dependencies, and steps on using the functions:

- *Support considerations in V2R2*

Security

Description: z/OS V2R2 Communications Server includes the following enhancements for security:

- **AT-TLS certificate processing enhancements** - Application Transparent TLS (AT-TLS) is enhanced to support the following features that System SSL provides.
  - RFC 5280 PKIX certificate and CRL profile. With this support, you can perform certificate validation according to RFC 5280.
  - Enhanced certificate revocation capabilities:
    - Retrieval of revocation information through the Online Certificate Status Protocol (OCSP)
    - Retrieval of Certificate Revocation Lists (CRLs) over HTTP
    - More flexible processing of CRLs through LDAP
- **Simplified access permissions to ICSF cryptographic functions for IPSec** - In prior releases, network applications that are sending or receiving IPSec protected traffic were required to be permitted to certain SAF resource profiles in the CSFSERV class when protection of the ICSF cryptographic operations was requested. The requirement is to be eliminated. You are no longer required to permit all network applications that are sending or receiving IPSec protected traffic to the relevant SAF resources in the CSFSERV class. Only the user ID that is associated with the TCP/IP stack must be permitted to the SAF resource profiles.
- **TCPIP profile IP security filter enhancements** - The default IP filters as defined in the TCP/IP profile data set are enhanced to support traffic direction specifications, address ranges, port ranges, ranges on relevant type and code values, and MIPv6 and Opaque protocol types.
- **TLS session reuse support for FTP and AT-TLS applications (AT-TLS)** - The SIOCTTLSCTL ioctl system call is enhanced to perform the following actions:
  - AT-TLS applications can retrieve the session ID for the secure socket.
  - AT-TLS applications can request that a session is reused on a socket by retrieving and setting the session token.
- **TLS session reuse support for FTP and AT-TLS applications (FTP)** - FTP is enhanced to support SSL session reuse. When using native SSL or AT-TLS, z/OS FTP supports reusing the SSL session ID of the control connection or a previous data connection on the subsequent data connections within an FTP session without port binding.

When change was introduced: z/OS V2R2

Reference information: See the following topics in *z/OS Communications Server: New Function Summary* for detailed descriptions that include any applicable restrictions, dependencies, and steps on using the functions:

- *AT-TLS certificate processing enhancements*
- *Simplified access permissions to ICSF cryptographic functions for IPSec*

- *TCPIP profile IP security filter enhancements*
- *TLS session reuse support for FTP and AT-TLS applications (AT-TLS)*
- *TLS session reuse support for FTP and AT-TLS applications (FTP)*

Simplification

Description: z/OS V2R2 Communications Server includes the following enhancement for simplification:

- **Removed support for the GATEWAY statement in the TCP/IP profile** - The GATEWAY profile statement cannot be used to configure IPv4 static routes to the TCP/IP stack. You can use the BEGINROUTES profile statement to configure your IPv4 static routes. The BEGINROUTES statement provides more functionality than the GATEWAY statement and the statement syntax is easier to use.

When change was introduced: z/OS V2R2

Reference information: See the following topic in *z/OS Communications Server: New Function Summary* for detailed descriptions that include any applicable restrictions, dependencies, and steps on using the functions:

- *Removed support for the GATEWAY statement in the TCP/IP profile*

Availability and business resilience

Description: z/OS V2R2 Communications Server includes the following enhancements for availability and business resilience:

- **Activating Trace Resolver without restarting applications** - The Resolver CTRACE TRACERES option is provided to collect Trace Resolver output as Resolver CTRACE records. You can use the Resolver CTRACE TRACERES option to dynamically enable or disable collection of Trace Resolver output for one or more applications without stopping and then restarting the application. You can also use the Resolver CTRACE TRACERES option to trace Resolver activity in address spaces that have multiple tasks or address spaces that generate many Resolver API calls. You can use **IPCS CTRACE** subcommand processing to view the formatted component trace data from a dump, or from an external ctrace data set.
- **Reordering of cached resolver results** - Cache support for the system resolver is enhanced. The resolver is enhanced to perform system-wide round-robin reordering of the list of IP addresses that are associated with a cached host name.

  Specify the CACHEREORDER statement in the resolver setup file to enable system-wide resolver reordering of cached data. Perform one of the following actions to disable the resolver reordering function:

  – To disable system-wide resolver reordering, specify the NOCACHEREORDER statement in the resolver setup file.
  – To disable resolver reordering for an application, specify the NOCACHEREORDER statement in the TCPIP.DATA file.

When change was introduced: z/OS V2R2

Reference information: See the following topics in *z/OS Communications Server: New Function Summary* for detailed descriptions that include any applicable restrictions, dependencies, and steps on using the functions:

- *Activating Trace Resolver without restarting applications*

        • *Reordering of cached resolver results*

Application, middleware, and workload enablement

Description: z/OS V2R2 Communications Server includes the following enhancements for application, middleware, and workload enablement:

- **CICS transaction tracking support for CICS TCP/IP IBM Listener** - The CICS Sockets Listener is enhanced to provide to CICS the IP addresses and port numbers of the local and remote session partners for use by the CICS Explorer or Session Monitor.
- **CSSMTP SMTP command editing option** - The Communications Server Simple Mail Transfer Protocol (CSSMTP) can be configured to remove the trailing nulls from SMTP Commands (**EHLO**, **HELO**, **STARTTLS**, **FROM**, **RCPT**, and **DATA**).

When change was introduced: z/OS V2R2

Reference information: See the following topics in *z/OS Communications Server: New Function Summary* for detailed descriptions that include any applicable restrictions, dependencies, and steps on using the functions:
- *CICS transaction tracking support for CICS TCP/IP IBM Listener*
- *CSSMTP SMTP command editing option*

Economics and platform efficiency

Description: z/OS V2R2 Communications Server includes the following enhancements for economics and platform efficiency:

- **64-bit enablement of the TCP/IP stack, strategic DLCs, and CSM** - The TCP/IP stack and the DLCs for OSA-Express in QDIO mode, HiperSockets, and RoCE-Express are enabled to fully use 64-bit virtual memory. These components run in AMODE64 and use virtual memory above the 2 GB bar, which significantly reduces the usage of data space, ECSA and private virtual storage below the 2 GB bar. The z/OS V2R2 TCP/IP stack 64-bit virtual memory support also improves networking scalability because TCP/IP's usage of data space, ECSA, and private virtual storage is not significantly affected by the scale of networking activity.

  In the following use cases, the z/OS V2R2 TCP/IP stack 64-bit virtual memory support might not provide the same level of performance as previous releases provide:

  - **Legacy network connectivity:**

    Communications Server software that is related to OSA-Express in QDIO mode, HiperSockets, and RoCE-Express is updated to fully use 64-bit virtual memory. All other types of TCP/IP network connectivity, for example. XCF, MPCPTP, LCS, or CTC, are legacy types and are updated to provide 64-bit stack compatibility. These drivers do not provide 64-bit exploitation. When you use the legacy types of network connectivity, your network performance and CPU cost might not be as efficient as it was in previous releases because extra data copies might be required.

    When legacy network connectivity is used for network traffic patterns going through z/OS, the impact might be more significant. Examples of these patterns include standard IP forwarding that is enabled by using IPCONFIG DATAGRAMFWD and sysplex distributor forwarding.

    Tip: Use VIPAROUTE over OSA-Express QDIO or Hipersockets for sysplex distributor forwarding to avoid using legacy network connectivity.

The impact is based on the characteristics of your specific workloads such as message size and patterns, and environment. This is primarily an issue for streaming or bulk workloads.

– **Enterprise Extender (EE) support when legacy network connectivity is used:**

The z/OS Communications Server SNA (APPN) support for EE does not fully use 64-bit virtual memory. EE outbound processing is not affected. However, if inbound processing is connected to the network that uses legacy connectivity types, an extra copy of the inbound data might be required.

Result: When you use OSA-Express in QDIO mode or HiperSockets for inbound EE processing, no additional data copies are required compared to V2R1.

Tip: OSA-Express Inbound Workload Queueing (IWQ) support optimizes EE inbound traffic and further reduces the copies that are required.

– **Application socket APIs using CSM:**

Applications that use socket API semantics using Communications Storage Manager (CSM) managed memory can pass CSM data space or ECSA memory directly across the sockets API by using the UNIX System Services srx_np (BPX1SRX, BPX4SRX) callable services. The callable services continue to be supported without semantic changes. These services allowed data copies within the stack to be minimized, which reduces the stack send and receive processing cost.

With the V2R2 64-bit virtual memory support, the performance benefits of the services are diminished. When you use the callable services, the TCP/IP stack copies the data between CSM buffers to 64-bit memory. The performance characteristics are similar to the sockets API with memory buffers provided by applications. In V2R2, you can continue to use applications that use the srx_np (BPX1SRX/BPX4SRX) services. Do not use these services for new applications.

- **CSSMTP migration enablement** - A new z/OS Health Checker for z/OS migration health checks is provided to help determine whether you are using any of the following functions on the system:
  - sendmail client
  - sendmail daemon
  - sendmail mail submission agent (sendmail MSA)
  - sendmail mail transfer agent (sendmail MTA)
  - SMPTD daemon
  - SMTPD mail transfer agent (SMPTD MTA)

  Support for these functions will be removed in a future z/OS release.
- **Enhanced Enterprise Extender scalability** - The scalability of Enterprise Extender connections is improved. The overall performance is improved when there are large numbers of Enterprise Extender connections.
- **Enhanced IKED Scalability** - Internet Key Exchange daemon (IKED) scalability is improved. Performance is improved when large numbers of IKE peers attempt to negotiate IPSec SAs with z/OS IKED concurrently. The IkeSyslogLevel configuration parameter in iked.conf is updated and a thread identifier that precedes every IKED message written through syslogd is included.
- **Increase single stack DVIPA limit to 4096** - The limit of total DVIPAs on a single stack is increased from 1024 to 4096. This allows more than 1024 Application Instance DVIPAs that are defined by VIPARANGE to be defined on a single TCP/IP stack.

- **Removed support for legacy devices** - The following device types can no longer be configured to the TCP/IP stack: Asynchronous Transfer Mode (ATM), Channel Data Link Control (CDLC), Common Link Access To Workstation (CLAW), HYPERchannel, SNALINK (both LU0 and LU6.2), and X.25. You must migrate from these device types to more recent types, such as OSA-Express QDIO and HiperSockets.

  This affects device types that are configured to the TCP/IP stack only.

  Because support is removed for the CDLC, SNALINK (both LU0 and LU6.2), and X.25 device types, you cannot use the following server applications:
  - NCPROUTE
  - SNALINK LU0
  - SNALINK LU6.2
  - X.25 NPSI

  Support for the ZOSMIGV2R1_CS_LEGACYDEVICE migration health check is also removed.

- **Shared Memory Communications over RDMA enhancements** - A maximum transmission unit (MTU) value of 4096 is supported and autonomics performance for Shared Memory Communications over Remote Direct Memory Access (RDMA) referred to as SMC-R is enhanced. Previously, MTU values of 1024 and 2048 were supported. A new MTU value of 4096 is supported for SMC-R. SMC-R autonomics provides the following performance enhancements:
  - SMCGLOBAL AUTOCACHE

    It enables the stack to cache failed attempts to use SMC-R communications to specific destination IP addresses. With this information, the stack can avoid the overhead of unproductive attempts to establish an SMC-R link. The stack instead directs the connection over TCP. This option is enabled by default.
  - SMCGLOBAL AUTOSMC

    It enables the stack to analyze incoming TCP connections to dynamically determine whether SMC-R is beneficial for a local TCP server application. The monitoring result influences whether TCP connections to a particular server (port) use SMC-R. It can help ensure TCP connections use the most appropriate communications protocol (TCP or SMC-R). This option is enabled by default.

- **SMC Applicability Tool (SMCAT)** - The SMC Applicability Tool (SMCAT) provides the ability to monitor and evaluate TCP/IP network. You can use the evaluation to determine the applicability of SMC-R to your network environment. To make the evaluation, you do not need to enable the SMC-R function on any system or enable the RoCE Express features.

  SMCAT can be used to monitor a TCP/IP stack for a set of configured destination IP addresses or subnets, and provide a report in the TCP/IP stack job log. The report provides details of the amount of TCP workload that can potentially use SMC-R if SMC-R is available.

- **TCP autonomic tuning enhancements** - The following enhancements are made to automatically tune resources that are related to TCP connections. The enhancements are based on real-time data and can improve overall performance of TCP connections.
  - Dynamic Right-Sizing (DRS) and Outbound Right-Sizing (ORS) autonomics

    DRS and ORS are z/OS Communications Server optimizations that improve overall performance for certain high latency streaming workloads. z/OS Communications Server V2R2 lifts restrictions on which workloads and applications are eligible for each optimization and makes each optimization more sensitive to connection and CSM ECSA storage conditions. In addition,

TCP/IP can stop and restart the DRS optimization dynamically for each connection based on the current system or application responsiveness.

– Delayed transmission of acknowledgement autonomics

The transmission of acknowledgements on a TCP connection based on user configuration settings is delayed. Autonomic capability to monitor the effectiveness of delaying the transmission of acknowledgements on a connection and a listener level is provided. In addition, TCP/IP can stop and restart the delaying transmission of acknowledgements for each connection based on workload and application characteristics.

– Fast Retransmit, Fast Recovery (FRR) autonomics

The detection of out-of-order packets to lost packets during FRR recovery is extended. When FRR recovery processing completes and no lost packets are detected, TCP/IP restores the transmission rates that were allowed before FRR recovery processing.

* **VIPAROUTE fragmentation avoidance** - A TCP/IP profile GLOBALCONFIG parameter, ADJUSTDVIPAMSS to adjust the TCP Maximum Segment Size (MSS) is added. Sysplex Distributor traffic that is routed by using VIPAROUTE adds a Generic Routing Encapsulation (GRE) header to the packet. Thus, the packet is fragmented from the distributor to the target stack. The new function takes the GRE header into account when specifying the MSS value. It eliminates the fragmentation that is caused by adding the GRE header.

When change was introduced: z/OS V2R2

Reference information: See the following topics in *z/OS Communications Server: New Function Summary* for detailed descriptions that include any applicable restrictions, dependencies, and steps on using the functions:

* *64-bit enablement of the TCP/IP stack, strategic DLCs, and CSM*
* *CSSMTP migration enablement*
* *Enhanced Enterprise Extender scalability*
* *Enhanced IKED Scalability*
* *Increase single stack DVIPA limit to 4096*
* *Removed support for legacy devices*
* *Shared Memory Communications over RDMA enhancements*
* *SMC Applicability Tool (SMCAT)*
* *TCP autonomic tuning enhancements*
* *VIPAROUTE fragmentation avoidance*

Cryptographic Services new functions to consider

This topic describes new Cryptographic Services functions in z/OS.

Enable PKI Services to sign the Online Certificate Status Protocol (OCSP) responses

Description: Enables PKI Services to sign the Online Certificate Status Protocol (OCSP) response with the client specified signing algorithm in the required manner.

When change was introduced: z/OS V2R2

Reference information:

z/OS Security Server RACF Callable Services

z/OS Cryptographic Services PKI Services Guide and Reference

PKI Services 64 bit support

Description: Enable PKI services in 64 bit mode.

When change was introduced: z/OS V2R2

Reference information:

z/OS Security Server RACF Data Areas

z/OS Security Server RACF Callable Services

z/OS Cryptographic Services PKI Services Guide and Reference

PKI Services support NxM authorization

Description: PKI Services is enhanced to support multiple number of administrators to approve certificate requests.

When change was introduced: z/OS V2R2

Reference information:

z/OS Security Server RACF Macros and Interfaces

z/OS Security Server RACF Data Areas

z/OS Security Server RACF Callable Services

z/OS Cryptographic Services PKI Services Guide and Reference

System SSL: Cache session identification

Description: System SSL clients and servers can specify a particular cached session ID to be used on an upcoming secure SSL/TLS connection by using the GSK_SID_VALUE and GSK_PEER_ID attribute identifiers.

When change was introduced: z/OS V2R2

Reference information:

z/OS Cryptographic Services System SSL Programming

System SSL: OCSP support and CRL updates

Description: System SSL is enhanced to:

- Support retrieval of certificate revocation lists (CRLs) through HTTP URLs specified in the certificate's CRL Distribution Points extension.
- Have more flexible processing of CRLs from a LDAP directory.
- Support retrieval of revocation information through the online certificate status protocol (OCSP). OCSP is defined in RFC 2560.

When change was introduced: z/OS V2R2

Reference information:

z/OS Cryptographic Services System SSL Programming

System SSL: PKCS #12 certificate store

Description: System SSL supports certificates and certificate keys through PKCS #12 certificate stores. A PKCS #12 certificate store is used by System SSL as a means to identify certificates and certificate keys to be used when establishing a SSL/TLS secure connection.

When change was introduced: z/OS V2R1 and z/OS V1R13 with PTFs for APAR OA45216.

Reference information:

z/OS Cryptographic Services System SSL Programming

ICSF: AES counter mode encryption support

Description: ICSF supports the counter (CTR) mode for the AES algorithm. Support for AES CTR mode is added to:
* Symmetric Key Decipher (CSNBSYD or CSNBSYD1 and CSNESYD or CSNESYD1)
* Symmetric Key Encipher (CSNBSYE or CSNBSYE1 and CSNESYE or CSNESYE1)
* PKCS #11 Secret key decrypt (CSFPSKD and CSFPSKD6)
* PKCS #11 Secret key encrypt (CSFPSKE and CSFPSKE6)

When change was introduced: PTFs for APAR OA45548 for FMID HCR77A1, HCR77A0, HCR7790, and HCR7780 and rolled into the base of Enhanced Cryptographic Support for z/OS V1R13 and z/OS V2R1 web deliverable.

Reference information:

z/OS Cryptographic Services ICSF Application Programmer's Guide

ICSF: CPACF RNG support

Description: ICSF exploits an existing instruction to:
* Instantiate and reseed a deterministic pseudo random-number generation mechanism.
* Generate a deterministic pseudo random number using the mechanism.

ICSF also added an option to entirely disable the RNG cache.

When change was introduced: Enhanced Cryptographic Support for z/OS V1R13 and z/OS V2R1 web deliverable.

Reference information:

z/OS Cryptographic Services ICSF Administrator's Guide

z/OS Cryptographic Services ICSF Application Programmer's Guide

z/OS Cryptographic Services ICSF System Programmer's Guide

ICSF: Format preserving encryption

Description: Format preserving encryption (FPE) is a method of encryption where the resulting cipher text has the same form as the input clear text. The form of the text can vary according to use and application.

When change was introduced: Enhanced Cryptographic Support for z/OS V1R13 and z/OS V2R1 web deliverable.

Reference information:

z/OS Cryptographic Services ICSF Overview

z/OS Cryptographic Services ICSF Administrator's Guide

z/OS Cryptographic Services ICSF Application Programmer's Guide

z/OS Cryptographic Services ICSF System Programmer's Guide

ICSF: KDS key archiving

Description: ICSF implemented the tracking of key usage in Cryptographic Support for z/OS V1R13 and z/OS V2R1 web deliverable (HCR77A1) and base z/OS V2R1 with the KDSR format for all key data sets. ICSF now implements a way to archive CCA keys and PKCS #11 objects.

When change was introduced: Enhanced Cryptographic Support for z/OS V1R13 and z/OS V2R1 web deliverable.

Reference information:

z/OS Cryptographic Services ICSF Overview

z/OS Cryptographic Services ICSF Administrator's Guide

z/OS Cryptographic Services ICSF Application Programmer's Guide

z/OS Cryptographic Services ICSF System Programmer's Guide

z/OS Cryptographic Services ICSF Messages

ICSF: Key material validity

Description: Key validity has two basic areas:

- Support for cryptoperiods for cryptographic objects. Cryptoperiods are enabled in ICSF through enforcement of start and end dates for KDS records. KDS record start and end dates are supported for KDSR format records only.

- Support for checking that the keys in the KDS are correctly formatted and that encrypted keys are enciphered under the current master key. If a key or keys in the CKDS or PKDS are not enciphered under the current master key, or have other formatting errors, this may cause a change MK operation to fail.

When change was introduced: Enhanced Cryptographic Support for z/OS V1R13 and z/OS V2R1 web deliverable.

Reference information:

z/OS Cryptographic Services ICSF Overview

z/OS Cryptographic Services ICSF Administrator's Guide

z/OS Cryptographic Services ICSF Application Programmer's Guide

z/OS Cryptographic Services ICSF System Programmer's Guide

z/OS Cryptographic Services ICSF Messages

ICSF: New functionality in the Crypto Express5

Description: ICSF can use the Crypto Express5 (CEX5) coprocessor, which has equivalent functionality to a Crypto Express4 (CEX4) coprocessor. Also, the CEX coprocessor short name has been changed for:

A CCA coprocessor:

CEX4C changed to 4C*xx*

CEX5C changed to 5C*xx*

A Enterprise PKCS #11 coprocessor
CEX4P changed to 4P*xx*

CEX5P changed to 5P*xx*

An accelerator
CEX4A changed to 4A*xx*

CEX5A changed to 5A*xx*

There are improved CSFINPV2 diagnostics which saves the load module name causing the failure prior to the ABEND.

When change was introduced: Enhanced Cryptographic Support for z/OS V1R13 and z/OS V2R1 web deliverable.

Reference information:

z/OS Cryptographic Services ICSF Overview

z/OS Cryptographic Services ICSF Administrator's Guide

z/OS Cryptographic Services ICSF Application Programmer's Guide

z/OS Cryptographic Services ICSF System Programmer's Guide

z/OS Cryptographic Services ICSF Writing PKCS #11 Applications

ICSF: Support architecture for greater than 16 domains

Description: ICSF is enhanced to use the AP queue number (APQN) format supporting greater than 16 domains.

When change was introduced: Enhanced Cryptographic Support for z/OS V1R13 and z/OS V2R1 web deliverable and PTFs for APAR OA44910 for FMID HCR77A1, HCR77A0, HCR7790, and HCR7780.

Reference information:

z/OS Cryptographic Services ICSF Overview

z/OS Cryptographic Services ICSF Administrator's Guide

z/OS Cryptographic Services ICSF System Programmer's Guide

ICSF: UDX exit support

Description: ICSF provides support for a new CSFQACP exit for use with UDX routines. ICSF provides a single CSVDYNEX exit that gets control for all services. This exit is called at the completion of each callable service, but before the service returns control to the application program. The intent of CSVDYNEX is for statistics generation. Formatting support to CTRACE for UDX routines is also added.

When change was introduced: Enhanced Cryptographic Support for z/OS V1R13 and z/OS V2R1 web deliverable. PTFs for APAR OA44816 for FMID HCR77A1, HCR77A0, and HCR7790 introduced support for the CSFQACP exit.

Reference information:

z/OS Cryptographic Services ICSF Application Programmer's Guide

z/OS Cryptographic Services ICSF System Programmer's Guide

z/OS Cryptographic Services ICSF Messages

PKI Services: Enterprise PKCS#11 secure key support

Description: PKI Services can now create secure keys in TKDS during certificate creation and return a PKCS#12 package containing the secure key to the requester.

When change was introduced: z/OS V2R1

Reference information:

z/OS Cryptographic Services PKI Services Guide and Reference

z/OS Security Server RACF Callable Services

z/OS Security Server RACF Command Language Reference

z/OS Security Server RACF Macros and Interfaces

z/OS Security Server RACF Security Administrator's Guide

PKI Services: RFC 5280 and 4523 currency

Description: Enable PKI Services to optionally create the path length value in the Basic Constraints extension to restrict a CA from signing another subordinate CA. Also, PKI Services provides an option to specify the binary attribute when posting a certificate or CRL to LDAP to suit the need of different types of LDAP servers.

When change was introduced: z/OS V2R1

Reference information: *z/OS Cryptographic Services PKI Services Guide and Reference*

PKI Services: Extended Validation (EV) certificate

Description: This enhancement supports the RDNs needed for Extended Validation (EV) certificates, from z/OS PKI Services, that requires validation on certificates.

When change was introduced: z/OS V2R1

Reference information:

z/OS Cryptographic Services PKI Services Guide and Reference

PKI Services: Certificate administration support

Description: Enable multiple PKI Services administrators granular control to perform different actions on different types of certificates on different domains and provide them the visibility of the signing algorithm when reviewing requests and certificates to ensure compliance with enterprise security policy.

When change was introduced: z/OS V2R1

Reference information:

z/OS Cryptographic Services PKI Services Guide and Reference

z/OS Security Server RACF Callable Services

z/OS Security Server RACF Command Language Reference

z/OS Security Server RACF Data Areas

z/OS Security Server RACF Macros and Interfaces

z/OS Security Server RACF Messages and Codes

z/OS Security Server RACF Security Administrator's Guide

z/OS Security Server RACF System Programmer's Guide

z/OS Security Server RACROUTE Macro Reference

System SSL: Transport Layer Security (TLS) protocol version 1.2

Description: TLS V1.2 protocol support is provided according to RFC 5246, for establishing secure connections between two communicating partners. TLS V1.2 adds support for exploiters to use higher strength cryptographic ciphers. TLS V1.2 main objectives are to replace the standard SHA-1/MD5 pseudorandom function (PRF) with a cipher-based PRF based on SHA-256, add support for SHA-256 based ciphers and allow client applications to specify what signature/hash values are supported for digital signatures.

When change was introduced: This function is available for z/OS V2R1 and rolled back to z/OS V1R13 with PTFs for APAR OA39422.

Reference information:
> *z/OS Cryptographic Services System SSL Programming*

System SSL: Suite B Cryptography

Description: System SSL is enhanced to provide Suite B Cryptography based on RFC 5430 - Suite B Profile for Transport Layer Security. RFC 5430 defines an implementation of the TLS V1.2 protocol that conforms to the Suite B guidelines. Suite B defines a set of security levels that require the key establishment and authentication algorithms that are used in a TLS session to be based on Elliptic Curve Cryptography (ECC) and the encryption algorithm to be AES based.

The security levels are:
- 128-bit security level corresponds to an elliptic curve size of 256 bits and AES-128
- 192-bit security level corresponds to an elliptic curve size of 384 bits and AES-256

When change was introduced: z/OS V2R1

Reference information:
> *z/OS Cryptographic Services System SSL Programming*

System SSL: Enhanced DSA Support

Description: System SSL's **gskkyman** certificate utility and Certificate Management (CMS) APIs are being enhanced to support 2048-bit DSA key pairs and DSA digital signatures using SHA-224 and SHA-256.

When change was introduced: z/OS V2R1

Reference information:
> *z/OS Cryptographic Services System SSL Programming*

System SSL: RFC 5280 PKIX certificate and CRL profile currency

Description: The certificate management API, **gsk_validate_certificate_mode()**, is enhanced to accept a new mode value to indicate RFC 5280. The SSL/TLS APIs for setting and getting environment and session attributes are also enhanced to support a new enumeration value to indicate certificate validation is to be performed according to RFC 5280.

When change was introduced: z/OS V2R1

Reference information:

z/OS Cryptographic Services System SSL Programming

System SSL: SAF key ring validation

Description: In z/OS V1R13, and earlier releases of System SSL, SAF key ring validation was designed to stop full validation at the first CA trust anchor in the SAF key ring. This support gives the capability to the application to indicate that certificate validation using SAF key rings must be performed up to and including the root CA certificate.

The certificate management API, **gsk_validate_certificate_mode()**, is enhanced to accept a new optional parameter to indicate full validation. The SSL/TLS APIs for setting and getting environment attributes are also enhanced to support a new attribute type (GSK_CERT_VALIDATE_KEYRING_ROOT) and two new enumeration values (GSK_CERT_VALIDATE_KEYRING_ROOT_ON and GSK_CERT_VALIDATE_KEYRING_ROOT_OFF) to indicate full or partial validation.

When change was introduced: z/OS V2R1

Reference information:

z/OS Cryptographic Services System SSL Programming

System SSL: Enterprise PKCS#11 hardware security module

Description: Currently, System SSL supports clear key PKCS #11 token private key objects. With the Crypto Express4S coprocessor configured in Enterprise PKCS #11 mode, support is available for secure PKCS #11 keys. System SSL's PKCS #11 token support is enhanced for secure private keys. This support allows System SSL to use the secure PKCS #11 token private keys in SSL/TLS secure connections that include the Certificate Management APIs (CMS) API interfaces that use private keys.

When change was introduced: z/OS V2R1

Reference information:

z/OS Cryptographic Services System SSL Programming

System SSL: gskkyman certificate creation menus refined

Description: System SSL's **gskkyman** certificate creation menus are refined to step the user of **gskkyman** through different selection menus to define the characteristics of the certificate or certificate request. Depending on what is being created, these characteristics can include certificate authority or user/server certificate, key type, key size, and digital signature algorithm.

When change was introduced: z/OS V2R1

Reference information:

z/OS Cryptographic Services System SSL Programming

DFSMS new functions to consider

This topic describes new DFSMS functions in z/OS.

Advanced Copy Services new functions

This topic describes new Advanced Copy Services functions in z/OS.

Advanced Copy Services enhancements for z/OS V2R2

z/OS V2R2 adds the following Advanced Copy Services enhancement:

- The XRECOVER command now accepts CHECK and FORCE parameters, to control XRECOVER enhanced checking.

Advanced Copy Services enhancements for z/OS V2R1

z/OS V2R1 adds the following Advanced Copy Services enhancement:

- XADDPAIRed primary volumes can remain offline when you issue the XSTART command for restart or the XADDPAIR command for suspended pairs. Utility volumes and secondary volumes must be online when you issue the XADDPAIR command.

DADSM/CVAF new functions

This topic describes new DADSM/CVAF functions in z/OS.

DADSM/CVAF enhancements for z/OS V2R2

SMS provides the following enhancements:

- A new parameter with the OBTAIN macro allows the caller to specify that if the resource is not available, the I/O read should not queue on the resource and wait. For more information, refer to Reading DSCBs from the VTOC Using OBTAIN in *z/OS DFSMSdfp Advanced Services*.

DADSM/CVAF enhancements for z/OS V2R1

The LSPACE macro now allows the caller to have obtained the SYSVTOC ENQ resource on the volume prior to calling LSPACE for that volume. A new ENQHELD keyword on the LSPACE macro specifies whether or not the LSPACE caller's address space has already obtained the SYSVTOC resource.

DFSMS catalog new functions

This topic describes new DFSMS catalog functions in z/OS.

DFSMS catalog enhancements for z/OS V2R2

The catalog component of DFSMS provides the following enhancements:

- **DUMPON support for catalog front end modules**: When you request CAS dynamic dumping with the MODIFY CATALOG,DUMPON command, you can now specify modules involved in catalog front end processing. For more information, refer to MODIFY CATALOG in *z/OS DFSMS Managing Catalogs*.
- **GDGSCRATCH parmlib variable**: The new GDGSCRATCH(YES|NO) parmlib variable provides the ability to specify whether the default should be SCRATCH or NOSCRATCH when defining a base GDG. See "DEFINE GENERATIONDATAGROUP" in *z/OS DFSMS Access Method Services Commands*.

  The MODIFY CATALOG,REPORT command is enhanced to indicate whether the GDGSCRATCH feature is enabled or disabled.
- **Extended format for generation data groups (GDGs)**: The new EXTENDED parameter of the IDCAMS DEFINE GDG command allows a new GDG to contain up to 999 generation data sets (GDSes). The previous GDS limit of 255

GDSes still applies for existing GDGs, and for new GDGs that do not specify the new extended format. For extended format GDGs, the LIMIT parameter of the IDCAMS DEFINE GDG command and the IDCAMS ALTER LIMIT command are enhanced to let you set a new GDS limit of up to 999. See "DEFINE GENERATIONDATAGROUP" and "ALTER" in *z/OS DFSMS Access Method Services Commands*.

- **Restore a user catalog to any volume**: You can now logically restore a user catalog to any volume with the same device type as the volume from which it was dumped. Previously, you could restore only to the same volume. Physically restoring a user catalog is not changed — it must be done to the same volume as the volume from which the user catalog was dumped. For more information, refer to Restoring integrated catalog facility catalogs in *z/OS DFSMSdss Storage Administration*.

- **Catalog attributes health check**: This enhancement is designed to inspect all the catalogs currently defined in the user's environment for shareoptions and DASD status and report any inconsistencies between the two. The CATALOG_ATTRIBUTE_CHECK will notify the system programmer of any inconsistent catalog(s) in their environment. The notification will be done in the form of a report in the message buffer using SDSF. The system programmer can decide to redefine or alter the inconsistent catalog(s) with the correct shareoptions at a convenient time. For more information, refer to *z/OS MVS System Messages, Vol 9 (IGF-IWM)* and *IBM Health Checker for z/OS User's Guide*.

- **IDCAMS VERIFY RECOVER ENHANCEMENT**: This enhancement will now allow for 3 ways to run the VERIFY command:
  - IDCAMS VERIFY: Original way as it is now where IDCAMS opens the data set for output and then issues the VERIFY macro with no options and then closes the data set.
  - IDCAMS VERIFY RECOVER: Currently the RECOVER option causes VSAM Record Management VERIFY to back out or complete any interrupted CA reclaim in addition to regular IDCAMS VERIFY functions. There will be no change to this way of running VERIFY.
  - EXAMINE/IDCAMS VERIFY RECOVER: This will be a new enhancement that is functional only when EXAMINE and VERIFY RECOVER are run in the same IDCAMS job step. EXAMINE has been enhanced to pass the error information that it finds (such as index CI#, data CI#, error type, and so forth) to VERIFY. As long as there is no concurrent access on the data set, VERIFY will attempt to repair any errors that it can.

- **IDCAMS small enhancements**: There are multiple small enhancements in IDCAMS:
  - A new parameter has been introduced to allow the user to control adding the TSO user id as a prefix when running LISTCAT as a TSO command. This new parameter is PREFIX/NOPREFIX.
  - A new option "CIMODE" has been introduced in the PRINT command and REPRO command to process data sets using CI level processing. This will allow the PRINT and REPRO commands to be able to read a broken VSAM ESDS dataset and extract the good records from it.

- **IDCAMS RAS enhancements**: There are multiple RAS enhancements in IDCAMS:
  - **IDCAMSPARM(TEST) enhancement**: AMS commands use system adapters UGPOOL, UGSPACE, UGSPC16 to obtain core storage for command processing. Some of the commands such as PARM(TEST) have 31 bit support but still perform below the line, because those system adapters use a macro

version of getmain/freemain (MF) that does not actually obtain the storage above the line as expected even though "LOC=ANY" is specified on the call of getmain.

– **REPROMERGECAT output enhancement**: IDCAMS will provide new optional keywords, MESSAGELEVE(ALL|SHORT) for REPRO MERGECAT. These options will provide existing or condensed output listings. ALL is the default.

- **CSI Enhancements**: This enhancement includes new CSI fields. For more information, refer to Sample Z Entry Request Output in *z/OS DFSMS Managing Catalogs*.

- **Catalog modify command security enhancements**: This enhancement will allow the MODIFY command for Catalog to separate authorization for those sub-commands which provide reporting capabilities from those sub-commands which alter the catalog environment. This is achieved by defining a new RACF Resource for the OPERCMDS class and permitting selected users with READ or UPDATE access.

- **New option for GDG management - PURGE**: This enhancement adds a new PURGE option to the DEFINE and ALTER commands. Additionally, it adds a new LISTCST field to print the PURGE option. The PURGE option is valid only when the SCRATCH option is specified. It will override expiration dates when deleting generation data sets (GDSes). If not specified, the default is NOPURGE, but this can be overridden by the new GDGPURGE parmlib variable.

DFSMS catalog enhancements for z/OS V2R1

The catalog component of DFSMS provides the following enhancements:

- **VSAM record-level sharing (RLS) directory only caching**: This enhancement adds new DIRONLY parameter to DATACLAS RLSCFCACHE, which specifies that RLS not cache the data or index part of the VSAM data set in the coupling facility cache structure.

- **Generation data set (GDS) support for PDSE data sets**: This enhancement removes the restriction against defining an SMS-managed partitioned data set extended (PDSE) as a generation data set (GDS). Both allocating a PDSE and defining a generation data group with generation data sets, including PDSEs, is unchanged. See "DEFINE GENERATIONDATAGROUP" in *z/OS DFSMS Access Method Services Commands*.

  You must have a system at the z/OS V2R1 level or higher to exploit the ability to define a PDSE as a generation data set. Attempts to define a PDSE as a generation data set on a system below the z/OS V2R1 level fails. In a mixed sysplex environment, systems below the z/OS V2R1 level see PDSE generation data set as a simple generation data set. Note also that DFSMShsm and DFSMSdss are unable to migrate or copy a PDSE generation data set from a z/OS V2R1 or higher system to pre-V2R1 systems. See "Data Set Organization of Generation Data Sets" in *z/OS DFSMS Using Data Sets*.

  The LISTCAT ENTRY output is enhanced to indicate when a generation data set is a PDSE by adding the DSNTYPE field with a value of LIBRARY.

- **New CSI field names**: You can now access the following fields using the Catalog Search Interface (CSI): ASSOC, ASSOCSYB, BUFND, BUFNI, HILVLRBA, INDXLVLS, SEQSTRBA, STRNO, and TRACKS.

  See "Field Name Directory" in *z/OS DFSMS Managing Catalogs*.

- **JES3 allocation assist tape TS7700**: For scratch and specific allocations, this enhancement allows you to use JES3 to direct the allocations to candidate clusters for scratch mounts or to particular distributed library clusters for specific mounts in the TS7700 Virtualization Engine.

- **Validate and remove an incorrect DEB address from the DEB table with new new PURGE,PURGE=FORCE option on the DEBCHK macro**: This function introduces the new PURGE,PURGE=FORCE option for the DEBCHK macro that tells catalog to validate and remove an incorrect DEB address from the DEB table. This is used when a DEB is FREEMAINed, but, for some reason the DEB table was not updated to remove that DEB address from the table. For example:

  1. An incorrect length in subpool 230 was FREEMAINed, including one or more DEBs

  2. An incorrect address was passed to FREEMAIN, including one or more DEBs.

  3. DEB storage was incorrectly overlaid, which destroys the next DEB pointer in that DEB, preventing the application program from closing subsequent DEBs in that chain.

  4. DEB storage was incorrectly overlaid, which destroys the next DEB pointer in that DEB. The system follows the DEB chain in the TCB for the terminating task and calls CLOSE for each DEB that the task neglected to close. If a CLOSE fails, the DEB is removed from the TCB DEB chain and from the DEB table. However if it gets a program check while following the DEB chain, it abandons the rest of the DEBs on the current TCB chain.

  The new PURGE,PURGE=FORCE option on the DEBCHK macro can prevent these problems by removing the DEB pointer from the DEB table without checking the DCB (or ACB). The caller must be in system key, supervisor state, hold the local lock, and the passed DEB pointer must exist in the DEB table but not not represent a valid DEB. See "Ensuring Data Security by Validating the Data Extent Block (DEBCHK macro)" in *z/OS DFSMSdfp Advanced Services*.

- **IDCAMS support for large block interface (LBI)**: This enhancement allows IDCAMS REPRO and PRINT commands to perform on data sets with a blocksize larger than 32K, up to the maximum that the LBI interface supports, if the LBI feature is enabled. The blocksize is still limited to 32K when the LBI feature is not enabled. See the following:

  - To enable LBI, see *z/OS DFSMS Using Data Sets*

  - For the IDCAMS PRINT and REPRO commands, see *z/OS DFSMS Access Method Services Commands*.

- **Catalog contention detection enhancements**: The new MODIFY CATALOG,CONTENTION command can be used to specifies a new wait time or action (or both) for one of the reason classes or Catalog resources for which contention detection is available (ALLOCLCK, SYSIGGV2, SYSZTIOT, and SYSZVVDS). See *z/OS DFSMS Access Method Services Commands* for information on the MODIFY CATALOG,CONTENTION command.

- **Generation data group enhancements**: You can now specify the order in which the generation data set list is to be returned for data set allocation when the generation data group (GDG) name is supplied on the DD statement. GDG entries can now be returned in either FIFO (oldest GDS defined to the newest GDS) or LIFO (newest GDS defined to the oldest GDS) order for concatenation. See *z/OS DFSMS Access Method Services Commands* for information on the new FIFO and LIFO parameters for the ALTER and DEFINE GENERATIONDATAGROUP commands.

  Also see *z/OS DFSMS Managing Catalogs* for information on activating the new GDG FIFO function using the IGGCATxx keyword GDGFIFOENABLE.

- **Catalog alias enhancements**:

  - IDCAMS now resolves the symbolic related name for an alias to make sure requests are oriented to the correct catalog. Previously, orientation was to the master catalog, which could cause unexpected results. The restriction on the

IDCAMS DEFINE ALIAS command that the resolved value for entryname must be a catalog entry that is located in the same catalog that contains the value for aliasname has been removed. See *z/OS DFSMS Access Method Services Commands* for information on the IDCAMS DEFINE ALIAS command.

– IDCAMS DEFINE ALIAS command will record the alias creation date. This date can be helpful when cleaning up obsolete high level qualifiers. If an alias has no associated data sets, the alias creation date can be used to determine whether this is a new alias for which no data sets have been created yet or this is an obsolete alias that should be deleted.

– IDCAMS will now check when deleting a catalog entry that has an associated alias to verify that the alias is related to the entry being deleted, before deleting the alias record. For example, non-VSAM record A has alias association C, but alias C has association D in its X record. In this case, the alias C should not be deleted when data set A is deleted. This check is done for all non-VSAM, GDS, and UCON records.

DFSMSdfp utility new functions

This topic describes new DFSMSdfp utility catalog functions in z/OS.

DFSMSdfp utility enhancements for z/OS V2R1

z/OS V2R1 adds the following DFSMSdfp utility enhancements:

- The IEBCOPY utility is enhanced with user exit capabilities for specifying control statements and for specific member selection.
- IEBCOPY's group copy function is expanded to include PDS to PDS member group copies. A new statement, COPYGROUP, provides the same functions as the existing COPYGRP statement, and expands it to support group copies when both the input and the output data set are PDSs.
- IEBCOPY's SELECT statement also has been enhanced to allow wild card characters in the specification of member names, when used with the COPYGROUP statement. Member name filter pattern masking, using the asterisk (*) and percent (%) characters, allows you to specify a wide range of similar member names. If you use member name filter pattern matching on a SELECT statement with COPYGROUP, you can also code a corresponding EXCLUDE statement with member name filter pattern matching.

The IEBCOPY utility is also enhanced to provide an ABEND code and the associated reason code in a structure returned in register 0, for certain ABENDs. Starting in z/OS V2R1, IEBCOPY returns this information if an ABEND occurs in the FAMS subcomponent. For details, see the IEBCOPY return code information in Appendix A of *z/OS DFSMSdfp Utilities*.

Also in z/OS V2R1, IEBCOPY introduces a new COPYGROUP statement that provides the same function as the COPYGRP statement but also performs that same function for a PDS to PDS copy. (With COPYGRP, when the input and output data sets are both PDSes, the operation is treated as a simple COPY operation, not a group copy.)

Use the COPYGROUP statement to begin a group copy, unload, or load. A group consists of a member and all of its aliases. COPYGROUP treats the group as a single entity.

You can use COPYGROUP to copy a data set in the following situations:
- PDS to PDS
- PDS to PDSE

- PDSE to PDS
- PDSE to PDSE.

You can use COPYGROUP for unloading groups in the following situations:
- PDS to PS
- PDSE to PS

You can use COPYGROUP for loading groups in the following situations:
- PS to PDSE
- PS to PDS

When using the COPYGROUP statement:
- All aliases in a group will be copied with the member or neither the aliases nor the member in a group will be copied.
- There can be only one INDD per copy operation.
- You can use the SELECT statement to selectively copy members. Either the member name or an alias can be specified to copy the member and all of its aliases.
- Do not indicate replace (R) on the SELECT statement.
- The EXCLUDE statement is not supported unless a SELECT MEMBER statement uses pattern filter matching and the EXCLUDE statement does also.

For complete details on using the new COPYGROUP statement, see the IEBCOPY chapter in *z/OS DFSMSdfp Utilities*.

DFSMSdss new functions

This topic describes new DFSMSdss functions in z/OS.

DFSMSdss enhancements for z/OS V2R1

z/OS V2R1 introduces the following enhancements for DFSMSdss:
- A RESET keyword has been added to the RESTORE FULL and RESTORE TRACKS commands. It specifies whether the data-set-changed indicator is reset for the data sets on the volume being restored. You can protect the use of RESET with the RESTORE command. In addition, you can now protect the use of RESET with the DUMP command.
- A DEBUG(SMSMSG) option has been added to the CONVERTV command, the COPY command for logical and physical data sets and the RESTORE command for logical and physical data sets. It instructs DFSMSdss to include ACS WRITE statements in the job output.
- The FCCGVERIFY keyword on the CGCREATED command now accepts multiple volume serials.
- The REPLACEUNCONDITIONAL keyword on the RESTORE command now works for physical data sets.
- The RENAMEUNCONDITIONAL keyword on the RESTORE command, which previously worked only on non-VSAM physical data sets, will now work on VSAM physical data sets, as well.

DFSMShsm new functions

This topic describes new DFSMShsm functions in z/OS.

DFSMShsm enhancements for z/OS V2R2

DFSMShsm provides the following enhancements:

| • **Storage tiers enhancements**: The DFSMShsm MIGRATE command is enhanced to support processing of one or more storage groups, and both class transitions and data set moving at the volume level, storage group level, and data set level.

| • **Distributed tape processing enhancements**: Administrators can distribute the processing of dump copies (FRBACKUP DUMP, BACKVOL DUMP, auto-dump) to all DFSMShsm tape resources available in a group of DFSMShsm hosts.

| • **Message simplification**: To simplify the analysis of fast replication errors for FRBACKUP and FRRECOV COPYPOOL requests, DFSMShsm now collects all related DFSMShsm and DFSMSdss messages and records them in a unique fast replication message data set. Control this option with the SETSYS FASTREPLICATION command. For more information, see that command descriptions in *z/OS DFSMShsm Storage Administration*.

DFSMShsm enhancements for z/OS V2R1

In z/OS V2R1, DFSMShsm is enhanced with the following new functions:

• **Storage tiers**

In previous releases, DFSMShsm treated all data in Level 0 (L0) as being in one single tier in the overall storage hierarchy, with no policies to enable automated data movement within that L0 tier. In this release, DFSMShsm is enhanced to move data from one class of devices to another within the L0 hierarchy.

• **Increased tape limit**

To allow DFSMShsm to migrate and back up larger data sets, the DFSMShsm limit of the number of tapes that a DFSMShsm migration or backup data set can span has been increased from 40 to 254. RECYCLE will now also process connected sets of up to 254 volumes.

The DFSMShsm MCD, MCC, and FSR records have been extended to contain up to 254 volumes. FSR records that list more than 144 tape volsers will be truncated when written to the DFSMShsm log data sets. This will affect the ARCPRLOG and ARCPEDIT output. The formatted dump of each FSR in the ARCPRLOG output will include only the portion of the FSR that was written to the log. When the output volsers included in an FSR for RECYCLE have been truncated, the ARCPRLOG and ARCPEDIT output will display "TOVOL=******".

• **Migration subtasking**

A MIGRATIONSUBTASKS(YES | NO) parameter has been added to the SETSYS command. It allows DFSMShsm to run multiple subtasks concurrently under each migration task for primary space management, on-demand migration, and interval migration on level 0 volumes that migrate data sets to ML1 or ML2 volumes.

The ADDITIONALSUBTASKS(*nn*) subparameter allows you to dynamically change the number of additional subtasks that the system can use, running under each migration task. These additional subtasks add to the number of subtasks that the system already uses when the MIGRATIONSUBTASKS parameter is specified. Note that the actual number of total subtasks used can vary. In general, the total migration subtasks used will be lower if a large value is specified with the maximum migration tasks (MAXMIGRATIONTASKS) parameter. Conversely, the total migration subtasks used will be higher, up to 15, if a smaller value is specified with the maximum migration tasks (MAXMIGRATIONTASKS) parameter.

By processing data sets in migration subtasks for a level 0 volume migration task, the aggregate throughput of all the migration tasks is improved.

• **Fast replication enhancements:**

– **Recovering a data set to a new name during fast replication data set recovery**

A NEWNAME(*newdsname*) parameter has been added to the FRRECOV command. It allows DFSMShsm to use a new, fully-qualified data set name for the recovered backup version or dump copy.

– **Recovering a data set to any volume during fast replication data set recovery**

DFSMShsm fast replication data set recovery will no longer be restricted to recovering data sets back to the original volumes. If DFSMShsm is not able to recover a data set to the original volumes, it will instead select the most eligible volumes with the most free space within the storage group. There are no changes to the DFSMShsm commands.

– **FlashCopy® consistency groups**

DFSMShsm fast replication backup will now support FlashCopy consistency groups. A new FlashCopy consistency group option will be added to the SMS copy pool definition. If set to 'Yes' for the copy pool, it indicates that the copy pool backup version must be data-consistent. If the FlashCopy consistency group function fails, the FRBACKUP command will be terminated and the new or in-process copy pool backup version will be invalidated. The FlashCopy consistency group option can be used in combination with other FlashCopy options.

For more information, refer to the topic "Defining copy pools" in *z/OS DFSMSdfp Storage Administration*.

• **Serviceability and usability enhancements:**

– **Automatically generating a new recycle command when tape take-away occurs during recycle**

A RECYCLETAKEAWAYRETRY(YES | NO) parameter has been added to the SETSYS command. It allows DFSMShsm to automatically generate a new RECYCLE command for a tape when the original recycle must terminate due to the takeaway process, or when the tape is in use by the another DFSMShsm task. Two additional subparameters, MAXRETRYATTEMPTS(*nn*) and DELAY(*ssss*), allow you to set the maximum number of recycle retry attempts and to set the delay interval in seconds between recycle attempts, respectively.

In addition, a SELECT(RECYCLETAKEAWAY) subparameter has been added to the LIST TAPETABLEOFCONTENTS command. It displays the volumes that were not completely recycled because they were taken away by recall or another DFSMShsm task

– **Using recycle instead of tapecopy for failed alternate tape**

A (TAPECOPY | RECYCLE) subparameter has been added to both the BACKUP and the MIGRATION parameters of the SETSYS DUPLEX command. It specifies whether, after an error occurs on the duplex alternate tape and the alternate tape is demounted and discarded so that DFSMShsm can continue to write to the original tape, a tapecopy or a recycle will be immediately attempted.

– **Resetting the data-set-changed indicator for data sets restored during full volume recover processing**

A RECOVERRESET keyword has been added to the DEFINE DUMPCLASS command. It specifies whether the data-set-changed indicator in the VTOC entry is reset for all data sets that are restored during full volume recover processing.

– **Additional output from QUERY ACTIVE(TCBADDRESS)**

The output returned from the QUERY ACTIVE(TCBADDRESS) command will now include the tape volser, device address, and task name.

– **SMSVSAM server errors**

When an SMSVSAM server error occurs, DFSMShsm will now detect the error and quiesce all CDS I/O activity. Once the SMSVSAM server initializes, DFSMShsm will automatically close and reopen the CDSs, and resume all requests waiting for CDS I/O operations.

If the SMSVSAM server does not initialize within five minutes after DFSMShsm detects the error, or if the server initializes but then immediately becomes unavailable again, DFSMShsm will shut down. If RESTART is not specified in the startup procedure, or if DFSMShsm is unable to restart within the allotted amount of time, the user must restart DFSMShsm when the SMSVSAM server initializes.

DFSMSrmm new functions

This topic describes new DFSMSrmm functions in z/OS.

DFSMSrmm enhancements for z/OS V2R2

The functional enhancements available with z/OS V2R2 DFSMSrmm provide you with these benefits:

- **DFSMSrmm operational enhancements**
  - *Specify expiration time for volumes and data sets:* DFSMSrmm now specifies an expiration time, in addition to an expiration date, for volumes and data sets, thus allowing greater control of exactly when a volume or data set is to expire.

    The expiration time will be set to the current time whenever RETPD is used in the JCL, as a default, or in ADDDATASET, ADDVOLUME, CHANGEDATASET, or CHANGEVOLUME subcommands. When EXPDT is used instead of RETPD (in JCL or on a DFSMSrmm subcommand), the expiration time will be set to midnight.

    In addition, the CHANGEDATASET and CHANGEVOLUME commands have been enhanced to enable the user to specify the time (in *hhmmss* format) that should be used, in addition to the date, when deciding when to expire volumes and data sets.

    The ability to specify both the expiration time and date will be helpful to customers using the EXPDT retention method. For example, you might have data sets created shortly before midnight with a default retention period of one day. This new function will allow you to ensure these data sets do not expire in a few minutes and are kept at least for 24 hours.

  - *Search volumes and data sets by date/time ranges:* The SEARCHDATASET and SEARCHVOLUME commands have been enhanced to enable the user to specify the time (in *hhmmss* format) in addition to the date when searching for volumes and data sets by the creation date.

    The ability to select records by both the creation time and date will be helpful to customers using the EXPDT retention method. For example, the daily night batch processing might create tapes starting from 8 PM and until 5 AM on the next day. This new function will allow you to assign the same expiration date to all of these volumes, even though they were created on different calendar days.

  - *Specify that a data set not expire while cataloged:* A new WHILECATALOG option has been added to the EDGRMMxx parmlib member OPTION command and to the CHANGEDATASET TSO subcommand to enable the user to specify either that:

- the dataset will be kept as long as it is cataloged. If the dataset is uncataloged, it will still be kept if the expiration date has not been reached yet.
- the dataset will be kept as long as it is cataloged, but no later than the expiration date.

DFSMSrmm enhancements for z/OS V2R1

The functional enhancements available with z/OS V21R1 DFSMSrmm provide you with these benefits:

- **DFSMSrmm operational enhancements**
  - *Retain data sets based on the number of days since they were last referenced:* Data sets managed by the EXPDT retention method can be retained or expired based on the number of days since the data set was last referenced. A new *LastReferenceDays* attribute is added to the data set record as a binary number. The value is taken from the new LASTREF suboperand of the DFSMSrmm parmlib OPTION RM(EXPDT) operand

    If the volume set is retained by SET or VOLUME the LastReferenceDays data set attribute will be kept equal for all files of a multi-volume data set. The latest *LastReferenceDays* update to a single file in a multivolume data set is propagated to all files that belong to the same multi-volume data set. However, for volume set retained by FIRSTFILE the *LastReferenceDays* data set attribute will be set but not equalized across the multi-volume data set because the expiration date depends only of the first file of the first volume, and its *LastReferenceDays*.

    The *LastReferenceDays* value can be:
    - Set by the ADDATASET subcommand when the data set record is created
    - Changed by the CHANGEDATASET subcommand any time after the data set record has been created.

  - *EXPDT retention method now allows retention to be based on a single volume or volume set, or on a controlling first file:* You now have the option of retaining volumes with the EXPDT retention method based on a single volume or volume set, or on a controlling first file. The parmlib OPTION RM(EXPDT(RETAINBY(VOLUME/SET/FIRSTFILE))) can specify:

    RETAINBY(VOLUME)
    DFSMSrmm expires volumes in a multi volume set at the volume level. Each volume has its own expiration date. RETAINBY(VOLUME) is the default value.

    RETAINBY(SET)
    DFSMSrmm expires volumes in a multi volume set at the volume set level. All volumes in the set have the same expiration date, which is the maximal expiration date of all volumes (except if changed by the CV command).

    RETAINBY(FIRSTFILE)
    DFSMSrmm expires volumes in a multi volume set at the volume set level. All volumes in the set have the same expiration date, which is the expiration date of the first file in the volume set (here a single volume is treated as a volume set with only one volume in it).

    You can also set the RETAINBY for a specific volume set by subcommand.

    Note: These new options apply only to the EXPDT retention method, not to the VRSEL expiration method. The processing of volume sets managed by the VRSEL retention method is unchanged.

– *DFSMS Management Class attributes:* You can now set the expiration date in DFSMSrmm for a tape data set with a DFSMS Management Class (MC). When you enable use of MC attributes by DFSMSrmm, the MC expiration attributes (except the MC Expiration attribute Retention limit) are retrieved by DFSMSrmm during OPEN for output and used to set the expiration date for the tape data set, and also to set the LASTREF extra days in the tape data set record on retention method EXPDT managed volumes. Regardless of whether the expiration attributes are retrieved from MC, from a DFSMSrmm default parmlib option or from an installation exit, an expiration date is calculated and will be used to manage expiration. Any attributes needed to continue management of retention, such as 'days non-usage' are bound to the data set record in the DFSMSrmm CDS, depending on the retention method. This is a one-time action, thus avoiding any overhead of repeating the policy decisions as part of inventory management. At OPEN for input the MC attributes are not considered for processing. At OPEN for output with Disposition MOD the MC attributes are not considered for processing. The enablement in DFSMSrmm provides options to use or not use these MC attributes for all volumes, and it provides an option for VRSEL managed volumes to exclude the MC attribute 'Expire after Date/Days'. This last option is recommended if it is desired that the processing of VRSEL managed volumes not change with DFSMSrmm V2R1.

The Management Class expiration attributes processed by DFSMSrmm are:

- Expire after days Non-usage, which is equivalent to LASTREF extra days

- Expire after Date/Days, which is equivalent to expiration date / retention period.

• *Web page for DFSMSrmm conversion support:* Information on migrating to DFSMSrmm from other products, former found in the EDGCMM01 documentation member of SYS1.SAMPLIB, has been updated and moved the Z/OS web site designated for "as-is" downloads (http://www.ibm.com/systems/z/os/zos/downloads/#asis), as a zipped sequential XMIT file of a PDS.

DFSMS Object Access Method (OAM) new functions to consider

This topic describes new DFSMS Object Access Method (OAM) functions in z/OS.

Object Access Method (OAM) enhancements for z/OS V2R2

z/OS DFSMS V2R2 provides the following enhancements to the Object Access Method (OAM):

• **System-managed tape enhancements for the TS7700:** Enhancements for Release 3.2 of the TS7700 Virtualization Engine, which include a new tape attach feature for the TS7720, as well as support for 496 devices per distributed library. Support for the added devices also involves doubling the number of allowed subsystems on a scratch allocation request from 253 to 506 and a new DEVSUPxx PARMLIB option (GREATER_253). For more information, refer to *z/OS DFSMS OAM Planning, Installation, and Storage Administration Guide for Tape Libraries*.

• The OSREQ application programming interface now allows OAM applications to provide object data buffers in 64-bit addressable virtual storage above the 2G "bar" when storing object data using the OSREQ STORE function or when retrieving object data using the OSREQ RETRIEVE function. These buffers can be used for objects from 1 byte to 2000M for all destinations in the OAM storage hierarchy: DB2 (4K, 32K, LOB), file system, tape, and optical (with the existing restriction of a maximum object size of 256M for optical); this includes the source system handling in OAMplex configurations for objects less than or equal

to 50M for optical writes and reads and tape reads that are routed to another system in the OAMplex . The ability to use 64-bit addressable virtual storage buffers above the 2G "bar" on the OSREQ application programming interface can provide virtual storage constraint relief for OAM applications that have difficulty acquiring sufficient virtual storage within a 2G address space.

This new functionality can be used as an alternative to:

– Storing an object up to 2000M in parts with the OSREQ store sequence functions (STOREBEG/STOREPRT/STOREEND) where multiple OSREQ API invocations are required and the maximum size for each part is limited by the practical amount of virtual storage available below the 2G "bar" for each STOREPRT API invocation

– Retrieving an object (or a partial object) with OSREQ RETRIEVE where multiple OSREQ API invocations are required and the maximum size for each retrieve request is limited to 256M

Therefore, this new functionality could also improve the efficiency of the interactions with OAM through the OSREQ application programming interface, because only a single OSREQ API invocation is needed to store an object up to 2000M in size or to retrieve an object up to 2000M in size.

This new functionality includes:

– TSO/E OSREQ command processor changes for STORE and RETRIEVE functions

– OSREQ macro changes for the STORE and RETRIEVE functions and associated new reason codes

– CBROSR2 sample program changes in support of the OSREQ macro changes.

Notes:

1. The OSREQ application programming interface remains AMODE 31.

2. The maximum possible OAM object size remains unchanged at 2000M.

Object Access Method (OAM) enhancements for z/OS V2R1

z/OS DFSMS V2 provides the following enhancements to the object access method (OAM):

- OAM now supports tape block sizes larger than 32760. A new TAPESDB keyword on the SETOAM statement in the CBROAMxx PARMLIB member can be set to enable larger block sizes. When the first object is written to an OAM tape volume, the maximum block size for the volume is established. If support for larger tape block sizes is enabled, that maximum block size is set to the optimal system-determined block size for the device. Otherwise, a maximum block size of 32760 is used. The maximum block size for all objects written to a tape volume is the maximum block size for the volume established when the first object was written regardless of the current SETOAM TAPESDB setting.

- OAM now provides a new ALLOCRETRYMINUTES keyword on the SETOAM statement in the CBROAMxx PARMLIB member, which can be set to control how long OAM makes retry attempts or to bypass retry processing entirely and issue CBR6400D immediately. This can be used with ATAM (Automated Tape Allocation Manager) processing.

- The minimum object size required to utilize Store Sequence processing (STOREBEG, STOREPRT, STOREEND) has been reduced from the previous limit of 256MB+1 to 50MB+1 for all objects except those being written to an optical volume.

- Previously, when OSMC moved an object to a different management class, existing backup copies of the object were kept. If the object moves to a

management class that requires fewer (or no) OAM backup copies, the extra
backup copies remained, but were no longer needed and waste storage space.
OAM now provides a new BACKUPDELETE keyword on the SETOSMC
statement in the CBROAMxx PARMLIB member which can be set to indicate
that OSMC should delete all unneeded OAM backup copies when processing an
object.

- OAM now provides a new SETTLIB statement for tape library settings. The
optional SETTLIB statement and its associated keywords in the CBROAMxx
PARMLIB member can be used to override the default behavior for some of the
main cartridge entry messages in a system managed tape library environment.
The SETTLIB statement and keywords are processed when the OAM address
space is started and cannot be updated by operator command. The SETTLIB
statement can be used to specify:
  - How OAM will display volume entry ignore messages during cartridge entry
    processing (DETAIL, SUMMARY, or SUPPRESS).
  - Where OAM will display volume entry ignore messages during cartridge
    entry processing (on both the console and system log or only on the system
    log).
  - Where OAM will display successful volume entry messages (CBR3610I)
    during cartridge entry processing (on both the console and system log or only
    on the system log).

PDSE new functions

This topic describes new PDSE functions in z/OS.

PDSE enhancements for z/OS V2R1

z/OS V2R1 adds the following PDSE enhancements:

- Increased PDSE member size limits. The maximum PDSE member size increases
from 15 728 639 records to 2 146 435 071 records. The larger size limit applies
to PDSEs being accessed with various sets of characteristics, including DSORG
and MACRF values, whether they are open for input or output, and whether
BLOCKTOKENSIZE=LARGE is specified. For a list of the PDSE access
characteristics that support the larger member size limit, see the topic on "PDSE
member size limits" in *z/OS DFSMS Using Data Sets*.

- New PDSE version. z/OS V2R1 introduces a new version of PDSE data sets that
can provide for improved performance, reduced path lengths, and improved
index searches. New data sets can be allocated as belonging to the new version
(version 2) by specifying a new positional parameter in the DSNTYPE keyword
of the DD statement or TSO/E ALLOCATE command, or by specifying a new
PARMLIB option (PDSE_VERSION) in IGDSMS*nn* members. Unless version 2 is
specified, new allocations continue to create the current version 1 PDSE data
sets. Externally, version 1 and version 2 PDSEs look the same, and both versions
can be open for input/output with no changes for the users. For more
information about the new PDSE version and how to specify it, see the topic
"PDSE Version" in *z/OS DFSMS Using Data Sets*.

Open/Close/End of Volume new functions

This topic describes new Open/Close/End of Volume functions in z/OS.

Open/Close/End of Volume enhancements for z/OS V2R2

Open/Close/End of Volume provides the following enhancements:

- **DEVSUP*xx* enhancements**: In previous releases, a subset of DEVSUP*xx*
keywords were reset to their default values whenever a member was processed,

unless the values were explicitly set in the member. Starting in V2R2, the current values of all keywords are preserved when a DEVSUP*xx* member is processed, unless the member explicitly specifies new values.

In addition, beginning in V2R2, multiple DEVSUP*xx* members can be specified on a single SET DEVSUP command invocation, by specifying their two-digit member suffixes separated by commas.

- **Dynamic exits for Open/Close/End of Volume**: This enhancement provides dynamic versions of the following Open/Close/End of Volume tape installation exits, which can be changed and put into effect without an IPL. In previous releases, these exits required an IPL for changes to go into effect.
  - Volume mount -- dynamic version is OCE_VOLUMEMOUNT
  - File start – dynamic version is OCE_FILESTART
  - File validate – dynamic version is OCE_FILEVALIDATE
  - File end – dynamic version is OCE_FILEEND
  - Label anomaly – dynamic version is OCE_LABELANOMALY.

  For more information, see the "Tape label processing installation exits" chapter of *z/OS DFSMS Installation Exits*

- **Controlling synchronization of files written to tape**: the new NUMFILES keyword on the SYNC parameter of the DCBE macro provides for potential performance improvements and improved recovery by letting you specify how many files should be written to tape volumes by a given job, before a synchronization occurs. For more information, see the DCBE section of *DFSMS Macro Instructions for Data Sets*

SMS new functions

This topic describes new SMS functions in z/OS.

SMS enhancements for z/OS V2R2

SMS provides the following enhancements:

- **Storage group space alert messages**: SMS provides new alert thresholds for pool storage groups, based on total space and track-managed space. For more information about the attributes, refer to the topic about Values for defining a pool storage group in *z/OS DFSMSdfp Storage Administration*.

- **User-defined ACS read-only variable**: SMS provides the ability to specify user-defined values for use with ACS routines. You use a new parameter in the IGDSMS*xx* member of PARMLIB, USER_ACSVAR. The values for USER_ACSVAR are saved when SMS is started and, during ACS processing, are passed to the ACS routines in the form of a new ACS read-only variable, &USER_ACSVAR. You can alter the values with the SETSMS command. For details on the IGDSMS*xx* member of PARMLIB, refer to IGDSMSxx in *z/OS MVS Initialization and Tuning Reference*.

- **Enhancements to SMS space constraint relief**:
  - New parameter in the data class that indicates whether space reduction on guaranteed space allocation is permitted or not
  - Support for the space reduction function on non-striped guaranteed space allocations when allocating a new data set or extending an existing data set to a new volume
  - Allocation of the largest possible space that satisfies the percentage specified in the parameter, Reduce Space Up to (%), during space reduction processing for both guaranteed space and non-guaranteed space allocation requests

– New SMS message when the Dynamic Volume Count (DVC) function is invoked.

For more information, refer to the topic about Specifying attributes to handle space constraints in *z/OS DFSMSdfp Storage Administration*.

- **SMS RAS enhancements**:
  – SMS issues a RESERVE with the resource name, IGDCDSXS, to serialize the access to SMS control data sets, ACDS and COMMDS.
  – SMS issues IGD030I messages indicating a syntax error when parameters, SELECT and DESELECT, specified in the SMS PARMLIB member extended to a third line.
  – ACS messages IGD01012I and IGD01015I are enhanced to include the data set name and the storage group name for problem diagnosis. SMS trace entries that are related to these events are also enhanced.
  – Prior to V2R2, SMS issued message IGD17800I when the specified volume(s) for a guaranteed space request or the volume provided by AMS for an AIX define can not be found in the eligible storage group list. The storage group(s) searched by SMS is not externalized to the user. To improve problem diagnosis, message IGD17800I is enhanced to display the storage group(s) that are searched.
  – The RETENTION LIMIT value in the Management Class limits the use of retention period and expiration date. Data sets that are assigned with a RETENTION LIMIT value of zero days specified in their Management Class are immediately expired with an IGD17364I message issued to the job log. This has caught some users by surprise, and they needed to recover these data sets. To facilitate this task, this item will also externalize IGD17364I to the hardcopy log. This allows the user to identify these expired data sets by searching for the IGD17364I messages in the hardcopy log. Prior to V2R2, the user may need to go through the joblogs to identify these data sets.

SMS enhancements for z/OS V2R1

In z/OS V2R1, SMS introduces these enhancements:

Exploiting clusters and extent pools in SMS volume selection: SMS improves volume selection to exploit clusters and extent pools. SMS now prefers volumes that are in the same cluster when:

- Allocating or extending a multi-volume data set if the accessibility attribute is CONTINUOUS or CONTINUOUS PREFERRED
- Allocating the target data set for the data set fast replication function.

When allocating a striped data set, SMS now attempts to allocate the stripes across separate extent pools.

Providing accurate space statistics: You can now use a VARY SMS command to update space statistics in the ACDS for a pool storage group or a DASD volume.

Providing an option to suppress SMS messages: SMS provides a new keyword in the IGDSMS*xx* PARMLIB member that allows an installation to suppress specific SMS messages.

Providing an option to guarantee that a PDS is created: SMS provides a new keyword in the IGDSMS*xx* PARMLIB member and SETSMS command that allow you to direct SMS to honor any value for DSNTYPE that specifies that a PDSE is to be allocated, regardless of whether directory blocks have been requested.

DFSMS VSAM new functions

This topic describes new DFSMS VSAM functions in z/OS.

VSAM and VSAM RLS enhancements for z/OS V2R2

z/OS V2R2 introduces the following enhancements for VSAM and VSAM RLS:

- VSAM dynamic buffer addition – LSR buffering is enhanced with a function called VSAM dynamic buffer addition, which adds buffers if no buffer is available for a given VSAM request.
- Feedback code added to message IDA9999I – when the VSAM Auto Dump function attempts but fails to capture a dump, message IDA9999I is issued with new information including a feedback code indicating the VSAM error and the job name.
- VSAM RLS locking at the control area (CA) level, rather than the data set level. This improves the performance of serialization for the following:
  - VSAM key-sequenced data sets (KSDS): control interval (CI) split, CI reclaim, and spanned record processing
  - Variable-length relative record data sets (VRRDS): CI split and CI reclaim processing.
- VSAM chained I/O for spanned records – for spanned records with NSR, if there are enough extra buffers defined for the data set, VSAM attempts to write all segments of the entire spanned record out to DASD with one single I/O (chained I/O), to improve integrity and I/O performance. For more information, see "Acquiring Buffers" in *z/OS DFSMS Using Data Sets*

VSAM and VSAM RLS enhancements for z/OS V2R1

z/OS V2R1 introduces the following enhancements for VSAM and VSAM RLS:

- The restriction that data sets accessed by VSAM RLS could not use dynamic volume count is removed. Dynamic volume count enables the dynamic addition of volumes to a DASD data set without increasing the number of candidate volumes stored in the catalog.
- The SHOWCB macro has added two new sub-parameters, BUFNOL and BUFUSE. These enhancements are used to display fields of an Access Method Control Block (ACB).
- A new data set attribute identifies whether a data set is eligible for VSAM replication.
- Expanded and new keywords for specifying record access bias and ACB RMODE31 values for a data class.

DFSORT new functions to consider

This topic describes new DFSORT functions in z/OS.

High Performance FICON (HPF) exploitation

Description: A program that invokes DFSORT, ICETOOL or ICEGENER will now be able to exploit the High Performance Ficon (zHPF) hardware. When zHPF is available, DFSORT SORT or MERGE applications will use BSAM for SORTIN, SORTOUT, and OUTFIL data sets.

When change was introduced: z/OS V2R2

Reference information: *z/OS DFSORT Application Programming Guide*

Date functions

Description: Two new date functions to calculate the week number of a given date and Age as date duration are added.

- WEEKNUM function converts a given Julian/Gregorian date to number of week. There are 2 versions of this function, the standard USA format and the ISO format.
- WEEKNUM=USA function returns an integer in the range of 1 to 54 that represents the week of the year. The week starts with Sunday, and January 1 is always in the first week.
- WEEKNUM=ISO function returns an integer in the range of 1 to 53 that represents the week of the year. The week starts with Monday and includes 7 days. Week 1 is the first week of the year to contain a Thursday, which is equivalent to the first week containing January 4.
- AGE function returns a date duration that specifies the number of years, months, and days between an input date and current date.
- Age=YMD produces an 8-byte result which has duration in years (0-9999), months (00-12), and days (00-31).
- Age=YM produces a 6-byte result which has duration in years (0-9999), months (00-12).
- Age=YD produces a 7-byte result which has duration in years (0-9999), days (00-366).

When change was introduced: z/OS V2R2

Reference information: *z/OS DFSORT Application Programming Guide*

64-bit support

Description: Eligible user programs and exits can now be written to:

- Call DFSORT from a program in 64-bit addressing mode (AMODE 64) using a new 64-bit parameter list and the entry name ICEMAN64 or SORT64
- Use DFSORT E15, E35 and E32 exits running in 64-bit addressing mode (AMODE 64)
- Pass 64-bit addressed records to DFSORT using new 64-bit parameter lists for E15, E32 and E35 exits.

When change was introduced: z/OS V2R1

Reference information: *z/OS DFSORT Application Programming Guide*

Performance and resource usage improvements

DFSORT has been enhanced to improve use of central storage in relation to system activity. The existing EXPMAX, EXPOLD and EXPRES installation options will now be evaluated in conjunction with available resources at run-time which can give you better control over how DFSORT uses available central storage resources. The likelihood of over committed central storage resources and excessive paging has been reduced, which can provide improved reliability and performance for all workloads including DFSORT.

The shipped default for EXPOLD is changed from MAX to 50%. The shipped default for EXPRES is changed from 0 to 10%.

DFSORT has been enhanced to allocate storage in smaller increments and then check resource availability before each additional increment is reserved. This can allow concurrent sort applications to better share available storage and allows sorts to stop allocating additional storage if resources are no longer available. Additionally, DFSORT's dynamic allocation of work data sets will be adjusted to reduce the likelihood of failure when a sort application is unable to obtain all of the expected central storage and must then use more disk work space than expected.

A new TUNE installation default allows you to specify whether DFSORT should allocate storage in increments with additional disk work space to minimize the risk of failure, or to allocate all storage at initialization so disk work space allocation can be reduced.

Blockset merge applications can now use storage above 16 MB virtual with more functions (such as E61, INREC, OUTREC, INCLUDE, OMIT and SUM), providing improved performance and virtual storage constraint relief.

When change was introduced: z/OS V2R1

Reference information: *z/OS DFSORT Application Programming Guide*

XTIOT, uncaptured UCBs and DSAB above 16 megabytes virtual

Description: Work data sets dynamically allocated by DFSORT will use options for XTIOT, uncaptured UCBs, and DSAB above 16 megabyte virtual to the extent that z/OS supports them.

When change was introduced: z/OS V2R1

Reference information: *z/OS DFSORT Application Programming Guide*

Extended address volumes

Description: DFSORT support for EAS-eligible data set types on Extended Address Volumes has been enhanced to increase the maximum size of a DFSORT work data set. With full track blocking, the maximum number of tracks that can be used for a single work data set has been increased from 1048576 to 16777215. In situations where DFSORT must use a reduced block size for the work data sets, less than 16777215 tracks can be used.

When change was introduced: z/OS V2R1

Reference information: *z/OS DFSORT Application Programming Guide*

Alphanumeric comparison tests

Description: New UC, LC, MC, UN, LN and MN keywords (similar to the previously available NUM keyword) now allow you to test a field for various combinations of alphanumeric characters or non-alphanumeric characters using binary (BI) format.

The new keywords allow you to select any of the following alphanumeric character sets:
- UC: Uppercase characters (A-Z)
- LC: Lowercase characters (a-z)

- MC: Mixed case characters (A-Z, a-z)
- UN: Uppercase and numeric characters (A-Z, 0-9)
- LN: Lowercase and numeric characters (a-z, 0-9)
- MN: Mixed case and numeric characters (A-Z, a-z, 0-9)

You can use these new keywords in the following comparison operands: COND, INCLUDE, OMIT, BEGIN, END, WHEN and TRLID.

When change was introduced: z/OS V2R1

Reference information: *z/OS DFSORT Application Programming Guide*

More PARSE fields

Description: You can now use up to 1000 parsed fields (%0-%999) with the PARSE function; the previous limit was 100 parsed fields (%0-%99).

When change was introduced: z/OS V2R1

Reference information: *z/OS DFSORT Application Programming Guide*

Repeating PARSE fields

Description: REPEAT=v is a new PARSE option that can be used to repeat a particular parse field definition multiple times.

REPEAT=v can be used with % to specify v identically defined consecutive parsed fields to be ignored.

REPEAT=v can be used with %n, %nn or %nnn to specify v identically defined consecutive parsed fields for which data is to be extracted. The parsed fields will start with the %n, %nn or %nnn field you select and be incremented by one for each repeated parsed field.

When change was introduced: z/OS V2R1

Reference information: *z/OS DFSORT Application Programming Guide*

Alphanumeric tests for PARSE fields

Description: STARTAFT=an, STARTAT=an, ENDBEFR=an and ENDAT=an can now be used with the PARSE function to start or end when a character from any of various alphanumeric character sets is found. New keywords for an allow you to select any of the following alphanumeric character sets:
- UC: Uppercase characters (A-Z)
- LC: Lowercase characters (a-z)
- MC: Mixed case characters (A-Z, a-z)
- UN: Uppercase and numeric characters (A-Z, 0-9)
- LN: Lowercase and numeric characters (a-z, 0-9)
- MN: Mixed case and numeric characters (A-Z, a-z, 0-9)
- NUM: Numeric characters (0-9)

When change was introduced: z/OS V2R1

Reference information: *z/OS DFSORT Application Programming Guide*

Insert a string at the end of variable-length records

Description: VLTRAIL=string is a new OUTFIL option that allows you to insert a character string (C'string') or hexadecimal string (X'yy...yy') at the end of each variable-length OUTFIL output record.

When change was introduced: z/OS V2R1

Reference information: *z/OS DFSORT Application Programming Guide*

Symbol enhancements

Description: DFSORT Symbols can now be used for many more operands. The following operands of the form KEYWORD=n can now be specified as KEYWORD=symbol where symbol represents an equivalent number (for example, if you have New_Length,25 in SYMNAMES, you can use LENGTH=New_Length wherever you can use LENGTH=25): ABSPOS, ACCEPT, ADDPOS, AVGRLEN, DO, ENDPOS, ENDREC, FIXLEN, ID, IFOUTLEN, INCR, LENGTH, LINES, MAXLEN, RECORDS, REPEAT, SAMPLE, SEQ, SKIPREC, SPLIT1R, SPLITBY, START, STARTPOS, STARTREC, STOPAFT and SUBPOS.

A symbol for a number can now be used for the length of the output field with the CHANGE operand, and for the length of the sequence number with the SEQNUM operand.

A symbol can be used for any of the new %000-%999 parsed fields.

A symbol can be used for string with the new VLTRAIL=string operand.

When change was introduced: z/OS V2R1

Reference information: *z/OS DFSORT Application Programming Guide*

Improved diagnostics

Description: DFSORT now provides specific reason codes and associated documentation to aid in diagnosing and correcting errors associated with messages ICE083A and ICE141A.

The text for message ICE118I has been changed to recommend the use of FILSZ=En.

The ICE236I options-in-effect message now includes values for TUNE, EXPMAX, EXPOLD and EXPRES.

The text for message ICE285A has been changed for clarification.

When change was introduced: z/OS V2R1

Reference information: *z/OS DFSORT Application Programming Guide*

Distributed File Service new functions to consider

Providing support for 64-bit addressing (AMODE64)

Description: To enhance performance, the z/OS kernel supports 64-bit addressing (AMODE64). zFS can now be run in the z/OS UNIX address space (OMVS), which provides additional performance enhancements.

When change was introduced: z/OS V2R2.

Reference information:
- *z/OS Distributed File Service zFS Administration*

Improved monitoring of zFS performance

Description: To allow for the monitoring of zFS performance over longer periods of time, zFS performance counters were changed from 4 bytes to 8. Information about file systems is more detailed and can be obtained more quickly with the introduction of a new API and commands. Various new sysplex-related performance reports are also available.

When change was introduced: z/OS V2R2.

Reference information:
- *z/OS Distributed File Service zFS Administration*

Improved large directory performance

Description: Performance of large directories is enhanced by using new version 1.5 aggregates and extended v5 directories. Conversion from current version 1.4 aggregates to version 1.5 aggregates can be done offline with the batch utility `ioefsult converttov5`, manually with the `zfsadm convert` command or automatically by use of the new `converttov5` IOEFSPRM configuration option and mount parameter. Version 1.5 aggregates can also be created with a `-version5` parameter on the `zfsadm format` command or with the `ioeagfmt` or `ioefsutl` format batch utilities.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS Distributed File Service zFS Administration*

Enhancements to the salvager utility

Description: The zFS salvage program `ioeagslv` was enhanced to allow for the verification and repair of large aggregates in a single pass.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS Distributed File Service zFS Administration*

Performing backup for changed aggregates

Description: zFS sets the DS1DSCHA backup change activity flag when an aggregate is changed, salvaged, or has the log replayed as a part of error recovery.

Distributed File Service (zFS and SMB)

This change allows backup programs to only perform backups for changed aggregates. Backup programs can also indicate to zFS when the backup is complete and the change activity bit can be reset.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS Distributed File Service zFS Administration*

Support added for Microsoft Windows Server 2008

Description: In z/OS V2.1, Distributed File Service provides SMB support for Microsoft Windows Server 2008 acting as a domain controller for passthrough authentication.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS Distributed File Service SMB Administration*

HCD and HCM new functions to consider

New function for Hardware Configuration Definition (HCD), Hardware Configuration Manager (HCM), and both are available in V2R1.

New function, feature, and support for HCD and HCM

Support 6 Channel Subsystems and 4 Subchannel Sets
For the new processor type the maximum number of channel subsystems is extended to 6 and the number of subchannel sets is increased.

VCHID support for internal channels
For internal channel paths, like IQD and ICP CHPIDs, there does not exist a physical correspondence to hardware, hence there does not exist a PCHID value. Instead a unique virtual channel ID (VCHID) is assigned. The VCHID value is arbitrary out of a range which is beyond the range of valid PCHID values.

New CS5 CHPID type
A new CHPID type CS5 based on PCIe technology is supported.

Support of PCIe functions
Peripheral Component Interconnect Express (PCIe) adapters offer new function to systems that are running on IBM zEnterprise EC12 and BC12 (zEC12 and zBC12) processors to connect, for example, to an IBM zEnterprise BladeCenter Extension (zBX). Therefore, HCD/HCM introduces a new dialog where users can define PCIe functions, assign them to LPARs, and activate them through IOCP or dynamically.
- The **PCIe Function Summary Report** displays the partitions in the access and candidate lists, which are entitled to access the available PCIe functions.
- The **PCIe Function Compare Report** shows the changes in the function and virtual numbers and attributes of PCIe functions between processors of two IODFs.

Enhancements of the I/O autoconfiguration

HCD/HCM provide the following enhancements of the I/O autoconfiguration function:

- In addition to switched FICON connected controllers, I/O autoconfiguration can now discover FICON directly attached controllers and devices and proposes point-to-point connection paths if available.
- I/O autoconfiguration supports the inclusion or exclusion of specific switches or CHPIDs into the discovery and proposal process, that users can explicitly specify by request. For this purpose, HCD introduces four new autoconfiguration policy keywords:

  AUTO_CHPID_INCLUDE

  AUTO_CHPID_EXCLUDE

  AUTO_SWAD_INCLUDE

  AUTO_SWAD_EXCLUDE.

- The autoconfiguration policy keyword AUTO_SS_DEVNUM_SCHEME accepts a new value **NONE**. This value bypasses control unit and device number proposals by HCD/HCM and lets the user manually apply the numbers for detected objects.
- I/O autoconfiguration allows discovery by controller serial number and filters the discovered controllers as such.
- HCD /HCM can process an I/O autoconfiguration request that is partially directed against unavailable systems of an LPAR group or a sysplex, or systems that are not capable to support I/O autoconfiguration. Users can specify that the request applies to appropriate systems only, and that unavailable or incapable systems are tolerated, yet ignored.
- HCD/HCM allows users to change I/O autoconfiguration policies between two subsequent controller discoveries without making a new fabric discovery. This change enables I/O autoconfiguration to perform each new controller discovery with changed policies.
- HCD provides the SAVE command on the I/O autoconfiguration list panels (**Discovered New or Changed Controller List**, **Proposed Control Unit List**, and **Proposed Control Unit / Device List**) to allow users to save the fabric and controller discovery results and proposals in a data set.

Verify a configuration by using I/O autoconfiguration

With HCD/HCM, you can now verify the active or target configuration by using I/O autoconfiguration, if TSA I/O operations are not installed or not working. This is possible for a processor that is supporting I/O autoconfiguration and for a system in the local sysplex, which has dynamic activates. The verification is limited to FICON attached storage devices.

New hardware support

HCD and HCM support

- HCD supports the IBM z13 processor family (processor types 2964-N30, -N36, -N96, -NC6 and -NE1).
- HCD supports the IBM zEnterprise EC12 and BC12 (zEC12 and zBC12) processor family (processor types 2827-H20 -H43, -H66, -H89, -HA1, and 2828-H06, -H13).

New support for HCM

New hardware support

HCD and HCM support the IBM zEnterprise EC12 and BC12 (zEC12 and zBC12) processor family (processor types 2827-H20 -H43, -H66, -H89, -HA1, and 2828-H06, -H13.

New function, feature, and support for HCD

Show single point of failure

When HCD generates the I/O path report, it now issues the IOSSPOF macro for all paths and integrates the returned information into the Sensed data information. This is done for the I/O path report using TSA I/O Operations and I/O autoconfiguration only, if the selected system is the local system.

New profile options

You can specify the following new keywords in the HCD profile for the purposes stated.

- **Unconditional generation of D/R site OS configurations:** Use profile option UNCOND_GENERATE_DROS to regenerate D/R site OS configurations whenever a new production IODF is built, independent from whether the configurations were previously modified.

- **Specify remote call connection table:** Use profile option CONNECTION_TABLE to specify the name of a data set that contains the connection table for establishing connectivity to the remote systems while its working with CPC images.

- **Enable remote call logging:** Use profile option RCALL_LOG to activate logging of remote calls in to a data set while itsworking with CPC images.

- **Set initial remote call timeout value:** Use profile option RCALL_TIMEOUT to set the timeout value for the initial connection to a remote system when its working with CPC images.

HMC-wide activates

You can use a new HMC-wide activate function of HCD to remotely distribute and activate a new production IODF from a single managing z/OS system on all target systems of CPCs that are configured in the Hardware Management Console (HMC) and that are defined in a specified TCP/IP connection table.

Start this function from the **System z Cluster List** using action **Work with CPC images** introduced in z/OS V1R13. The upcoming **CPC Image List** now displays the activation status of the connected z/OS and z/VM® systems. It also provides new actions to activate the accessed production IODF for hardware, software changes, or both at the selected z/OS or z/VM system. The new production IODF is sent to the target system if necessary. You can remotely issue any operational commands that are required for the activation. The messages that result from the activation or from other system commands are displayed in a message list.

Validation enhancements

HCD implements several new validation checks to help users to avoid unintended results:

Validation enhancement	Description
A new warning message is issued when a CF CIB connection changes due to connectivity updates.	HCD issues a new warning message CBDG422I, when users add or delete a CSS to/from a CIB CHPID that involves a change of the coupling facility connection, affecting the definition of the connected processor. This message informs the user about the change and a potentially required dynamic activation of the target processor.
Existing warning message CBDA845I is also issued for the `ACTIVATE SOFT` system command.	For users of the HCD **Activate ...** dialogs, when required, HCD issues a warning message, CBDA845I, when users specify an ACTIVATE software only request without hardware validation because this does not process involved changes to coupling facility control units and devices for the software. This message is now also issued, when users specify an ACTIVATE SOFT system command without establishing hardware validation.

Enhanced CF Channel Path Connectivity List
> A new column in the **CF Channel Path Connectivity List** shows for both the external source and destination channel path either the physical channel identifier (PCHID) to which the channel path is assigned or its host communication adapter ID and port number.

OS group change action available for device groups
> The `OS group change` action was available from the I/O Device List showing single devices only. In z/OS V2R1, this action is also available from the **I/O Device List** showing device groups.

Filter parameters for graphical reports that are created from a batch utility
> As with the HCD dialog for creating graphical reports, you now can specify filter parameters when creating graphical reports with the batch utility function.

IBM Tivoli Directory Server for z/OS new functions to consider

Replication of password policy operational attributes from read-only replica to supplier server

Description: Read-only replica password policy replication support provides consistent replication updates of password policy operational attributes on all servers when they are updated in a read-only server in a replication topology. As a result, this new feature reduces the opportunity for circumvention of password policies while it ensures functional equivalence across Tivoli Directory Server distributed and z/OS. A new attribute, **ibm-slapdReplicateSecurityAttributes**, is added to cn=replication, cn=configuration for it to enable this feature.

When change was introduced: z/OS V2R2

Reference information:
> *z/OS IBM Tivoli Directory Server Administration and Use for z/OS*
> *z/OS IBM Tivoli Directory Server Messages and Codes for z/OS*

Dynamic group performance and scalability improvements

Description: The support for dynamic groups is redesigned to improve performance when determining a user's groups. Scalability is improved, allowing administrators to define a large number of dynamic groups without experiencing performance issues.

This improvement is automatically enabled. No configuration task is necessary.

When change was introduced: z/OS V2R2

Reference information:

> *z/OS IBM Tivoli Directory Server Administration and Use for z/OS*

Activity log enhancements

Description: z/OS Tivoli Directory Server provides the following enhancements to activity logging:

- Additional client events are now logged. This includes connect, disconnect, abandon requests, and unknown requests.
- Additional data is provided in existing log records. This includes attribute names in add requests, attribute names, and modification operation type in modify requests, and message ID in all request records.
- Improved consistency between the data that is captured in activity logging and SMF auditing.
- Versioning of the activity log record contents to avoid compatibility and migration issues when functional enhancements change the data contents of the activity log.
- Additional configuration options, eliminating the need to use environment variables to control some of the configuration options.

When change was introduced: z/OS V2R2

Reference information:

> *z/OS IBM Tivoli Directory Server Administration and Use for z/OS*
> *z/OS IBM Tivoli Directory Server Messages and Codes for z/OS*

Server compatibility level upgrade with no downtime

Description: This support allows improved availability when migrating new function across a sysplex. To update the **serverCompatLevel** or backends in a sysplex group without LDAP service outage, a run mode (transition mode) is now added. The LDAP instance can now be started in transition mode and continue to be operational while others are updated and recycled. In transition mode, the server can be started successfully with the updated **serverCompatLevel** or backends configurations. Transition mode is a temporary work mode that is used during sysplex level configuration updates.

When change was introduced: z/OS V2R2

Reference information:

> *z/OS IBM Tivoli Directory Server Administration and Use for z/OS*
> *z/OS IBM Tivoli Directory Server Messages and Codes for z/OS*

Transport Layer Security (TLS) protocol version 1.2

Description: In z/OS V2R1, z/OS IBM Tivoli® Directory Server introduces support for TLS V1.2 protocol. The TLS V1.2 protocol includes a number of updates to previous versions of the Transport Layer Security (TLS) protocol. This support improves security with secure socket layer communications between IBM Tivoli Directory Server for z/OS client and server. It also includes more cipher suites, and Suite B enablement as provided by z/OS System SSL.

When change was introduced: z/OS V2R1

Reference information:

z/OS IBM Tivoli Directory Server Administration and Use for z/OS

z/OS IBM Tivoli Directory Server Client Programming for z/OS

z/OS IBM Tivoli Directory Server Messages and Codes for z/OS

z/OS Cryptographic Services System SSL Programming

Remote Cryptographic services

Description: By using an LDAP extended operation protocol, distributed applications can now store keys in the persistent key data sets on the host that enables a centralized key management scheme. The remote crypto plug-in extension can be configured to perform PKCS #11 or CCA services functions with ICSF.

When change was introduced: z/OS V2R1

Reference information:

z/OS IBM Tivoli Directory Server Administration and Use for z/OS

z/OS IBM Tivoli Directory Server Messages and Codes for z/OS

z/OS IBM Tivoli Directory Server Plug-in Reference for z/OS

z/OS Cryptographic Services ICSF Application Programmer's Guide

z/OS Cryptographic Services ICSF Writing PKCS #11 Applications

ICTX Plug-in

Description: An enhanced ICTX plug-in, which is based on the prior EIM implementation, is now provided with z/OS IBM TDS to perform remote auditing and authorization checking. This enhanced implementation supports 64-bit addressing mode and more bind mechanisms.

When change was introduced: z/OS V2R1

Reference information:

z/OS IBM Tivoli Directory Server Administration and Use for z/OS

z/OS IBM Tivoli Directory Server Messages and Codes for z/OS

z/OS IBM Tivoli Directory Server Plug-in Reference for z/OS

ICKDSF new functions to consider

This topic describes new functions in ICKDSF.

SPID fencing

Description: ICKDSF adds a SPID parameter to the CONTROL command, which lets you clear the SPID fenced state for a device or devices.

When change was introduced: z/OS V2R2

Reference information: *Device Support Facilities (ICKDSF) User's Guide and Reference* .

Infoprint Server new functions to consider

This topic describes z/OS Infoprint Server enhancements.

Infoprint Central enhancements

The Infoprint Central user interface has been updated with usability and accessibility enhancements.

Description:

The Infoprint Central user interface has been updated with these enhancements:

- The user interface has been redesigned to follow IBM accessibility and usability standards, and now includes support for Mozilla Firefox.
- The IBM HTTP Server powered by Domino that Infoprint Central previously used has been replaced with the IBM HTTP Server - Powered by Apache.
- You can now display TSO output jobs in the list of print jobs from a search. This function is available when the **Operating mode** field is set to z/OS 2.2 on the ISPF System Configuration panel.
- The System Status page now displays a table with the component, XCF member name, job name, system, and state when the **Operating mode** field is set to z/OS 2.2.
- Job selection rules are now accessed from the menu bar rather than the System Status page.

When change was introduced:
z/OS V2R2.

Reference information:

- *z/OS Infoprint Server Customization*
- *z/OS Infoprint Server Operation and Administration*

Serviceability enhancements

Infoprint Server now supports a data element that lets you decide whether new product functions are activated during or after installation.

Description:

To minimize migration actions when a new z/OS release is installed, Infoprint Server now supports a data element that lets you decide whether new product functions are activated during or after installation. You can set the **Operating mode** field on the ISPF System Configuration panel or the **ipsmode** attribute in the PIDU command to the product function level that you want Infoprint Server to operate with.

When change was introduced:
z/OS V2R2.

Reference information:
- *z/OS Infoprint Server Customization*
- *z/OS Infoprint Server Operation and Administration*

Start and stop Infoprint Server daemons

Infoprint Server now gives you the ability to start and stop individual daemons on a single processor.

Description:
Infoprint Server runs as multiple daemons on a single processor with a master daemon that starts and stops the other daemons as necessary. Infoprint Server now gives you the ability to start and stop individual daemons on a single processor when the **Operating mode** field is set to z/OS 2.2.

When change was introduced:
z/OS V2R2.

Reference information:
- *z/OS Infoprint Server Customization*
- *z/OS Infoprint Server Operation and Administration*

TSO/E command for controlling printers

Infoprint Server now supports a TSO/E command, AOPCMND, that can start and stop IP PrintWay extended mode printers from TSO.

Description:
Infoprint Central was previously the primary method that is used to start and stop Infoprint Server printers. Infoprint Server now supports a TSO/E command, AOPCMND, that can start and stop IP PrintWay extended mode printers from TSO.

Some advantages of using the TSO/E AOPCMND command are:
- You can control IP PrintWay™ extended mode printers without implementing the Infoprint Central component that runs under the IBM HTTP Server - Powered by Apache.
- You can migrate from a non-IBM print application to Infoprint Server.

When change was introduced:
z/OS V2R2.

Reference information:
- *z/OS Infoprint Server Customization*
- *z/OS Infoprint Server Operation and Administration*

Variable inline email message

You can now use Infoprint Server to customize email messages with personalized inline text.

Description:
You can now use Infoprint Server to customize email messages with personalized inline text.

Some advantages of using a variable inline email message are:
- By using an existing text job attribute, such as **name-text**, you can include a text string at the beginning of each email before an inline

message. For example, if `name-text="Mr. Jones"`, then `Mr. Jones` is included on the first line in the email.
- You can also now specify the existing **`mail_inline_message`** printer attribute as a job attribute so you can send a unique message for the job.

When change was introduced:
z/OS V2R2.

Reference information:
See *z/OS Infoprint Server User's Guide*.

Dynamic configuration

You can now configure Infoprint Server dynamically while Infoprint Server is running.

Description:
You can now configure Infoprint Server dynamically while Infoprint Server is running. You can use a new Infoprint Server ISPF panel or the Printer Inventory Definition Utility (PIDU) program to view configuration attributes and change some of them. If you change a configuration attribute, with a few exceptions, you no longer need to stop and restart Infoprint Server for the new value to take effect. To restrict who can use the new ISPF panel and PIDU to view or change configuration attributes, you can define a new RACF® resource profile.

When change was introduced:
z/OS V2R1.

Reference information:
See *z/OS Infoprint Server Customization*.

SMF type 6 enhancements

In IP PrintWay extended mode, your accounting programs can now take advantage of additional accounting information.

Description:
If you run IP PrintWay extended mode, your accounting programs can now take advantage of additional accounting information from the JOB JCL statement in System Management Facilities (SMF) type 6 records.

When change was introduced:
z/OS V2R1.

Reference information:
See *z/OS Infoprint Server Customization*.

System logger

You can now use the system logger, a component of MVS, for Infoprint Server messages.

Description:
You can now use the system logger, a component of MVS, for Infoprint Server messages. The system logger provides a robust, reliable method for storing messages for a specified number of days.

When change was introduced:
z/OS V2R1.

Reference information:
See *z/OS Infoprint Server Customization*.

Integrated Security Services new functions to consider

For Security Services, see "Security Server (RACF) new functions to consider" on page 96. Also see "Cryptographic Services new functions to consider" on page 29.

ISPF new functions to consider

This topic describes ISPF enhancements in V2R2.

EDIF and VIIF services enhancement to support an edit line command table

Description:
The name of a line command table can now be provided on calls to the EDIF and VIIF services.

Introduced:
z/OS V2R2

Reference information:
See the topics about "EDIF—Edit interface" and "VIIF—View interface" in *z/OS V2R2 ISPF Services Guide*.

Browse enhancement to display the RDW of variable records

Description:
This enhancement introduces a new browse command to allow the record descriptor word (RDW) to be displayed for variable length records.

Introduced:
z/OS V2R2

Reference information:
See the topic about "DISPLAY—control the display" in *z/OS V2R2 ISPF User's Guide Vol II*.

Browse enhancement to increase the record number limit

Description:
This enhancement increases the number of records that Browse can process beyond 99,999,999.

Introduced:
z/OS V2R2

Reference information:
See the topic about "LOCATE—locate lines" in *z/OS V2R2 ISPF User's Guide Vol II*.

See the topic about "BRIF—Browse interface" in *z/OS V2R2 ISPF Services Guide*.

Global configuration option to define a default line command table

Description:
This enhancement provides a configuration table option to define a global line command table that is active when a line command table is not otherwise specified.

Introduced:
z/OS V2R2

Reference information:
> See the topic about "Edit-related settings" in *z/OS V2R2 ISPF Planning and Customizing*.

DTL compiler enhancement to use the system variable ZISPFRC

Description:
> This enhancement allows the DTL compiler to influence JCL step return codes by using the ZISPFRC variable.

Introduced:
> z/OS V2R2

Reference information:
> See the topic about "Conversion Utility Syntax" in *z/OS V2R2 ISPF Dialog Tag Language Guide and Reference*.

Global configuration option to disable the editor PACK operation

Description:
> This enhancement provides a configuration table option to disable the PACK operation used by the editor. Any currently packed data is unpacked if saved. PACK is disabled from having any effect with the COPY and MOVE services.

Introduced:
> z/OS V2R2

Reference information:
> See the topic about "Edit-related settings" in *z/OS V2R2 ISPF Planning and Customizing*.

ISPSTART command enhancement to support an initial command stack on the OPT parameter

Description:
> This enhancement allows an initial command stack variable to be specified on the OPT parameter of the ISPSTART command. ZSTART is supported as a default variable, and BASIC is supported as an override of a defined ZSTART variable.

Introduced:
> z/OS V2R2

Reference information:
> See the topic about "Syntax for issuing the ISPSTART command" in *z/OS V2R2 ISPF Dialog Developer's Guide and Reference*.

CONTROL service enhancement for left and right scroll commands

Description:
> This enhancement provides a service to request that the left and right scroll commands are not processed by ISPF and instead are passed through to the dialog for processing.

Introduced:
> z/OS V2R2

Reference information:
> • See the topic about "CONTROL services" in *z/OS V2R2 ISPF Dialog Developer's Guide and Reference*.

- See the topic about "CONTROL—set processing modes" in *z/OS V2R2 ISPF Services Guide*.

Interactive ISPF Gateway

Description:

This enhancement provides a new ISPF gateway that supports interactive communication and manages the TSO/E sessions using z/OS CEA TSO/E address space services.

Introduced:

z/OS V2R2

Reference information:

See the topic about "Interactive ISPF Gateway" in *z/OS V2R2 ISPF Planning and Customizing*.

Enhancements for using the ISPF Gateway with IBM HTTP server powered by Apache

Description:

The IBM HTTP server powered by Domino is no longer provided after z/OS V2R1. Support is provided for running the gateway under the IBM HTTP server powered by Apache.

Introduced:

z/OS V2R2

Reference information:

See the topic about "Customizing the gateway calling environment" in *z/OS V2R2 ISPF Planning and Customizing*.

z/OS UNIX file system support in ISPF

Description:

This enhancement adds to ISPF 3.17 support that is similar to what is provided under the ISHELL File_Systems menu. This includes the ability to mount a z/OS UNIX file system, display and work with the mounted file systems, create a zFS data set, and display and work with attached zFS aggregates.

Introduced:

z/OS V2R2

Reference information:

See the topic about "z/OS UNIX Mounted File Systems" in *z/OS V2R2 ISPF User's Guide Vol II*.

Remove BookManager/Build from ISPF z/OS Applications menu

Description:

The BookManager/Build product is no longer delivered by IBM after z/OS V2R1. This product was accessed through ISPF Primary Option 13.1.

Introduced:

z/OS V2R2

Removal of extraneous commands from the ISPF TSO command table

Description:
> The COPY, FORM, FORMAT, LIST, MERGE, and PASCALVS commands are removed from the ISPF TSO command table.

Introduced:
> z/OS V2R2

ISPF Dialog Manager component changes

Description: The DM component of ISPF includes the following new functions and enhancements:

- Support is added for the processing of data sets allocated with an extended task I/O table (XTIOT) entry.
- The ISPF Services Guide is updated to include a new section documenting the format of JSON messages exchanged between TSO/ISPF and a client. This JSON API enables the user interface for an ISPF application to operate in the client environment.
- The ISPF Dialog Developers Guide and Reference is updated to describe ISPF variables that can be used by an application to pass information to the client by means of the JSON API.
- Support is provided for users to define a command stack to be run at ISPF invocation. This can be used to start multiple logical screens.
- Scroll amounts up to 9,999,999 are now supported.
- A new options panel allows a user to customize the display format for the SWAPBAR.

When change was introduced: z/OS V2R1

Reference information:
> *z/OS V2R1 ISPF Dialog Developer's Guide and Reference*
> *z/OS V2R1 ISPF Planning and Customizing*
> *z/OS V2R1 ISPF Services Guide*
> *z/OS V2R1 ISPF User's Guide Vol I*

PDF component changes

Description: The ISPF PDF component contains the following new functions and enhancements:

- The ISPF editor FIND and CHANGE commands have been enhanced to support regular expressions.
- The ISPF editor CREATE, REPLACE, COPY, MOVE, and CUT commands have been enhanced to support data conversion to/from EBCDIC, ASCII, and UTF-8.
- The ISPF editor HILITE command has been enhanced to show invalid use of lower-case characters in JCL.
- The member count field on member list panels is expanded to support values up to 9,999,999.
- The following enhancements have been made to the z/OS UNIX Directory List Utility:
  - Pattern matching characters can now be used to specify a path name filter for a z/OS UNIX directory list display.

- – A SRCHFOR command is provided to search for strings in regular files in the directory.
  - – Directory list line commands can now be entered in blocks.
  - – The file name column in the directory list can now have a display width of up to 110 characters.
  - – A command shell is now provided allowing users to save and retrieve z/OS UNIX commands.
- • The Data Set List Utility is changed to allow a path name to be entered in the Dsname Level field in order to have a z/OS UNIX Directory List displayed.
- • The F (free) line command of the Data Set List Utility can now be used against a multi-volume data set to free unused space.
- • The MEMLIST service supports the new DEFAULT keyword which allows the the caller to specify a line command that is used to replace an "S" line command entered on the member list display.
- • The ISPF editor provides support to view and edit Unicode data in data sets and z/OS UNIX files.
- • The following enhancements have been made to the ISPF editor COMPARE command:
  - – The VOL parameter is provided to support comparing against an uncataloged data set.
  - – The target data set or path name can now be entered on the options panel displayed when the COMPARE command is entered without any parameters.
- • To support the input of long editor commands, the editor command field can be expanded to a length of 255 characters using the ZEXPAND command.
- • The UDLIST command is enhanced to convert the specified pathname to lowercase and re-issue the directory find if the directory for the pathname initially specified with the UDLIST command is not found.
- • Data in the PROMPT column of the enhanced member list is now passed as an argument to a command entered against a member.

When change was introduced: z/OS V2R1

Reference information:
> *z/OS V2R1 ISPF Edit and Edit Macros*
> *z/OS V2R1 ISPF Messages and Codes*
> *z/OS V2R1 ISPF Services Guide*
> *z/OS V2R1 ISPF User's Guide Vol I*
> *z/OS V2R1 ISPF User's Guide Vol II*

JES2 new functions to consider

This topic describes new JES2 functions in z/OS.

JES2 growth and job limits

JES2 increases the limit of the number of jobs that can be resident on SPOOL.

Description:
> The JES2 limit for the number of jobs that can be resident on SPOOL has increased and accordingly job queue elements (JQEs), job output element (JOEs) and block extension reuse tables (BERTs) have new size limits:
>> JQE = 1,000,000

JOE = 2,500,000

BERT = 2,500,000

To take advantage of the full-function level of z/OS V2R2 JES2, you must use the new z22 mode on the **$ACTIVATE** command.

When change was introduced:
z/OS V2R2.

Reference information:
- *z/OS Migration*
- *z/OS Summary of Message and Interface Changes*
- *z/OS JES2 Installation Exits.*
- *z/OS JES2 Commands.*
- *z/OS JES2 Initialization and Tuning Guide.*
- *z/OS MVS Using the Subsystem Interface.*
- *z/OS JES2 Messages.*

JES2 updates the job execution control interface

JES2 adds function to make it easier to write JCL jobs that run in a specific order without the need for an external job scheduling package. Though not intended to replace job scheduler, this function simplifies breaking down large complex multistep jobs into multiple jobs that can eventually be placed under the control of a job scheduler. It is also intended to ease applications that can analyze JCL while it is being submitted and break down the steps into separate, dependent jobs. This function helps users that are running both JES3 and JES2 by providing similar functions as the JES3 dependent job control (DJC) in the JES2 environment.

Description:
JES2 Job execution controls (JEC) provide similar functions as the JES3 dependent job control (DJC) in the JES2 environment to simplify the decomposing of a multistep batch job into multiple single-step jobs. This function helps increase parallel execution of job steps and because of that improves the batch processing window. To use JEC, the new z22 mode must be set on the **$ACTIVATE** command.

When change was introduced:
z/OS V2R2.

Reference information:
- *z/OS JES2 Commands.*
- *z/OS JES2 Initialization and Tuning Guide.*
- *z/OS JES2 Messages.*
- *z/OS MVS JCL Reference.*
- *z/OS MVS Using the Subsystem Interface.*
- *Network Job Entry (NJE) Formats and Protocols.*

JES2 deadline scheduling

JES2 provides functions to hold jobs until a specified time and to make jobs more likely to start running by a specified time.

Description:
JES2 adds support for the new SCHEDULE JCL statement with parameters **HOLDUNTL** and **STARTBY**. Use **HOLDUNTL** to hold the job until the specified

time. Use **STARTBY** to move the job forward in the queue (increasing its priority, if needed) to make it more likely to start by the specified time.

When change was introduced:
z/OS V2R2.

Reference information:
- *z/OS JES2 Commands*.
- *z/OS JES2 Initialization and Tuning Guide*.
- *z/OS MVS JCL Reference*.
- *z/OS MVS Using the Subsystem Interface*.
- *Network Job Entry (NJE) Formats and Protocols*.

JES2 adds step completion code

JES2 adds a step completion code and records data in the EVENTLOG data set.

Description:
JES2 adds a step completion code to enable applications to access information about the return codes of every job step. To do so JES2 added a new internal data set that contains information about the execution of each step that is associated with a job. To ease access for an application developer or the installation to extract the SMF records for a job, JES2 provides the data set and recording capabilities along with the ability to suppress SMF data in the EVENTLOG data set.

To control the volume of data collection, commands **$D JOBDEF** and **$T JOBDEF** support a new parameter **SUP_EVENTLOG_SMF** that indicates whether EVENTLOG SMF data can be suppressed. **SUP_EVENTLOG_SMF** defaults to NO.

When change was introduced:
z/OS V2R2.

Reference information:
- *z/OS JES2 Commands*.
- *z/OS JES2 Initialization and Tuning Guide*.
- *z/OS JES Application Programming*.

JES2 supports 8-character job class names

Description: JES2 supports 8-character job class names. JES2 also supports creating up to 512 job classes.

When change was introduced: z/OS V2R1.

Reference information: *z/OS JES2 Commands*.

JES2 supports job modification SSI 85

Description: MVS SSI 85 (IAZSSJM) supports JES2 job modification via the MVS subsystem interface.

When change was introduced: z/OS V2R1.

Reference information: *z/OS MVS Using the Subsystem Interface*.

JES2 supports JCL symbolics

Description: The new JCL symbol service (IEFSJSYM) and the new JES symbol service (IAZSYMBL) enable JCL and system symbols to be available to the job execution phase. A new job correlator is provided for querying and tracking jobs.

When change was introduced: z/OS V2R1.

Reference information: *z/OS JES Application Programming* and *z/OS MVS JCL Reference*.

JES2 adds in-stream data support

Description: JES2 adds support for in-stream data sets in PROC and INCLUDE statements.

When change was introduced: z/OS V2R1.

Reference information: *z/OS MVS JCL User's Guide* and *z/OS MVS JCL Reference*.

JES2 supports 64-bit storage requests

Description: JES2 supports requests for 64-bit storage. MVS SSI 80 (IAZSSST) includes new 64-bit fields.

When change was introduced: z/OS V2R1.

Reference information: *z/OS JES2 Commands*. and *z/OS MVS Using the Subsystem Interface*.

JES2 adds SYSOUT work selection optimization

Description: SAPI POST and SAPI GET JOE Index work selection optimization improves SYSOUT work selection performance by reducing the volume of JOE processing.

When change was introduced: z/OS V2R1.

Reference information: *z/OS JES2 Commands*. and *z/OS JES2 Initialization and Tuning Guide*.

JES2 supports new keywords on the JOB JCL statement

Description: JES2 adds support for the new SYSTEM and SYSAFF keywords on the JOB JCL statement, for directing jobs to specific JES3 main systems.

When change was introduced: z/OS V2R1.

Reference information: *z/OS MVS JCL Reference*.

JES2 supports access controls on job classes

Description: JES2 adds support for SAF control over job class usage, using new profiles in the JESJOBS class.

When change was introduced: z/OS V2R1.

Reference information: *z/OS JES2 Initialization and Tuning Guide*.

JES3 new functions to consider

This topic describes new JES3 functions in z/OS.

JES3 Common JCL

Description: JES3 supports the PROCLIB keyword for the JCLLIB statement so you can specify the JES3 concatenation to be used for a job, and supports the MERGE and DDNAME keywords of the OUTPUT statement.

When change was introduced: z/OS V2R2.

Reference information:

z/OS JES3 Commands

z/OS JES3 Initialization and Tuning Guide

z/OS JES3 Initialization and Tuning Reference

z/OS JES3 Messages

z/OS MVS JCL Reference.

JES3 Data set integrity

Description: JES3 adds protection against JES3 data sets being manipulated or deleted while JES3 is using them by adding new function that interrogates the DSI/NODSI setting for JES3 and JES3 C/I FSS and propagating the setting to all dynamic allocations.

When change was introduced: z/OS V2R2.

Reference information:

z/OS JES3 Initialization and Tuning Guide

IBM Health Checker for z/OS User's Guide.

JES3 JECL Tracking

Description: JES3 adds support to use the z/OS Generic Tracker to help identify JES3 JECL statements. This supports migration from JES3 to JES2 by helping to write non-specific JES JCL.

When change was introduced: z/OS V2R2.

Reference information:

z/OS JES3 Diagnosis

z/OS MVS Diagnosis: Tools and Service Aids

z/OS MVS JCL Reference.

JES3 Output disposition (OUTDISP)

Description: JES3 adds support for the output disposition (OUTDISP) parameter of the JCL OUTPUT statement making managing output data sets easier.

When change was introduced: z/OS V2R2.

Reference information:

z/OS JES3 Commands

z/OS JES3 Customization

z/OS JES3 Diagnosis

z/OS JES3 Initialization and Tuning Guide

z/OS JES3 Initialization and Tuning Reference

z/OS JES3 Messages

z/OS MVS Programming: Assembler Services Guide

z/OS MVS JCL User's Guide

z/OS MVS JCL Reference

Network Job Entry (NJE) Formats and Protocols.

JES3 Scaling of workloads

Description: JES3 adds support for a larger number of job spool files and additional functional enhancements needing additional job-specific data on spool.

When change was introduced: z/OS V2R2.

Reference information:

z/OS JES3 Commands

z/OS JES3 Customization

z/OS JES3 Diagnosis

z/OS JES3 Diagnosis Reference

z/OS JES3 Initialization and Tuning Reference

z/OS JES3 Messages

IBM Health Checker for z/OS User's Guide.

JES3 Symbolics

Description: JES3 adds support for symbol processing which allows JCL and system symbols to be accessible during job execution. This makes JCL and system symbols easier to use in multiple environments.

When change was introduced: z/OS V2R2.

Reference information:

z/OS JES3 Commands

z/OS JES3 Diagnosis

z/OS JES3 Diagnosis Reference

z/OS JES3 Messages

z/OS MVS System Codes.

JES3 expands 8-character class name support

Description: JES3 adds support for 8-character job class names on the JOB JCL statement.

When change was introduced: z/OS V2R1.

Reference information: z/OS JES3 Commands and z/OS MVS JCL Reference.

JES3 supports system symbol updates

Description: JES3 adds support for updating system symbols on the local system.

When change was introduced: z/OS V2R1.

Reference information: *z/OS JES3 Commands* and *z/OS JES3 Initialization and Tuning Guide*.

JES3 adds in-stream data support

Description: JES3 adds support for in-stream data sets in PROC and INCLUDE statements.

When change was introduced: z/OS V2R1.

Reference information: *z/OS MVS JCL User's Guide* and *z/OS MVS JCL Reference*.

JES3 supports 64-bit storage requests

Description: JES3 supports requests for 64-bit storage. MVS SSI 80 (IAZSSST) includes new 64-bit fields.

When change was introduced: z/OS V2R1.

Reference information: *z/OS MVS Using the Subsystem Interface*.

JES3 supports deleting spool volumes

Description: JES3 supports deleting spool volumes. JES3 also supports obtaining spool allocation data for jobs.

When change was introduced: z/OS V2R1.

Reference information: *z/OS JES3 Commands*.

JES3 supports ENF 70 events

Description: JES3 supports monitoring for ENF 70 events.

When change was introduced: z/OS V2R1.

Reference information: *z/OS JES3 Commands* and *z/OS MVS Using the Subsystem Interface*.

JES3 supports new keywords on the JOB JCL statement

Description: JES3 adds support for the new SYSTEM and SYSAFF keywords on the JOB JCL statement, for directing jobs to specific JES3 main systems.

When change was introduced: z/OS V2R1.

Reference information: *z/OS MVS JCL Reference*.

JES3 supports access controls on job classes

Description: JES3 adds support for SAF control over job class usage, using new profiles in the JESJOBS class.

When change was introduced: z/OS V2R1.

Reference information: *z/OS JES3 Initialization and Tuning Guide*.

JES3 supports multiple TSO/E user ID log on

Description: JES3 adds support to allow a user to log on to multiple systems within a sysplex using the same TSO/E user ID.

When change was introduced: z/OS V2R1.

Reference information: *z/OS JES3 Initialization and Tuning Guide* and *z/OS TSO/E Customization*.

Language Environment new functions to consider

This topic describes new Language Environment® functions in z/OS.

Providing support for delayed debug

Description: In V2R2, Language Environment, with the z/OS XL C/C++ compiler, provides support to allow a programmer to delay the start of the debugger until a C language function of interest receives control.

When change was introduced: z/OS V2R2.

Reference information:
- *z/OS Language Environment Debugging Guide*
- *z/OS Language Environment Vendor Interfaces*

Reflecting the WORKING-STORAGE allocation in the storage report produced by Language Environment

Description: Previously, the WORKING-STORAGE section of a program was not reflected in the storage report that is produced by Language Environment. In V2R2, for COBOL programs compiled with the RENT option, the Enterprise COBOL V5.1 compiler allocates the WORKING-STORAGE section on the Language Environment heap. This allocation is reflected in the storage report produced by the Language Environment.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS Language Environment Vendor Interfaces*

Accessing exported JCL symbols

Description: New Language Environment interfaces allow programs to access exported JCL symbols. For 31-bit, callable service callable service CEEGTJS is provided. For 64bit, the C function __le_ceegtjs() is provided. This support provides another way to pass information to running programs from JCL.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS XL C/C++ Runtime Library Reference*
- *z/OS Language Environment Programming Guide*

- *z/OS Language Environment Programming Reference*
- *z/OS V2R1.0 Language Environment Concepts Guide*
- *z/OS V2R1.0 Language Environment Programming Guide for 64-bit Virtual Addressing Mode*

AMODE 64 support for large pages

Description: You can exploit large pages in AMODE 64 in order to improve performance. A new Language Environment runtime option, PAGEFRAMESIZE64, is used to request that storage be backed by 1M pages for AMODE 64 applications.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS Language Environment Customization*
- *z/OS Language Environment Debugging Guide*
- *z/OS Language Environment Programming Reference*
- *z/OS V2R1.0 Language Environment Programming Guide for 64-bit Virtual Addressing Mode*
- *z/OS Language Environment Vendor Interfaces*

Enterprise COBOL V5.1 support

Description: The Enterprise COBOL V5.1 runtime library is now supported with member ID 4.

When change was introduced: APAR PM87183.

Reference information:
- *z/OS Language Environment Debugging Guide*
- *z/OS Language Environment Runtime Messages*
- *z/OS Language Environment Vendor Interfaces*

Converting between multibyte characters and specified Unicode characters

Description: Users can convert between multibyte characters and specified Unicode characters using four new functions, mbrtoc16(), mbrtoc32(), c16rtomb() and c32rtomb() as specified in the C language standard, currently known as C11.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS XL C/C++ Runtime Library Reference*
- *z/OS XL C/C++ Programming Guide*

Added support for exposing memory overlays that cause heap damage

Description: Support was added for a new option that programmers can use to expose memory overlays that cause heap damage. A new HEAPZONES runtime option specifies that a checkzone be appended to each requested storage area. To find problems that might otherwise be difficult to identify, you can specify that Language Environment detect stored data in the check zone, or ignore data that is stored in it.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS Language Environment Programming Guide*
- *z/OS Language Environment Programming Reference*
- *z/OS Language Environment Debugging Guide*
- *z/OS Language Environment Vendor Interfaces*

Nested CEEPIPI environments

Description: Language Environment provides support to allow nested CEEPIPI environments. Programs running in active CEEPIPI environments can now call CEEPIPI to create and use a nested CEEPIPI environment.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS Language Environment Programming Guide*
- *z/OS Language Environment Programming Reference*
- *z/OS Language Environment Debugging Guide*

Accessing data by blocks instead of bytes or records

Description: With the BSAM type=blocked support, you can use XL C/C++ runtime library routines to process sequential data sets using blocked I/O, and to read from, write to, and reposition (seek) within data sets by blocks. Accessing data by blocks can provide significant performance improvements when you do not have to manipulate data within blocks.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS XL C/C++ Runtime Library Reference*
- *z/OS XL C/C++ Programming Guide*
- *z/OS Language Environment Runtime Messages*

Removal of runtime option usermods

Description: Support for creating usermods to modify runtime option defaults at the installation level was removed. The CEEXOPT macro was updated to prevent assembly of CEEDOPT or CELQDOPT CSETs. To override the IBM-supplied defaults at a system level, use the CEEPRMxx parmlib member support.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS Language Environment Customization*
- *z/OS Migration*

Providing support for SIMD

Description: Previously, Language Environment did not support applications that used single-instruction, multiple-data (SIMD), which provides a set of vector instructions and registers that allow programs to perform a variety of operations against a set of data within those registers. In V2R1, Language Environment provides support for SIMD.

When change was introduced: z/OS V2R1.

Reference information:

- *z/OS Language Environment Debugging Guide*
- *z/OS Language Environment Programming Guide*
- *z/OS Language Environment Vendor Interfaces*

Additional file I/O programming interfaces for z/OS UNIX System Services

Description: Language Environment provides a set of nonstandard XL C/C++ file I/O functions that allow access to information about the file. A new header, <stdio_ext.h> is provided to improve the portability of these applications between z/OS and other UNIX platforms.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS XL C/C++ Runtime Library Reference*

Updates made for C11 compliance

Description: Certain functions were made compliant to the C language standard (currently known as C11) when the environment variable _EDC_SUSV3=2 is set: log(), logf(), logl() log10(), log10f(), log10l() log1p(), log1pf(), log1pl() log2(), log2f(), log2l() pow(), powl().

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS XL C/C++ Runtime Library Reference*
- *z/OS XL C/C++ Programming Guide*

Converting multibyte Unicode encoded data to wide character data

Description: Language Environment provides new functions to convert multibyte Unicode encoded data to wide character data. Four new conversion services are provided to perform these conversions between data encoded as char16_t and char32_t, and CCSIDs supported by z/OS Unicode.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS Language Environment Customization*
- *z/OS Language Environment Vendor Interfaces*
- *z/OS XL C/C++ Programming Guide*
- *z/OS XL C/C++ Runtime Library Reference*

Library Server new functions to consider

This topic describes new Library Server functions in z/OS.

IBM Knowledge Center for z/OS

Description:
z/OS V2R2 includes an SMP/E installable version of IBM Knowledge Center for z/OS. Softcopy Librarian, available as a download, is enhanced to make it easy to manage and update the Knowledge Center document content in a z/OS repository for IBM Knowledge Center for z/OS.

Use IBM Knowledge Center for z/OS to perform IBM Knowledge Center functions using your own local document repository, which is especially valuable for:

- Security reasons for enterprises with no Internet access
- As a valuable backup for enterprises when Internet access is disrupted
- Personalizing or controlling the content of an enterprise library

IBM Library Server continues as an element of z/OS to manage BookManager and PDF files.

Introduced
z/OS V2R2.

Reference information:
- Download IBM Softcopy Librarian (ibm.com/support/docview.wss?uid=swg27018846).
- *z/OS Planning for Installation*
- *z/OS Migration*

Library Server extends PDF search capabilities

Description:
Library Server extends its PDF search capabilities beyond that for indexed shelves, to searching loose PDF collections on any of the configured Library Server "Collection Directories". The underlying architecture within Library Server is enhanced to improve indexing, navigation, and search performance for Eclipse document plug-ins. It also adds support for a previously indexed information center.

Introduced
z/OS V2R1

Reference information:
Library Server: Getting Started

Metal C Runtime Library new functions to consider

This topic describes new Metal C Runtime Library functions in z/OS.

Support for alternative name for function "main"

Description: When building a Metal C program, you can define an alternative entry point name for function "main" while maintaining all the characteristics of function "main".

When change was introduced: z/OS V2R1

Reference information:
- *z/OS Metal C Programming Guide and Reference*

Support for mixed mode IPA

Description: For Metal C compilation, AMODE-switching is supported at IPA link.

When change was introduced: z/OS V2R1

Reference information:
- *z/OS Metal C Programming Guide and Reference*

NFS new functions to consider

This topic describes new Network File System (NFS) functions in z/OS.

z/OS NFS Client AMODE64 or LP64

Description: This relieves the 2GB client address space constraints, improves scalability and complies with larger and wider data flow from end-to-end.

When change was introduced: z/OS V2R2

Reference information: *z/OS Network File System Guide and Reference*

z/OS NFS Client mount option for UNSTABLE NFSv4 write

Description: This prevents z/OS NFS Client from running out of memory, without impacting NFS Server sides performance.

When change was introduced: z/OS V2R2

Reference information: *z/OS Network File System Guide and Reference*

Cache for UID/GID name mapping

Description: This improves performance of NFS version 4 by UID/GID caching thus reducing number of RACF calls.

When change was introduced: z/OS V2R2

Reference information: *z/OS Network File System Guide and Reference*

z/OS NFS BPXMTEXT support

Description: The BPXMTEXT command tool customers rely on to diagnose problems by displaying reason codes with error messages now also supports z/OS NFS reason codes.

When change was introduced: z/OS V2R2

Reference information: *z/OS Network File System Guide and Reference*

z/OS NFS Server Ctrace without MODESET SVT

Description: This improves z/OS NFS Server performance when some Ctrace options, including the option "ALL", are enabled.

When change was introduced: z/OS V2R2

Reference information: *z/OS Network File System Guide and Reference*

z/OS NFS Server persistent filehandle

Description: "alias" is now supported with z/OS NFS Exports List. This reduces filehandle recovery instances requiring customers intervention.

When change was introduced: z/OS V2R2

Reference information: *z/OS Network File System Guide and Reference*

z/OS NFS crosscheck Site Attribute vs Checklist

Description: z/OS NFS Server now detects and warns about conflicting checklist entries between site attribute and export list.

When change was introduced: z/OS V2R2

Reference information: *z/OS Network File System Guide and Reference*

Add timestamp to error logs and capability to retain latest error log data

Description: z/OS NFS is improved to retain latest error log data by start writing to the oldest error log. Timestamp is added to error logs assisting problem analysis.

When change was introduced: z/OS V2R2

Reference information: *z/OS Network File System Guide and Reference*

Display NFS version 4 domain

Description: z/OS NFS Server now returns the default domain from z/OS TCPIP when nfsv4domain site attribute is not specified.

When change was introduced: z/OS V2R2

Reference information: *z/OS Network File System Guide and Reference*

CONSOLEMSGS operand

Description: This operand specifies the number of messages for NFS operator commands: LIST=MOUNTS, LIST=DSNAMES, LISTLOCK will print on the console. It does not impact on console output of other NFS operator commands including VERSION=ALL.

When change was introduced: z/OS V2R2

Reference information: *z/OS Network File System Guide and Reference*

Ctrace buffer size

Description: This operand provides the ability to dynamically change Ctrace buffer sizes.

When change was introduced: z/OS V2R2

Reference information: *z/OS Network File System Guide and Reference*

AMODE64 or LP64

Description: The z/OS NFS Server has improved from AMODE31 or ILP32 to AMODE64 or LP64.

When change was introduced: z/OS V2R1

Reference information: *z/OS Network File System Guide and Reference*

Resource Measurement Facility (RMF) new functions to consider

This topic provides an overview of the new features, functions, and support for Resource Measurement Facility™ (RMF™) that are available in z/OS V2R2 and V2R1.

New features, functions, and support for z/OS V2R2

Resource Measurement Facility (RMF) provides these new features, functions, and support in z/OS V2R2.

New Monitor III and Postprocessor reports for storage class memory (SCM)

RMF enhances Monitor III and Postprocessor to support storage class memory (SCM) provided by Flash Express. These enhancements include:
- A new Monitor III Storage Class Memory (SCM) Report for SCM to allow short-term performance analysis.
- A new Postprocessor Storage Class Memory (SCM) Report for SCM for long-term overview analysis.
- A new SC data gathering option that can be used to control Monitor III data collection of storage class memory (SCM) activity
- A new subtype 10 for SMF record type 74.

When change was introduced: z/OS V2R2

Reference information:

See *z/OS RMF Report Analysis* for a description of new reports.

See *z/OS RMF User's Guide* for a description of the new storage class memory (SCM) data gathering option.

See *z/OS MVS System Management Facilities (SMF)* for a description of the new SMF records 74-10.

New Monitor III report for PCIe and hardware accelerators

RMF enhances Monitor III to support Peripheral Component Interconnect Express (PCIe) and hardware accelerators. These enhancements include:
- A new Monitor III PCIE Activity Report for PCIe and hardware accelerators to allow short-term performance analysis.
- A new PCIE | NOPCIE data gathering option that can be used to control Monitor III data collection of PCIE and hardware accelerator activity

When change was introduced: z/OS V2R2

Reference information:

See *z/OS RMF Report Analysis* for a description of new Monitor III PCIE report.

See *z/OS RMF User's Guide* for a description of the new PCIE | NOPCIE data gathering option.

RMF support for Shared Pageable Large Pages

Shared Pageable Large Pages is a virtual storage concept to allow large pages in high virtual storage (64-bit storage) be shared between address spaces. In support of Shared Pageable Large Pages, RMF has enhanced these reports:
- RMF Monitor I Paging Activity Report (PAGING)
- RMF Monitor I Virtual Storage Activity Report (VSTOR)
- RMF Monitor III STORM Report
- RMF Monitor III STORF Report

New overview conditions are provided for the Postprocessor, based on the enhanced SMF record 71.

When change was introduced: z/OS V2R2

Reference information:

See *z/OS RMF Report Analysis* for a description of the reports.

See *z/OS MVS System Management Facilities (SMF)* for a description of the enhanced SMF record type 71.

Monitor III Job USAGE Report

This new report is provided as a complement to the existing Monitor III Job Delay Report. It displays the GQSCAN usage statistics on a job level, together with some key metrics related to performance from the CPU, I/O, and storage areas.

When change was introduced: z/OS V2R2

Reference information:

See *z/OS RMF Report Analysis* for a description of this reports

RMF support for multithreading

If enabled, multithreading uses CPU resources more efficiently when a unit of work (thread) running on a core encounters a cache miss. When one thread takes a cache miss and can no longer make progress, the core will be able to switch to running a different thread that is ready to execute.

When change was introduced: z/OS V2R2 (Also V2R1 with APAR OA44101)

Reference information:

See *z/OS MVS System Management Facilities (SMF)z/OS MVS System Management Facilities (SMF)* for a description of the updated SMF records 70, 71, and 72.

See *z/OS RMF Report Analysis* for a description of changes to:
    CPC - Tabular report data table ERBCPCT3
    Fields in the CPC report header
    SYSINFO - Tabular report data table ERBSYST3
    Fields in the SYSINFO report header
    ERBCPCDB - CPC data control block

ERBCPUG3 - Processor data control block

ERBOPDG3 - OMVS process data table

IBMz_CEC

IBMz_ComputerSystem

See *z/OS RMF Report Analysis* for a description of changes to:

CPU Activity - SMF record type 70-1

Workload Activity - SMF record type 72-3

RMF support for real storage configurations of up to 4 TB in a single LPAR

RMF has enhanced SMF records 71 and 75 to enable the Paging Activity (PAGING) and Page Data Set Activity (PAGESP) reports to support real storage configurations of up to 4 TB in a single LPAR.

When change was introduced: z/OS V2R2 (Also V2R1 with APAR OA44503)

Reference information:

See *z/OS MVS System Management Facilities (SMF)* for a description of the updated SMF records 71 and 75.

See *z/OS RMF Report Analysis* for a description of the PAGING and PAGESP reports.

RMF support for zHPF Extended Distance 2 Feature

RMF enhances Monitor I to support reporting on zHPF Extended Distance 2 Feature. The I/O Queuing configuration data sections of SMF record 78 subtype 3 and SMF record 79 subtype 14 are extended to provide the new transport-mode related performance counters. The new performance measurements are provided in new RMF Postprocessor Overview conditions.

When change was introduced: z/OS V2R2 (Also V2R1 with APAR OA44525)

Reference information:

See *z/OS RMF User's Guide* for a description of the new RMF Postprocessor Overview conditions.

See *z/OS MVS System Management Facilities (SMF)* for a description of the updated SMF records 78-3 and 79-14.

RMF support for new CHPID type CS5

RMF has enhanced the RMF Postprocessor CF Activity report (Subchannel Activity section and CF to CF Activity section) and the Monitor III CFSYS Report to provide extended path attributes, which include latency and degraded mode, for the CS5 CHPID type when the enhanced-reporting-of-channel-path-characteristics (ERCPC) facility is active. Physical information, such as how the CHPID maps to a physical link, adapter and port information, and the CHPID's SAP affinity, are also provided for the new CS5 CHPID type.

Data related to CHPID type CS5 is stored in SMF record 74-4.

When change was introduced: z/OS V2R2 (Also V2R1 with APAR OA44502)

Reference information:

See *z/OS RMF Report Analysis* for a description of these reports.

See *z/OS MVS System Management Facilities (SMF)* for a description of the updated SMF record 74-4.

Enhanced Crypto Hardware Activity report

RMF has enhanced the Postprocessor Crypto Hardware Activity report to provide activity measurements from the Crypto Express5S (CEX5) card configured in one of these ways:
* Cryptographic CCA coprocessor
* Cryptographic PKCS11 coprocessor
* Cryptographic accelerator

In addition, new ICSF service measurements are provided for:
* RSA (Ron Rivest, Adi Shamir and Leonard Adleman) Digital Signature Generate and Verify callable services
* ECC (Elliptic Curve Cryptography) Digital Signature Generate and Verify callable services
* AES (Advanced Encryption Standard) MAC (Message Authentication Code) Generate and Verify callable services
* FPE (Format Preserving Encryption) Encipher, Decipher and Translate callable services

New overview conditions are provided for the Postprocessor, based on the enhanced SMF record 70-2.

When change was introduced: z/OS V2R2 (Also V2R1 with APAR OA43493)

Reference information:

See *z/OS RMF Report Analysis* for a description of this report.

See *z/OS MVS System Management Facilities (SMF)* for a description of the enhanced SMF record 70-2.

New features, functions, and support for z/OS V2R1

Resource Measurement Facility (RMF) provided these new features, functions, and support in z/OS V2R1.

Exploitation of IBM z Systems Integrated Information Processors

The RMF Monitor III data gatherer RMFGAT has been entitled to partially run on IBM z Systems Integrated Information Processors (zIIPs). A new Monitor III gatherer option ZIIPUSE/NOZIIPUSE is introduced to determine whether the RMFGAT address space is eligible for zIIP exploitation.

When change was introduced: z/OS V2R1

Statistics about CF structures in storage class memory

Storage class memory (SCM) usage and statistics information is available for coupling facilities and structures that are allocated with storage class memory.

RMF provides SCM related information in SMF record type 74.4, and in the SCM Structure Summary and the Storage Summary of the Usage Summary section in the Postprocessor **Coupling Facility Activity** report.

For structures allocated with SCM, the Monitor III Coupling Facility Activity (CFACT) report displays a new **Structure Details** pop-up window, showing SCM measurements and general structure data.

In addition, enhancements to SMF record 74.4 show new overview conditions for the postprocessor.

When change was introduced: z/OS V2R1

Monitoring PCIe and zEDC activity

A new Postprocessor PCIE Activity Report is available in XML output format and provides measurements about the activity of PCI Express based functions (PCIe functions) and their exploitation of hardware accelerators.

A PCIe function is captured by the report if one of the following hardware feature activities has been measured:
- Remote Direct Memory Access (RDMA) over Converged Ethernet
- zEnterprise Data Compression (zEDC) capability using zEDC Express.

In addition, RMF provides new overview conditions for the postprocessor based on SMF record 74 with a new subtype 9.

When change was introduced: z/OS V2R1

Support of Group Capacity enhancements and absolute LPAR capacity limits

WLM introduces negative phantom weights for softcapping and uses initial weights to distribute the group capping limit when it becomes necessary to enforce the group limits. RMF adds new fields to SMF record 70-1 and takes the new WLM functionality into account when reporting about capacity groups.

RMF adds support to report on the new absolute LPAR capacity limit that can be defined using the logical partition controls of the Hardware Management Console (HMC). The Postprocessor Partition Data report and the Monitor III CPC Capacity report display whether either Initial Capping or an absolute LPAR capacity limit was active during a reporting interval.

Use the new RMF postprocessor overview conditions, based on SMF record 70-1, for a more detailed analysis of the hardware capping options.

When change was introduced: z/OS V2R1

New channel path details in Monitor III and Postprocessor coupling facility reports

New channel path detail information is available for CIB and CFP channels paths. RMF provides this information in both the Subchannel Activity and the CF to CF Activity sections of the Postprocessor Coupling Facility Activity report.

Also, the Monitor III Coupling Facility Systems report is enhanced to provide a new Channel Path Details section in the Subchannels and Paths pop-up window.

In addition, RMF stores the newly gathered channel path detail information for coupling facilities into SMF record 74.4.

When change was introduced: z/OS V2R1

Enhanced Postprocessor Crypto Hardware Activity report

RMF enhances the Postprocessor Crypto Hardware Activity report to provide activity measurements from the Crypto Express4S (CEX4) card configured in one of the three ways:
* Cryptographic CCA coprocessor
* Cryptographic PKCS11 coprocessor
* Cryptographic accelerator

New overview conditions are provided for the postprocessor, based on the enhanced SMF record 70-2.

When change was introduced: z/OS V2R1

Additional Postprocessor reports in XML format

By specifying appropriate ddnames in the job for the postprocessor output, users can request the following reports in XML output format:
* Cache Subsystem Activity
* Channel Path Activity
* Coupling Facility Activity
* Enqueue Activity
* Hierarchical File System Statistics
* I/O Queuing Activity
* Page Data Set Activity
* PCIE Activity Report
* Shared Device Activity
* Virtual Storage Activity
* XCF Activity

When change was introduced: z/OS V2R1

Cross platform monitoring support for Windows

Besides the support of the AIX and Linux operating systems, RMF XP has been extended to support Windows systems as monitored endpoints. You can display

the Resource Monitoring plug-in for z/OS Management Facility (z/OSMF) performance metrics from Windows systems the same way, and together, with metrics from other platforms.

When change was introduced: z/OS V2R1

SMF Recording Facility for AIX, Linux and Windows

You can now use RMF XP for long-term performance analysis and capacity planning of your AIX, Linux and Windows systems. For this purpose, you can write performance data collected from the monitored endpoints to the new SMF record type 104.

When change was introduced: z/OS V2R1

Controlling the invocation of data reduction exit routines

RMF now controls the names of the data reduction exit routines that are invoked by callers of RMF Monitor II sysplex data gathering service ERB2XDGS, or Monitor III Sysplex Data Retrieval service ERB3XDRS.

z/OS RMF Report Analysis (see Note) describes how to apply the required access control. Especially when an unauthorized application is making use of the `<exit_name>` parameter, a new RACF resource profile of class FACILITY is required.

When change was introduced: z/OS V2R1

Monitoring of pageable large pages activity

RMF provides enhanced performance measurements about memory objects and frames in the reports listed here.

- In the Postprocessor **Paging Activity** report, the Memory Objects and Frames section has been renamed to Memory Objects and High Virtual Storage Frames, which now contains the following enhanced measurements:

    additional metrics for high virtual common and shared storage frames

    metrics for 1 MB frames are now reported in more detail

    number of auxiliary storage slots for frames from virtual common and shared storage backed on DASD.

  In addition, RMF provides new overview conditions for the postprocessor based on SMF record 71.
- In the Postprocessor **Virtual Storage Activity** report, the information about 1 MB frames in the Private Area Detail section is now separated into the categories `fixed` and `pageable`.
- The Monitor III **Storage Memory Objects** report now provides measurements for 1 MB frames in more detail at system and address space level.

When change was introduced: z/OS V2R1

Support of Storage Class Memory for paging

RMF provides measurements about storage type storage class memory (SCM) in the following reports:

- The Postprocessor as well as the Monitor II **Page Data Set Activity** reports provide information about SCM blocks used by the Auxiliary Storage Manager (ASM).
- The Postprocessor **Paging Activity** report provides information about shared and high virtual shared and common frames backed on SCM and also provides information about SCM blocks used by ASM.

When change was introduced: z/OS V2R1

Run-Time Library Extensions new functions to consider

There are no new functions for Run-Time Library Extensions in the last z/OS releases.

SDSF new functions to consider

This topic describes new SDSF functions in z/OS.

New panels for system resources and data sets

Description: New tabular panels provide information about the resources and data sets for systems in the sysplex:
- ENQ (enqueues for each system in the sysplex)
- SYM (system static and dynamic symbols for each system in the sysplex)
- LNK (link list data sets)
- LPA (link pack area data set list)
- APF (authorized program facility data set list)
- PAGE (page data sets)
- PARM (parmlib data sets)
- SYS (system information)

When change was introduced: z/OS V2R1

Reference information: *z/OS SDSF Operation and Customization*

New job detail panels

Description: New panels show devices and memory used by a job, and reasons that a job might be delayed.

When change was introduced: z/OS V2R2

Reference information: *z/OS SDSF Operation and Customization*

Job step panel

Description: A new panel shows the steps for a job.

When change was introduced: z/OS V2R2

Reference information: *z/OS SDSF Operation and Customization*

Job group and dependency panels

Description: New panels exploit enhancements in JES2 related to job execution control. The new Job Group panel lets you display information about JES2 job

groups, or execution zones, which are created when JCL is submitted that describes a relationship between a set of jobs. The new Job Dependency panel lets you view:

- For a selected job group, all of the dependencies within the group
- For a selected job:
  - Jobs that it is dependent on
  - Jobs that have dependencies on it.

When change was introduced: z/OS V2R2

Reference information: *z/OS SDSF Operation and Customization*

SDSF REXX enhancements

Description: SDSF adds several enhancements to its support for REXX:

- A new RGEN command generates a REXX exec for the current panel and displays it with ISPF Edit. The exec includes ISFEXEC and ISFACT statements for accessing the panel, and special variables as appropriate, such as those for filtering.
- You can now invoke a REXX exec with the % action character, when SDSF is running under ISPF. This allows you to create a customized action character that performs a desired function against a row on a tabular panel.
- A new COMPACT option on the ISFACT, ISFEXEC, and ISFGET commands causes data for an entire row to be returned in a new SDSFROW stem variable, rather than in a separate stem variable for each column.
- When you access a panel with an action character, you can use new special variables that use a prefix to ensure that the variables are unique.

When change was introduced: z/OS V2R2

Reference information: *z/OS SDSF Operation and Customization*

System command enhancements

Description: Using the System Command Extension pop-up, you can now assign system commands to groups and add comments to describe them. New pop-ups, filtering and sorting help you work with saved commands. The number of commands saved in the ISPF profile is increased, and if you allocate ISPF table library ISFTABL, the number is increased further.

When change was introduced: z/OS V2R2

Reference information: *z/OS SDSF Operation and Customization*

Saving and printing tabular data

Description: The SNAPSHOT command lets you display the data that is displayed on a tabular panel (such as DA or ST) with Browse or Edit. You might then print the data or copy it to a data set.

When change was introduced: z/OS V2R2

Reference information: *z/OS SDSF Operation and Customization*

Action characters and overtypeable fields from the command line

Description: You can issue action characters against rows on a tabular panel from the command line, and overtype the values in columns from the command line. This provides a quick alternative to typing action characters in the NP column or overtyping columns in the table.

When change was introduced: z/OS V2R2

Reference information: *z/OS SDSF Operation and Customization*

IBM z Integrated Information Processor (zIIP) exploitation

Description: SDSF now allows some processing to be performed on a zIIP if one has been configured.

When change was introduced: z/OS V2R2

Reference information: *z/OS SDSF Operation and Customization*

HASPINDX removal

Description: The HASPINDX data set is no longer used. Previously, SDSF used it to manage SYSLOG data sets that were created on z/OS systems prior to z/OS V1R11.

When change was introduced: z/OS V2R2

Reference information: *z/OS SDSF Operation and Customization*

64-bit addressing

Description: SDSF supports 64-bit addressing, which allows SDSF panels to handle very large numbers of rows.

When change was introduced: z/OS V2R1

Reference information: *z/OS SDSF Operation and Customization*

Enhanced support for browsing with REXX and Java

Description: A new ISFBROWSE host command and new special variables provide support for browsing job output, check output and the system log using a REXX exec. This provides an alternative to the previously available support, which allowed you to allocate the data sets and then use EXECIO or a similar utility to browse them. New special variables provide function that corresponds to finding a string in the data and scrolling the data. New methods provide the same support for browsing job output, check output and the system log using a Java program. New special variables support a FIND function to search for character strings when browsing data.

When change was introduced: z/OS V2R1

Reference information: *z/OS SDSF Operation and Customization* and online help

Sort on up to 10 columns

Description: Tabular panels now allow sorting on up to 10 columns. With the SORT command, use plus (+) or minus (-) parameters to add or remove sort criteria.

When change was introduced: z/OS V2R1

Reference information: *z/OS SDSF Operation and Customization* and online help

Symbols in filtering

Description: You can use system symbols (both static and dynamic) with filtering. The Filter pop-up lets you display a list of the current symbols and their values.

When change was introduced: z/OS V2R1

Reference information: *z/OS SDSF Operation and Customization* and online help

Long job class names

Description: SDSF supports the JES2 enhancement for job class names of up to 8 characters. There are related changes to SDSF panels. The default width of columns that display job class now expands to 8 when there are long (greater than 1-character) class names in the MAS.

When change was introduced: z/OS V2R1

Reference information: *z/OS SDSF Operation and Customization*

Trace SDSF security

Description: SDSF's security trace function helps you understand and diagnose SDSF security (SAF or ISFPARMS). In response to the actions that you take, such as issuing commands or overtyping columns, it issues messages that describe the associated SAF resources or ISFPARMS statements. You control security trace with commands, REXX variable or Java methods.

When change was introduced: z/OS V2R1

Reference information: *z/OS SDSF Operation and Customization* and online help

Print using source attributes, carriage control and other enhancements

Description: When printing to SYSOUT, you can request that the SYSOUT use the attributes of the source. You can also specify additional attributes, including writer name, record length and record format. SDSF can now use the record format value to determine how to handle carriage control for all printing. By default, SDSF always prints with ASA carriage control.

When change was introduced: z/OS V2R1

Reference information: *z/OS SDSF Operation and Customization* and online help

Console name modification

Description: When SDSF needs to activate an extended console and the default console name is in use (for example, when you invoke SDSF from a REXX exec

while also using SDSF interactively) SDSF attempts to activate a new console with a different name, which is derived by modifying the default console name. To modify the name, SDSF appends a single-character suffix. You can control console name modification with a command, ISFPARMS, REXX special variable or Java program.

When change was introduced: z/OS V2R1

Reference information: *z/OS SDSF Operation and Customization* and online help

Display of duplicate data sets

Description: You can now control whether SDSF displays duplicate SYSOUT data sets when you browse or print job output. Duplicate data sets result from DD statements referencing more than one OUTPUT JCL control card.

When change was introduced: z/OS V2R1

Reference information: *z/OS SDSF Operation and Customization* and online help

Security Server (RACF) new functions to consider

This topic describes new Security Server (RACF) functions in z/OS.

IBM Multi-Factor Authentication for z/OS

Description: IBM Multi-Factor Authentication for z/OS requires that multiple authentication factors be presented during logon to verify a user's identity. Each authentication factor must be from a separate category of credential types.

When change was introduced: z/OS V2R2

Reference information:

> *z/OS Security Server RACF Security Administrator's Guide*
>
> *z/OS Security Server RACF System Programmer's Guide*
>
> *z/OS Security Server RACF Macros and Interfaces*
>
> *z/OS Security Server RACF Command Language Reference*
>
> *z/OS Security Server RACF Messages and Codes*
>
> *z/OS Security Server RACF Data Areas*
>
> *z/OS Security Server RACF Callable Services*
>
> *z/OS Security Server RACF General User's Guide*

Remote sharing enhancements to allow dynamic MAIN switching

Description: RACF allows the dynamic assignment of a new MAIN system in an RRSF Multisystem Node (MSN) with a vastly simplified procedure which replaces an extremely complicated 11-step process that is only intended for long-term configuration changes. In contrast, the new function may be employed in situations such as a scheduled maintenance window, an increased workload, or an unexpected outage, on the current MAIN system.

When change was introduced: z/OS V2R2

Reference information:

z/OS Security Server RACF System Programmer's Guide

z/OS Security Server RACF Macros and Interfaces

z/OS Security Server RACF Command Language Reference

z/OS Security Server RACF Messages and Codes

z/OS Security Server RACF Security Administrator's Guide

z/OS Security Server RACF Data Areas

z/OS Security Server RACF Callable Services

Remote sharing enhancements to deny inbound requests

Description: RACF Remote Sharing Facility (RRSF) is enhanced to support a one-way RRSF connection that is completely under the control of the denying system.

When change was introduced: z/OS V2R2

Reference information:

z/OS Security Server RACF System Programmer's Guide

z/OS Security Server RACF Macros and Interfaces

z/OS Security Server RACF Command Language Reference

z/OS Security Server RACF Messages and Codes

z/OS Security Server RACF Security Administrator's Guide

z/OS Security Server RACF Data Areas

z/OS Security Server RACF Callable Services

R_admin callable service enhancement to extract RACF remote sharing configuration data

Description: A new programming interface provides RRSF configuration and operational information. Apart from the benefit of being able to report on RRSF without parsing command output, it may also facilitate the automation of MAIN switches.

When change was introduced: z/OS V2R2

Reference information:

z/OS Security Server RACF System Programmer's Guide

z/OS Security Server RACF Macros and Interfaces

z/OS Security Server RACF Command Language Reference

z/OS Security Server RACF Messages and Codes

z/OS Security Server RACF Security Administrator's Guide

z/OS Security Server RACF Data Areas

z/OS Security Server RACF Callable Services

RACF Read-Only Auditor

Description: RACF enhances the ADDUSER and ALTUSER commands to enable the user with AUDITOR in a READ-ONLY mode with the new ROAUDIT attribute.

When change was introduced: z/OS V2R2

Reference information:

z/OS Security Server RACF System Programmer's Guide

z/OS Security Server RACF Macros and Interfaces

z/OS Security Server RACF Command Language Reference

z/OS Security Server RACF Messages and Codes

z/OS Security Server RACF Security Administrator's Guide

z/OS Security Server RACF Auditor's Guide

z/OS Security Server RACF Diagnosis Guide

z/OS Security Server RACF Data Areas

z/OS Security Server RACROUTE Macro Reference

z/OS Security Server RACF Callable Services

z/OS Cryptographic Services PKI Services Guide and Reference

UNIX Search Authority

Description: RACF is enhanced to enable and simplify z/OS UNIX administration and to grant UNIX administrators the authority to read or search directories containing the files to be administered without granting more authority than necessary.

When change was introduced: z/OS V2R2

Reference information:

z/OS Security Server RACF System Programmer's Guide

z/OS Security Server RACF Macros and Interfaces

z/OS Security Server RACF Command Language Reference

z/OS Security Server RACF Messages and Codes

z/OS Security Server RACF Security Administrator's Guide

z/OS Security Server RACF Auditor's Guide

z/OS Security Server RACF Data Areas

z/OS Security Server RACROUTE Macro Reference

z/OS Security Server RACF Callable Services

z/OS UNIX System Services Planning

RACF RACDCERT granular certificate administration support.

Description: The RACF RACDCERT command is enhanced to provide granular certificate administration support through the RDATALIB classes.

When change was introduced: z/OS V2R2

Reference information:

z/OS Security Server RACF Command Language Reference

z/OS Security Server RACF Security Administrator's Guide

Network Authentication Services (NAS) support for Public Key Cryptography for Initial Authentication (PKINIT)

Description: Network Authentication Services is enabled to support the integration of public key cryptography onto the initial authentication exchange for a ticket-granting-ticket

When change was introduced: z/OS V2R2

Reference information:

z/OS Integrated Security Services Network Authentication Service Administration

z/OS Integrated Security Services Network Authentication Service Programming

RACF R_datalib enhancement

Description:R_datalib callable service is enhanced to manage certificates and key rings in RACF through similar to the functions that the RACDCERT commands provide.

When change was introduced: z/OS V2R2

Reference information:

z/OS Security Server RACF Macros and Interfaces

z/OS Security Server RACF Security Administrator's Guide

z/OS Security Server RACF Diagnosis Guide

z/OS Security Server RACF Data Areas

z/OS Security Server RACF Callable Services

Enhanced RACF password security

Description: RACF password syntax rules are enhanced to support additional special characters.

When change was introduced: z/OS V2R2

Reference information:

z/OS Security Server RACF General User's Guide

z/OS Security Server RACF Macros and Interfaces

z/OS Security Server RACF Command Language Reference

z/OS Security Server RACF Security Administrator's Guide

z/OS Security Server RACF Diagnosis Guide

z/OS Security Server RACF Data Areas

z/OS Security Server RACF Callable Services

RACF Health Checks

Description: Four new RACF health checks (RACF_CSFSERV_ACTIVE, RACF_CSFKEYS_ACTIVE, RACF_PASSWORD_CONTROLS, and RACF_ENCRYPTION_ALGORITHM) and updates to RACF_SENSITIVE_RESOURCES are introduced to verify that system administrator's have the best possible security configuration for their z/OS environment.

When change was introduced: z/OS V2R2

Reference information:

z/OS Security Server RACF Messages and Codes

IBM Health Checker for z/OS User's Guide

Database unload of certificate DNs

Description: The database unload utility (IRRDBU00) is enhanced to provide extended processing for fields such as the certificate field in profiles in the DIGTCERT class. This allows information, such as the subject's distinguished name, the issuer's distinguished name, and the signature algorithm to be unloaded.

When change was introduced: z/OS V2R1

Reference information:

z/OS Security Server RACF Macros and Interfaces

Restricting access to a zFS file system

Description: To restrict access to a zFS file system, you can define a general resource profile in the FSACCESS class. You can then use RACF commands to restrict z/OS UNIX access to the specified zFS file system for most users and allow selected users and groups to remain eligible to access the file system. This method supports an improved audit posture by enabling the RACF administrator to demonstrate a single point of control for restricting access to one or more file systems that might contain sensitive or personal data.

When change was introduced: z/OS V2R1

Reference information:

z/OS Security Server RACF Callable Services
z/OS Security Server RACF Command Language Reference
z/OS Security Server RACF Data Areas
z/OS Security Server RACF Macros and Interfaces
z/OS Security Server RACF Messages and Codes
z/OS Security Server RACF Security Administrator's Guide
z/OS Security Server RACF System Programmer's Guide
z/OS UNIX System Services Planning
z/OS Security Server RACROUTE Macro Reference

Remove BPX.DEFAULT.USER Profile

Description: Default OMVS segment support is no longer provided regardless of whether the BPX.DEFAULT.USER profile is defined in the FACILITY class. z/OS UNIX users or groups must have OMVS segments that are defined for user and group profiles with unique UIDs and GIDs. Alternatively, you can use RACF support for automatically generating unique UIDs and GIDs on demand for users and groups that do not have OMVS segments that are defined.

When change was introduced: z/OS V2R1

Reference information:

z/OS Security Server RACF Auditor's Guide
z/OS Security Server RACF Callable Services
z/OS Security Server RACF Command Language Reference
z/OS Security Server RACF Messages and Codes
z/OS Security Server RACF Security Administrator's Guide
z/OS Migration

IBM Health Checker for z/OS User's Guide

Reporting certificates in the chain when added and listed

Description: Report to the user the labels used for all the certificates in the chain when the chain is added. Add function to display information about the certificates in the chain.

When change was introduced: z/OS V2R1

Reference information:

z/OS Security Server RACF Command Language Reference

z/OS Security Server RACF Messages and Codes

z/OS Security Server RACF Security Administrator's Guide

Enterprise PKCS#11 secure key support

Description: RACF can now use the ICSF Enterprise PKCS#11 secure key support by using the RACDCERT functions to create and manage secure key on the TKDS for the certificate and the retrieval of the certificate through the R_datalib callable service.

When change was introduced: z/OS V2R1

Reference information:

z/OS Security Server RACF Callable Services

z/OS Security Server RACF Command Language Reference

z/OS Security Server RACF Macros and Interfaces

z/OS Security Server RACF Security Administrator's Guide

z/OS Security Server RACF System Programmer's Guide

RACF Remote sharing enhancements

Description: In z/OS V2R1, RACF Remote Sharing (RRSF) is enhanced to use IPv6, if it is enabled on z/OS. It is used for establishing TCP/IP connections with remote RRSF systems and allows a z/OS system with an IPv6 address to be specified on the RACF TARGET command for the TCP(ADDRESS) operand. Also, when using AT-TLS to encrypt data that is sent between RRSF nodes using TCP/IP, stronger cryptography suites can be used in z/OS V2R1, including elliptic curve cryptography (ECC)-based certificates. Support is also added to allow blank lines and comments in RACF parameter library members.

When change was introduced: z/OS V2R1

Reference information:

z/OS Security Server RACF Command Language Reference

z/OS Security Server RACF System Programmer's Guide

RACDCERT enhancement

Description: This enhancement prevents the deletion of a certificate that was used for generating a request, but also grant clients an override mechanism to delete it when needed.

When change was introduced: z/OS V2R1

Reference information:

z/OS Security Server RACF Callable Services

z/OS Security Server RACF Macros and Interfaces

Health check for digital certificate expiration

Description: Applications that rely on certificates might experience an interruption if a certificate that is used by the application or one of the users of the application is allowed to expire. RACF is introducing a new health check, RACF_CERTIFICATE_EXPIRATION, which identifies certificates that are stored in the RACF database that are expired or are about to expire.

When change was introduced: z/OS V2R1

Reference information:

IBM Health Checker for z/OS User's Guide

z/OS Security Server RACF Messages and Codes

z/OS Security Server RACF Security Administrator's Guide

RACF support for DB2 V11

Description: In DB2® V11, DB2 is enhancing cache management for RACF permissions when DB2 listens to RACF ENF events to determine when to purge the cache. In addition to DB2 listening to RACF ENF events 62 and 71, RACF ENF event 79 is added.

When change was introduced: z/OS V2R1

Reference information:

z/OS MVS Programming: Authorized Assembler Services Reference EDT-IXG

z/OS Security Server RACF Command Language Reference

z/OS Security Server RACF Data Areas

z/OS Security Server RACF Macros and Interfaces

z/OS Security Server RACF Security Administrator's Guide

z/OS Security Server RACF System Programmer's Guide

z/OS Security Server RACROUTE Macro Reference

ServerPac new functions to consider

This topic describes new ServerPac functions in z/OS.

ServerPac supports ordering products without a full system or subsystem

Description: ServerPac supports ordering products without having to order a full system or subsystem in a ServerPac. ServerPac also provides the option to install into an existing GLOBAL zone or use orders shipped GLOBAL.

When change was introduced: z/OS V2R1.

Reference information:

• *ServerPac: Using the Installation Dialog*

Secure FTP

Description: All CB Offerings internet orders are now downloaded securely using secure FTP.

When change was introduced: z/OS V2R1.

Reference information:
- *ServerPac: Using the Installation Dialog*

RACF enhancements

Description: RACF enhancements include the following:
- A new job to identify the difference between current shipped RACF definitions and a previous saved configuration which is selected for merge
- Enhanced RACFDRV and RACFTGT jobs
- A new job to identify missing security definitions on the driving system by generating the RLIST output of each of the entries in the RACFDRV job

When change was introduced: z/OS V2R1.

Reference information:
- *ServerPac: Using the Installation Dialog*

SMP/E new functions to consider

SMP/E ZONEMERGE enhancements

Description: SMP/E provides enhanced ZONEMERGE command processing. Three operands have been introduced with this enhancement: BYPASS(IFREQ), CHECK, and VERIFY. These operands allow ZONEMERGE processing to verify target and distribution zones that can be merged without conflicts and without creating incompatible SYSMOD relationships. In addition, ZONERMERGE will both enforce SYSMOD requisites and preserve conditional requisites. These enhancements are intended to allow products in separate SMP/E zones to be merged, consolidating product sets and simplifying overall software management.

When change was introduced: APAR IO23466.

Reference information:
> *SMP/E for z/OS Messages, Codes, and Diagnosis*
> *SMP/E for z/OS Commands*

Support for HTTPS downloads

Description: SMP/E supports secure and encrypted download operations using HTTPS (HTTP over SSL).

When change was introduced: APAR IO20858.

Reference information:
> *SMP/E for z/OS Messages, Codes, and Diagnosis*
> *SMP/E for z/OS Commands*
> *SMP/E for z/OS Reference*
> *SMP/E for z/OS User's Guide*

Support for SMP/E ISPF dialog split screen

Description: More than one SMP/E ISPF dialog can be open at a single time, allowing for a split screen. This allows any number of screens to be open for reading CSI data sets concurrently, but a CSI data set may only be open for update in a single dialog screen.

When change was introduced: APAR IO18093.

Reference information: None.

TSO/E new functions to consider

This topic describes new TSO/E functions in z/OS.

TSO/E OPERSEWAIT default change

Description: The default of the OPERSEWAIT keyword on the SEND statement in PARMLIB member IKJTSOxx is changed from ON to OFF. When the default is applied to an Operator SEND, the system will no longer wait (while potentially holding critical system resources) to complete the send if not all recipients have an available VTAM buffer.

When change was introduced: z/OS V2R2

Reference information:

z/OS TSO/E System Programming Command Reference

z/OS TSO/E Customization

z/OS TSO/E Messages

z/OS MVS Initialization and Tuning Reference

TSO/E REXX enhancements to EXECIO, LISTDSI, and STORAGE functions and new MVSVAR variable

Description: TSO/E provides a number of REXX enhancements to EXECIO, and to the LISTDSI, and STORAGE functions, and provides a new MVSVAR variable to indicate the level of the operating system. These enhancements are intended to make it easier to retrieve information about data sets in the extended addressing space (EAS) of extended address volumes (EAVs), as well as multi-volume, PDSE, and concatenated data sets; to support I/O to undefined and spanned record format data sets in order to improve the usability and capability of EXECIO; and to eliminate unnecessary calls from LISTDSI to an external security manager, such as RACF.

When change was introduced: z/OS V2R1

Reference information:

z/OS TSO/E REXX Reference

z/OS TSO/E Command Reference

z/OS TSO/E Customization

z/OS TSO/E Messages

z/OS TSO/E CLISTs

z/OS MVS System Messages, Vol 9 (IGF-IWM)

TSO/E TMP supports PARMDD keyword of the JCL EXEC statement passing a parameter string greater than 100 characters long to TMP

Description: The TSO/E TMP supports the PARMDD keyword of the JCL EXEC statement for passing a parameter string greater than 100 characters long to the TMP.

When change was introduced: z/OS V2R1

Reference information:

> *z/OS TSO/E Customization*

XL C/C++ new functions to consider

This topic describes new XL C/C++ functions in z/OS.

Automonitor type support for XL C/C++ applications

Description: Specifying the DEBUG(FORMAT(DWARF)) option with the OPTIMIZE or NOOPTIMIZE option generates automonitor debug information for XL C/C++ applications.

When change was introduced: z/OS V2R1

Reference information:
* *z/OS XL C/C++ User's Guide*

Changes to default ARCH and TUNE level

Description: The default ARCH level is changed from ARCH(5) to ARCH(7), and the default TUNE level is changed from TUNE(5) to TUNE(7).

When change was introduced: z/OS V2R1

Reference information:
* *z/OS XL C/C++ User's Guide*

Changes to the SUPPRESS compiler option

Description: The default of the SUPPRESS option for C++ compilation is changed to SUPPRESS(CCN5900, CCN5922), and NOSUPPRESS accepts suboptions.

When change was introduced: z/OS V2R1

Reference information:
* *z/OS XL C/C++ User's Guide*

Name change of the OBJECTMODEL(COMPAT) compiler option

Description: The name of suboption OBJECTMODEL(COMPAT) is changed to OBJECTMODEL(CLASSIC), but COMPAT is still accepted as the synonym of CLASSIC.

When change was introduced: z/OS V2R1

Reference information:
- *z/OS XL C/C++ User's Guide*
- *z/OS XL C/C++ Language Reference*

New debug information format

Description: When the DEBUG option is in effect, the compiler generates debug information based on the DWARF Version 4 debugging information format.

When change was introduced: z/OS V2R1

Reference information:
- *z/OS XL C/C++ User's Guide*

Support for debugging optimized code

Description: The DEBUG(LEVEL) suboption is introduced to support debugging optimized code. Different debug levels can balance between debug capability and compiler optimization.

When change was introduced: z/OS V2R1

Reference information:
- *z/OS XL C/C++ User's Guide*

Support for new hardware built-in functions

Description: The XL C/C++ compiler introduces the following new hardware built-in functions to support hardware packed-decimal instructions:
- Compare Decimal (CP)
- Add Decimal (AP)
- Subtract Decimal (SP)
- Multiply Decimal (MP)
- Divide Decimal (DP)
- Shift and Round Decimal (SRP)

The XL C/C++ compiler introduces the following new hardware built-in functions to support conversions between DFP and Zoned types:
- Zoned to DFP conversion (CDZT)
- Zoned to DFP conversion (CXZT)
- DFP to Zoned conversion (CZDT)
- DFP to Zoned conversion (CZXT)

When change was introduced: z/OS V2R1

Reference information:
- *z/OS XL C/C++ Programming Guide*

Support for parallel programming

Description: The XL C/C++ compiler supports parallelization of C and C++ program code using pragma directives compliant to the OpenMP Application Program Interface V3.1 specification. Program parallelization is enabled when the SMP compiler option is in effect.

When change was introduced: z/OS V2R1

Reference information:
- *z/OS XL C/C++ User's Guide*
- *z/OS XL C/C++ Language Reference*
- *z/OS XL C/C++ Programming Guide*

XL C/C++ compiler option INCLUDE is introduced

Description: The INCLUDE option is introduced to specify additional header files to be included in a compilation unit, as though the files were named in consecutive #include statements that are inserted before the first line of the source file.

When change was introduced: z/OS V2R1

Reference information:
- *z/OS XL C/C++ User's Guide*

XL C/C++ compiler option LANGLVL has new suboptions

Description: The LANGLVL option has the following new suboptions to support the C11 and C++11 programming languages:
- C1XNORETURN
- CONSTEXPR
- DEFAULTANDDELETE
- EXTC1X
- EXPLICITCONVERSIONOPERATORS
- REFERENCECOLLAPSING
- RIGHTANGLEBRACKET
- RVALUEREFERENCES
- SCOPEDENUM

When change was introduced: z/OS V2R1

Reference information:
- *z/OS XL C/C++ User's Guide*
- *z/OS XL C/C++ Language Reference*

XL C/C++ compiler option SMP is introduced

Description: The SMP option is introduced to enable parallelization of program code.

When change was introduced: z/OS V2R1

Reference information:
- *z/OS XL C/C++ User's Guide*

XL C/C++ compiler option SYSSTATE is introduced

Description: The SYSSTATE option is introduced to provide additional SYSSTATE macro parameters to the SYSSTATE macro that is generated by the compiler. The SYSSTATE option is for Metal C compilation only.

When change was introduced: z/OS V2R1

Reference information:
- *z/OS XL C/C++ User's Guide*

XL C/C++ compiler option THREADED is introduced

Description: The THREADED option is introduced to indicate to the compiler whether it must generate threadsafe code. Specifying the NOTHREADED option enables the optimizers to perform non-threadsafe transformations for single threaded programs.

When change was introduced: z/OS V2R1

Reference information:
- *z/OS XL C/C++ User's Guide*

z/OS OpenSSH new functions to consider

This topic describes new z/OS OpenSSH functions in z/OS.

Support for Kerberos through General Security Service - API

Description: Support is provided for Kerberos through General Security Service - API (GSS-API) authentication and key exchange. New GSS-API options are available in ssh_config and sshd_config.

When change was introduced: z/OS V2R2.

Reference information:
- *z/OS V2R2 OpenSSH User's Guide*

zEnterprise Data Compression implementation

Description: Previously, z/OS OpenSSH used the open source zlib compression library version 1.2.3. In z/OS V2R2, z/OS OpenSSH now uses the zEnterprise Data Compression zlib. A new zEDCCompression option is available in zos_ssh_config, zos_ssh_user_config, and zos_sshd_config.

When change was introduced: z/OS V2R2.

Reference information:
- *z/OS V2R2 OpenSSH User's Guide*

Support for FIPS 140-2 mode

Description: Support was added to meet FIPS 140-2 specifications. New options added to zos_ssh_config, zos_ssh_user_config, and zos_sshd_config.

When change was introduced: z/OS V2R2.

Reference information:
- *z/OS V2R2 OpenSSH User's Guide*

z/OS UNIX System Services new functions to consider

This topic describes new z/OS UNIX functions in z/OS.

Limiting access to the Write an SMF Record function

Description: The BPX.SMF resource profile in the RACF FACILITY class provides generic access to the z/OS UNIX Write an SMF Record function. In V2R2 with APAR OA48775, access to that function can be further limited to specific SMF record types and subtypes by using the BPX.SMF.*xxx.yyy* FACILITY class, where *xxx* is the SMF record type and *yyy* is the SMF record subtype.

When change was introduced: z/OS V2R2.

Reference information:
- *z/OS UNIX System Services Planning*
- *z/OS UNIX System Services Programming: Assembler Callable Services Reference*
- *z/OS XL C/C++ Runtime Library Reference*

Enhancements for the kernel and LFS: 64-bit addressing mode and above-the bar stack storage

Description: Previously, the kernel and LFS ran in 31-bit addressing mode. In V2R2, the kernel and LFS run in 64-bit addressing mode, and the LFS also accommodates PFSes that run in 64-bit addressing mode. To alleviate storage constraints, above-the-bar stack storage for space-switched services that are used by the kernel and LFS is supported.

When change was introduced: z/OS V2R2.

Reference information:
- *z/OS UNIX System Services File System Interface Reference*
- *z/OS MVS System Commands*
- *z/OS MVS System Messages, Vol 3 (ASB-BPX)*

Increased thread limit in the kernel with the KERNELSTACKS(ABOVE) parmlib option

Description: Previously, the limit of the number of threads that could be run in the kernel was approximately 32,000. In V2R2, the limit is higher, depending on services that are used and the additional storage that those services require. The D OMVS,ST system command option displays the maximum number of threads that can be created and run in the kernel.

When change was introduced: z/OS V2R2.

Reference information:
- *z/OS MVS Initialization and Tuning Reference*
- *IBM Health Checker for z/OS User's Guide*
- *z/OS MVS System Messages, Vol 3 (ASB-BPX)*
- *z/OS MVS System Commands*
- *z/OS UNIX System Services Messages and Codes*

Providing support for task-level security

Description: Previously, when checking ownership of process information, the w_getpsent() callable service did not support a thread-level security environment because it was defined as a process-level service. In V2R2, a new environment

| variable is provided that enables the w_getpsent() callable service to use the
| thread-level identity that is created by the pthread_security_np() service.

| **When change was introduced:** z/OS V2R2.

| **Reference information:**
| • *z/OS UNIX System Services Programming: Assembler Callable Services Reference*

Debugging vector registers

Description: Previously, the ptrace service did not support the reading and writing of vector registers. In V2R1, support was added for reading and writing vector registers, which enables debuggers such as dbx to read and write vector registers.

When change was introduced: z/OS V2R1.

Reference information:
• *z/OS UNIX System Services Programming: Assembler Callable Services Reference*
• *z/OS UNIX System Services Messages and Codes*

Added dbx support of vector-enabled programs

Description: Previously, dbx did not support vector-enabled programs. In V2R1, the dbx debugger supports debugging of vector-enabled programs. This support includes the ability to dissemble the new vector instructions. Vector registers and vector variables can also be set and displayed.

When change was introduced: z/OS V2R1.

Reference information:
• *z/OS UNIX System Services Programming Tools*
• *z/OS UNIX System Services Command Reference*
• *z/OS UNIX System Services Messages and Codes*

Additional support for conversion of text files

Description: Previously, z/OS shell commands (which are EBCDIC applications) could not be used to process untagged z/OS text files containing ASCII or Unicode data. They also could not override the code set value of tagged files. In Version 2 Release 1, support was added to a select set of commands that process text files to allow additional control over the text conversion of those text files.

When change was introduced: z/OS V2R1.

Reference information:
• *z/OS UNIX System Services Command Reference*

Enhancements to the automount facility

Description: Previously, a convenient method of recognizing the last use information of the automount-managed file systems was not available. In V2R1, a new option (-f) displays the last use information. Other enhancements include setting permission bits other than the default for the file system that it creates, using static system symbols in the master file, and other usability improvements.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS UNIX System Services Command Reference*

Expanded number of shared condition variables and mutexes

Description: The number of mutexes and condition variables the system supports for authorized programs was increased from 131,072 to 16,777,215. The overall system limit was increased to 4,294,967,295. This change makes it easier to port applications that require a large number of mutexes and condition variables to z/OS UNIX.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS UNIX System Services Planning*
- *z/OS UNIX System Services Programming: Assembler Callable Services Reference*

Full support added for conversion between code pages

Description: Previously, z/OS UNIX did not fully participate in text conversion or fully support automatic conversion for all IBM code pages. In Version 2 Release 1, z/OS UNIX exploits Unicode Services to provide code page-to-code page conversion.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS UNIX System Services Planning*
- *z/OS UNIX System Services Command Reference*

Increased number of supported pipes

Description: Previously, there was a system limit of 8730 pipes. In Version 2 Release 1, the system limit was increased to 15K pipes and enhancements made to pipe monitoring and reviewing.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS UNIX System Services Planning*
- *z/OS UNIX System Services Programming: Assembler Callable Services Reference*
- *z/OS UNIX System Services Command Reference*
- *z/OS Using REXX and z/OS UNIX System Services*
- *z/OS MVS Initialization and Tuning Reference*
- *z/OS MVS System Commands*
- *z/OS MVS System Messages, Vol 3 (ASB-BPX)*

More accurate access counts in a new SMF record

Description: Previously, SMF close records were not an ideal way of determining which files or directories were frequently accessed. In Version 2 Release 1, a more accurate access count in a new SMF record for z/OS UNIX is provided, making it possible to perform diagnosis of z/OS UNIX file performance issues.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS UNIX System Services Planning*

- *z/OS MVS System Management Facilities (SMF)*

Running tagged shell scripts in different SBCS locales

Description: Previously, users could not run shell scripts under different SBCS locales. In Version 2, Release 1, with automatic conversion enabled, tagged shell scripts can be run in different SBCS locales.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS UNIX System Services Command Reference*

Simplified management of TFS file systems

Description: Previously, warnings were not issued when space in the temporary file system (TFS); reason codes were not produced for error conditions. In Version 2 Release 1, error messages are issued if space becomes critical and unique reason codes are issued. The TFS can also be configured to increase in size.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS UNIX System Services Planning*

Using the _login() service without specifying a password

Description: Applications with appropriate privileges can use the _login() service without specifying a password because support was added for SURROGAT class profiles.

When change was introduced: z/OS V2R1.

Reference information:
- *z/OS UNIX System Services Programming: Assembler Callable Services Reference*

Chapter 2. z/OS elements and features

z/OS base elements

z/OS provides function equivalent to the following elements. For the version and release numbers of those elements that also exist as separately orderable products, see *z/OS Planning for Installation*.

An extra set of integrated features is available on an optional basis, see "z/OS optional features" on page 114.

The following is a list of z/OS base elements:
- Alternate Library for REXX
- Base Control Program (BCP)
- BookManager READ
- Bulk Data Transfer (BDT)
- Common Information Model (CIM)
- Communications Server
- Cryptographic Services (includes ICSF, OCSF Base, PKI Services, and System SSL)
- Distributed File Service
- DFSMSdfp
- EREP
- ESCON Director Support
- FFST
- GDDM (includes PCLK and OS/2 Link)
- Hardware Configuration Definition (HCD)
- High Level Assembler (HLASM)
- IBM HTTP Server - Powered by Apache (includes IBM HTTP Server NA Secure)
- IBM Knowledge Center for z/OS
- IBM Tivoli Directory Server for z/OS (IBM TDS for z/OS)
- ICKDSF
- Integrated Security Services (includes Enterprise Identity Mapping (EIM), Network Authentication Service, and Open Cryptographic Enhanced Plug-ins (OCEP))
- ISPF
- JES2
- Language Environment
- Library Server
- Metal C Runtime Library
- MICR/OCR Support
- Network File System
- OSA Support Facility
- OpenSSH
- Runtime Library Extensions
- SMP/E
- TIOC
- TSO/E
- z/OS Font Collection
- z/OS Management Facility (z/OSMF)
- z/OS UNIX System Services
- 3270 PC File Transfer Program

z/OS optional features

Some optional features are not priced, but priced as well as unpriced features are
included in z/OS integration-testing. All priced, host-based features are capable of
being dynamically enabled or disabled. For the version and release levels of those
features that also exist independently, see *z/OS Planning for Installation*.

The following is a list of z/OS optional features:
- BookManager BUILD
- Bulk Data Transfer (BDT) File-to-File
- Bulk Data Transfer (BDT) SNA NJE
- Communications Server Security Level 3
- DFSMSdss
- DFSMShsm
- DFSMSrmm
- DFSMStvs
- DFSORT
- GDDM-PGF
- GDDM-REXX
- High Level Assembler (HLASM) Toolkit
- Hardware Configuration Manager (HCM)
- Infoprint Server
- JES3
- RMF
- SDSF
- Security Server (includes RACF)
- XL C/C++
- zEnterprise Data Compression (zEDC)
- z/OS Security Level 3 (includes OCSF Security Level 3, IBM Tivoli Directory
  Server for z/OS Security Level 3, Network Authentication Service Security Level
  3, and System Secure Sockets Layer (SSL) Security Level 3)

Chapter 3. z/OS base elements descriptions

The following is a description of each base element in z/OS.

Alternate Library for REXX

Alternate Library for REXX enables users who do not have the REXX on System z library installed to run compiled REXX programs. It contains a language processor that transforms the compiled programs and runs them with the REXX interpreter, which is shipped as part of the z/OS operating system.

Software developers are no longer required to distribute the Alternate Library for REXX with their compiled REXX programs. Customers who have the REXX on System z Library installed will gain the performance benefits of running compiled REXX, while those customers who have the Alternate Library for REXX installed may still run the programs as interpreted.

By using the Alternate Library for REXX with z/OS, software developers gain the benefits of shipping compiled REXX programs without the source code:
- Maintenance of the program is simplified since the code can not be modified inadvertently.
- Compiled programs can be shipped in load module format, simplifying packaging and installation.
- The Alternate Library for REXX does not need to be shipped and installed with the software program.
- Maintenance of the Alternate Library for REXX is handled by the z/OS system administrator.

BCP (Base Control Program)

The backbone of the z/OS system is the multiple virtual storage (MVS) Basic Control Program with JES2 or JES3. These provide the essential services that make z/OS the system of choice when you need to process your workloads reliably, securely, with complete data integrity and without interruption.

Unicode support:

The Unicode Standard is the universal character encoding standard used for representation of text for computer processing; it provides the capacity to encode all of the characters used for the written languages of the world. z/OS Unicode support is based on Version 6.0 of the Unicode Standard, although lower versions are supported by some services. Review each individual service to see the Unicode Standard versions supported. z/OS Unicode Services supports the following services:
- Character conversion
- Case conversion
- Normalization
- Collation
- Stringprep
- Bidirectional transformation

- Conversion information service
- Dynamic locale service

Find summary and complete details about these services in *z/OS Unicode Services User's Guide and Reference*.

z/OS XML System Services:

z/OS XML System Services is an integrated component of the BCP. It is a system level XML parser intended for use by system components, middleware, and applications that need a simple, efficient, non-validating XML parser. It provides a buffer-in, buffer-out processing model in which the document to parse is provided by the caller in one buffer; the z/OS XML System Services parser creates a parsed record stream in another buffer, also provided by the caller. Large documents can be processed by replenishing the input buffer with more data, and reusing the output buffer or specifying a new one when it is filled. z/OS XML System Services is invoked as a callable service and provides an assembler interface for callers to use. It is accessible from normal environments such as batch and z/OS Unix System Services, as well as from more esoteric environments such as SRB mode and cross-memory.

BookManager READ

BookManager READ allows you to use any online BookManager book that you can access. Using the BookManager panels, windows, and function keys, you can manage, display, and search online books quickly and easily.

BDT (Bulk Data Transfer)

Bulk Data Transfer (BDT) provides the base services that BDT File-to-File and BDT SNA NJE need to transfer data from one computer system to another.

Common Information Model (CIM)

The Common Information Model (CIM) is a standard data model for describing and accessing systems management data in heterogeneous environments. It allows system administrators or vendors to write applications (CIM monitoring clients) that measure system resources in a network with different operating systems and hardware. With z/OS CIM, it is possible to use the DMTF CIM open standard for systems managment which is also implemented on further major server platforms (for example, Linux on zSeries, Linux on xSeries, i5/OS™, or AIX).

z/OS CIM implements the CIM server which is based on the OpenPegasus open source project. A CIM client invokes the CIM server which, in turn, collects z/OS data from the system and returns it to the calling client. To get the z/OS data, the CIM server invokes a CIM provider which retrieves the data from z/OS system resources.

The metrics obtained by this new API are common across server platforms so you can use it to create end-to-end monitoring applications.

Communications Server

IP   IP (formerly known as IBM TCP/IP) is a set of industry standard protocols and applications that allow you to share data and computing resources with other computers, both IBM and non-IBM. UNIX applications use IP.

By using IP commands at your workstation, you can perform tasks and communicate easily with a variety of other systems and workstations. IP allows you to perform tasks independent of the computer type. Some common uses of IP include: electronic mail, file transfer, remote logon, and the Internet.

IP CICS® Sockets

IP CICS Sockets, which is integrated into the base TCP/IP stack, provides the ability to use the generalized Application Programming Interface (API) and socket applications in COBOL, PL/I, and assembler.

IP IMS Sockets

IMS IP support, also integrated into the base TCP/IP stack, allows the development of peer-to-peer applications in which IMS and an IP-connected peer form a client/server relationship. Using this support, IMS can be either client or server.

This element consists of three parts:
- The Sockets Extended Application Programming Interface. Using this API, IMS message processing programs can communicate with remote IP-connected hosts using socket protocol.
- If IMS is acting as the server, the IMS Listener can be used to collect incoming transaction requests from remote IP-connected hosts and schedule IMS message processing programs to service these requests.
- The IBM Assist module provides support for the IMS application programmer who wishes to code IP client/server application programs using the IMS API. When used, this optional function intercepts IMS message queue calls and replaces them with socket calls.

SNA Formerly known as VTAM®, Systems Network Architecture (SNA) is a network communication access method and provides Advanced Peer-to-Peer Networking (APPN). SNA is the interface between application programs in a host processor and other resources in an SNA network, and links peer users of the network. It establishes and terminates sessions between users of the network, forwarding session data to and from each session partner.

In addition to establishing and terminating sessions, it activates and deactivates resources under its control, including application programs, Network Control Programs (and the devices they control), and devices to which SNA is directly attached. SNA also maintains information on the network configuration, active sessions, and network conditions.

To help users control a network, SNA receives commands from an operator to perform network services. Through operator messages, the operator is kept informed about those services and about any network conditions.

Cryptographic Services

Cryptographic Services includes ICSF, PKI Services, OCSF, and System SSL, and provides cryptographic functions for data secrecy, data integrity, personal identification, digital signatures, and the management of cryptographic keys.

ICSF and PKI Services are provided through the combination of secure cryptographic hardware, the ICSF cryptographic API, and the ICSF administration interface. ICSF supports the Common Cryptographic Architecture (CCA), as well as the DES algorithm, RSA public key cryptography, and the Digital Signature Standard. Cryptographic services support a wide variety of applications with high performance, security, and availability.

Additional functions include:
- Trusted Key Entry—the key entry unit for master keys has been replaced by a secure channel version implemented on a workstation known as the Trusted Key Entry Workstation. The unit is an optional cost feature.
- Commercial Data Masking Facility supports privacy functions.
- Public Key API (PKA Support) provides additional formatting or message digest standards.
- Public Key Cryptography Standards #11 (PKCS #11)

Public Key Infrastructure Services (PKI Services) allows you to establish a PKI infrastructure and serve as a certificate authority for your internal and external users, issuing and administering digital certificates in accordance with your own organization's policies. You can use a PKI Services application to request and obtain certificates through their own Web browsers, while your authorized PKI administrators approve, modify, or reject these requests through their own Web browsers. The Web applications provided with PKI Services are customizable, and a programming exit is also included for advanced customization. The approval for certificate requests can be manual or automatic if additional authentication such as RACF user IDs, is provided. You can issue certificates for different purposes, such as virtual private network (VPN) devices, smart cards, and secure e-mail, through different types of templates. PKI Services supports Public Key Infrastructure for X.509 version 3 (PKIX) and Common Data Security Architecture (CDSA) cryptographic standards.

The OCSF Architecture consists of a set of layered security services and associated programming interfaces designed to furnish an integrated set of information and communication security capabilities. Each layer builds on the more fundamental services of the layer directly below it.

These layers start with fundamental components such as cryptographic algorithms, random numbers, and unique identification information in the lower layers, and build up to digital certificates, key management and recovery mechanisms, and secure transaction protocols in higher layers. The OCSF Architecture is intended to be the multiplatform security architecture that is both horizontally broad and vertically robust.

System SSL supports the SSL V2.0, SSL V3.0, TLS (Transport Layer Security) V1.0, TLS V1.1, and TLS V1.2 protocols. TLS V1.2 is the latest version of the secure sockets layer protocol.

z/OS provides a set of SSL C/C++ callable application programming interfaces that, when used with the z/OS Sockets APIs, provide the functions required for applications to establish this secure sockets communications.

In addition to providing the API interfaces to exploit the Secure Sockets Layer and Transport Layer Security protocols, System SSL is also providing a suite of Certificate Management APIs. These APIs give the capability to create/manage your own certificate databases, utilize certificates stored in key database and key rings for purpose other than SSL and to build/process PKCS #7 standard messages.

Distributed File Service (DFS)

The Distributed File Service Server Message Block (SMB) support provides a server that makes Hierarchical File System (HFS) files and data sets available to SMB clients. Server Message Block (SMB) is a protocol for remote file/print access used by Windows clients. This protocol is also known as Common Internet File System. The data sets supported include sequential data sets (on DASD), partitioned data sets (PDS), partitioned data sets extended (PDSE), and Virtual Storage Access Method (VSAM) data sets. The data set support is usually referred to as Record File System (RFS) support. The SMB protocol is supported through the use of TCP/IP on z/OS. This communication protocol allows clients to access shared directory paths and shared printers. Personal Computer (PC) clients on the network use the file and print sharing functions that are included in their operating systems. Supported SMB clients include Microsoft Windows 7, Windows Vista, Windows XP, Windows Server 2003, Windows Terminal Server, and Linux. At the same time, these files can be shared with local z/OS UNIX System Services applications. In addition, Windows SMB clients can make remote print requests to z/OS printers that are connected to Infoprint Server for z/OS.

The Distributed File Service z/OS File System (zFS) support provides a Physical File System (PFS) that can be used in addition to the Hierarchical File System (HFS). zFS file systems contain files and directories that are accessed with the z/OS hierarchical file system file application programming interfaces. zFS file systems can be mounted into the z/OS UNIX hierarchy along with other local (or remote) file system types such as HFS, TFS, and NFS. zFS typically provides improved performance over HFS.

DFSMSdfp

DFSMSdfp provides the foundation for:

Storage management
> DFSMSdfp includes ISMF, an interactive facility that lets you define and maintain policies to manage your storage resources. These policies help to improve the use of storage devices, and to increase levels of service for user data, with minimal effort required from users. SMS manages these policies for the operating system. You can also use the NaviQuest tool under ISMF to help you migrate to SMS, maintain your SMS configuration, and perform many testing, implementation, and reporting tasks in batch.

Tape mount management
> SMS provides a means for implementing tape mount management, a methodology for improving tape usage and reducing tape costs. This methodology involves intercepting selected tape data set allocations through the SMS automatic class selection (ACS) process, and redirecting them to a DASD buffer. Once on DASD, these data sets can be migrated to a single tape or small set of tapes, thereby reducing the overhead associated with multiple tape mounts.

Data management
> DFSMSdfp helps you store and catalog information on DASD, optical, and tape resources, so that it can be quickly identified and retrieved from the system. You can use the catalog search interface, now part of DFSMSdfp, to access the catalog.

Program management
> DFSMSdfp combines programs into executable modules, prepares them to run on the operating system, stores them in libraries, and reads them into storage for execution.

Device management
> DFSMSdfp is involved in defining your input and output devices to the system, and in controlling the operation of those devices in the z/OS environment.

Distributed data access
> Distributed data access allows all authorized systems and users in a network to exploit the powerful features of system-managed storage, or automated storage management provided by DFSMS. DFSMSdfp uses the Distributed FileManager (DFM) to support remote access of z/OS data and storage resources from workstations, personal computers, or any other system on a SNA LU 6.2 network.
>
> The z/OS UNIX System Services (z/OS UNIX) file system works in conjunction with z/OS UNIX to provide a full UNIX environment within the z/OS system. z/OS becomes a full-feature UNIX client or server when coupled with the z/OS Network File System (z/OS NFS). With the z/OS UNIX file system, z/OS programs can directly access UNIX data. When the z/OS NFS client and z/OS UNIX are used together, z/OS can act as a client and access data from any remote system, including another z/OS or UNIX system that is connected using a TCP/IP network served by a Network File System server.

Environmental Record Editing and Printing Program (EREP)

The Environmental Record Editing and Printing Program (EREP) edits and prints reports for the records placed in the error recording data set (ERDS), helping IBM service representatives fix problems.

ESCON Director Support

When your installation uses ESCON directors, the ESCON Director Device Support feature enables reporting of ESCON director device errors to z/OS.

FFST/MVS (First Failure Support Technology/MVS)

FFST/MVS provides immediate notification and first failure data capture for software events. FFST/MVS also incorporates its own technology by including software probes in its own code. When one of these probes is triggered, FFST/MVS issues a symptom string that describes the event.

FFST/MVS provides the following services for IBM products:
- Customized dumps
- Symptom strings
- Symptom records
- Messages
- Network notification

GDDM (includes PCLK and OS/2 LINK)

GDDM provides presentation services and device-driving capability. GDDM has a powerful application-programming interface for creating, displaying, and storing vector graphics, images and alphanumerics. GDDM drives displays, printers and plotters, and includes several utilities for end users. GDDM's excellence as a graphics program and device driver is recognized worldwide, and as a result it is used extensively as a graphics enabler by other licensed programs, including other elements of z/OS, such as BookManager.

HCD (Hardware Configuration Definition)

HCD is used to define both the operating system configuration and the processor hardware configuration for a system. Because HCD validates data when it is defined rather than when a device is accessed, inconsistencies can be corrected right away and unplanned system outages resulting from inconsistent definitions avoided. The defined configuration can be used to POR/IPL or dynamically reconfigure your system.

HLASM (High Level Assembler)

High Level Assembler integrates almost all functions of past assemblers. It also provides extensions and improvements including:
- Many new and expanded cross reference facilities and diagnostics that enable substantial savings in time and in human and machine resources, and support integration of HLASM into tool and development environments.
- Numerous language enhancements that improve the speed and accuracy of application development and the quality and reliability of the resulting code.
- Assembly-time options extensions and enhancements that allow increased flexibility and precision in controlling the processes you use to manage application development.

HLASM helps to maximize the productivity of application programmers by relieving them of many tedious and unproductive tasks that can now be done by the assembler itself and helps organizations avoid the necessity for converting existing -- and working -- applications from Assembler Language to other languages.

IBM HTTP Server - Powered by Apache

The IBM HTTP Server - Powered by Apache is a full-featured web server. This element was previously known as a base element of z/OS under the names Lotus® Domino® Go, the Internet Connection Secure Server (ICSS), and the Internet Connection Server (ICS).

Included in IBM HTTP Server - Powered by Apache is IBM HTTP Server North America (NA) Secure. With IBM HTTP Server, IBM HTTP Server NA Secure uses Secure Sockets Layer (SSL) to provide secure communications over an open communications network, such as the Internet. The HTTP server uses SSL to initiate a secure connection between the client and itself. The server then uses SSL to decrypt and encrypt all of the information in the client request and the server response.

IBM Tivoli Directory Server for z/OS (IBM TDS for z/OS)

The IBM Tivoli Directory Server for z/OS (IBM TDS for z/OS) provides secure access for applications and systems on the network to directory information held on z/OS using the Lightweight Directory Access Protocol (LDAP). This component consists of the LDAP server, LDAP client, and utilities.

ICKDSF (Device Support Facility)

ICKDSF enables you to perform functions needed for the installation and use of IBM DASD. You can also use it to perform service functions, error detection, and media maintenance.

Integrated Security Services

Integrated Security Services includes:

Enterprise Identity Mapping (EIM)

EIM is an architecture that serves as a security technology to make it easier to manage users in a cross-platform environment.

Network Authentication Service

Network Authentication Service, which is based on Kerberos Version 5, provides Kerberos security services without requiring that you purchase or use a middleware product such as Distributed Computing Environment (DCE). These services include native Kerberos application programming interface (API) functions, including the Generic Security Service application programming interface (GSS-API) functions defined in Internet RFC 2078, Generic Security Service Application Program Interface, Version 2 and Internet RFC 2744, Generic Security Service API Version 2: C-bindings. Network Authentication Service performs authentication as a trusted third-party authentication service by using conventional shared secret-key cryptography. Network Authentication Service provides a means of verifying the identities of principals, without relying on authentication by the host operating system, without basing trust on host addresses, without requiring physical security of all the hosts on the network, and under the assumption that packets traveling along the network can be read, modified, and inserted at will.

Open Cryptographic Services Facility (OCSF)

Open Cryptographic Services Facility (OCSF) is a derivative of the IBM Keyworks technology, which is an implementation of the Common Data Security Architecture (CDSA) for applications running in the UNIX Services environment. It is an extensible architecture that provides mechanisms to manage service provider security modules, which use cryptography as a computational base to build security protocols and security systems. Figure 1 shows the four basic layers of the OCSF: Application Domains, System Security Services, OCSF Framework, and Service Providers. The OCSF Framework is the core of this architecture. It provides a means for applications to directly access security services through the OCSF security application programming interface (API), or to indirectly access security services by way of layered security services and tools that are implemented over the OCSF API. The OCSF Framework manages the service provider security modules and directs application calls through the OCSF API to the selected service provider module that services the request. The OCSF API defines the interface for accessing security services. The OCSF service provider interface (OCSF SPI) defines the interface for service providers who develop plug-able security service products.

ISPF

ISPF provides facilities for all aspects of host-based software development.

- Programmers can use ISPF to develop and document batch and interactive programs.
- Data center administrators and system programmers can monitor and control program libraries, and communicate with MVS through TSO commands, CLISTs, or REXX EXECs.
- Terminal users can work with interactive applications called dialogs.
- Managers can prepare and print memos by using ISPF Edit and the Hardcopy utility.

ISPF has four major components:

Dialog Manager (DM)

The Dialog Manager (DM) provides services to dialogs and users. These services include:
- Display
- Variable services
- Input and output
- User and application profiles
- Table management
- System interface services
- Dialog testing and debugging aids

Program Development Facility (PDF)

The Program Development Facility (PDF) provides services to assist dialog or application developers. These include
- Edit and Browse functions
- A wide range of foreground and batch compilers
- Data set and catalog utilities
- TSO or CMS command interfaces
- Data set search and compare functions.

Software Configuration and Library Manager (SCLM)

The Software Configuration and Library Manager (SCLM) is a tool that automatically controls, maintains, and tracks all of the software components of the application throughout the development cycle.

Client/Server component

The Client/Server component provides users who have a workstation that runs Windows or UNIX with a Graphical User Interface to ISPF application panels.

JES2

JES2 accepts the submission of work for the BCP. Major JES2 functions and design features include:
- The interpretation of job control language (JCL) statements
- The disposition of output
- A single-system image
- The ability to run multiple copies of JES2 (poly-JES)
- JES2 WLM for Sysplex

JES2 differs from JES3 in two main processing areas:
- JES2 exercises independent control over its job processing functions. JES3 exercises centralized control. Each JES2 processor in a multi-processor environment controls its own job input, job scheduling, and job output processing.
- JES3 does pre-execution of job setup. JES2 does not do this.

Language Environment

Language Environment provides common services and language-specific routines in a single run-time environment. It ensures consistent and predictable results for your language applications, independent of the language they are written in.

Language Environment is the prerequisite run-time environment for applications generated with the following IBM compiler products:
- z/OS XL C/C++
- OS/390® C/C++
- C/C++ for MVS/ESA

- COBOL for OS/390 & VM
- COBOL for MVS & VM (formerly COBOL/370)
- Enterprise COBOL for z/OS
- Enterprise COBOL for z/OS and OS/390
- AD/Cycle C/370™ Compiler
- Enterprise PL/I for z/OS
- Enterprise PL/I for z/OS and OS/390
- VisualAge® PL/I for OS/390
- PL/I for MVS & VM
- AD/Cycle PL/I for MVS & VM
- VisualAge for Java, Enterprise Edition for OS/390
- VS FORTRAN and FORTRAN IV (in compatibility mode)

Language Environment supports the VS FORTRAN compiler's object/load module compatibility, which means FORTRAN load modules can be run under Language Environment and object code can be link-edited with Language Environment and run under it. Language Environment also provides a set of assembler macros for running assembler language routines.

Language Environment supports, but is not required for, an interactive debug tool for debugging applications in your native z/OS environment. The interactive IBM Debug Tool is available with the latest release of the PL/I compiler or this product can be ordered separately for use with the IBM XL C/C++, COBOL, and PL/I compilers on z/OS. For more information, see IBM Debug Tool at >http://www.ibm.com/software/awdtools/debugtool.

Some benefits are that you can:
- Mix old code with new code.
- Handle conditions, such as program checks or abends, in your COBOL programs without having to use assembler.
- Share common run-time services.
- Run applications that conform to the POSIX 1003.1 standard or the X/Open Single UNIX Specification, also known as UNIX 95 or XPG4.2.
- Access CICS and IMS transactions and data through a C, COBOL, or PL/I server from any client in your network.
- Perform interlanguage communication more efficiently.
- Manage storage dynamically for your C/C++, COBOL, and PL/I routines with a common storage manager.
- Access a rich set of math services.

Library Server

Library Server enables customers to provide entire libraries of documents on the World Wide Web. Customers are able to serve BookManager, PDF, or Eclipse plug-in document formats to web browsers connected to either the Internet or an intranet. The information is stored in a virtual library, which is composed of Book, PDF, plug-in, Collection, Shelve, Case, and information center formats.

MICR/OCR

MICR/OCR provides the device support code for the following devices:
- 1287/1288 - IBM Optical reader and page reader respectively
- 3540 - IBM Disk device
- 3886 - IBM Optical Character reader
- 3890 - IBM Magnetic Ink Reader
- 3895 - IBM Printer device

Metal C Runtime Library

The Metal C runtime library element provides a set of header files and functions for use with the XL C METAL compiler option.

The XL C METAL compiler option generates code that does not require access to the Language Environment support at run time. Instead, the METAL option provides C-language extensions that allow you to specify assembly statements that call system services directly. Using these language extensions, you can provide almost any assembly macro, and your own function prologs and epilogs, to be embedded in the generated HLASM source file. When you understand how the METAL-generated code uses MVS linkage conventions to interact with HLASM code, you can use this capability to write freestanding programs.

Prior to the introduction of Metal C runtime library, all z/OS XL C compiler-generated code required Language Environment. In addition to depending on the C runtime library functions that are available only with Language Environment, the generated code depended on the establishment of an overall execution context, including the heap storage and dynamic storage areas. These dependencies prohibit you from using the XL C compiler to generate code that runs in an environment where Language Environment did not exist.

Network File System (NFS)

The z/OS NFS server acts as an intermediary to read, write, create or delete z/OS UNIX files and MVS data sets that are maintained on a z/OS host system. The remote MVS data sets or z/OS UNIX files are mounted from the host processor to appear as local directories and files on the client system. This server makes the strengths of an z/OS host processor (storage management, high-performance disk storage, security, and centralized data) available to the client platforms.

The NFS uses the communication services provided by TCP/IP, a suite of protocols that includes the remote procedure call (RPC) and external data representation (XDR) protocols. RPC allows a program on one machine to start a procedure on another machine, as if the procedure is local. XDR resolves the differences in data representation of different machines. The NFS, then, can be used for file sharing between platforms and file serving (as a data repository).

Open Systems Adapter Support Facility (OSA/SF)

OSA/SF is an element that supports S/390® Open System Adapter (OSA-Express and OSA-2) hardware features to deliver connectivity via directly-attached local area clients using:
- Transmission Control Protocol/Internet Protocol (IP) network protocol
- Systems Network Architecture Application Peer-to-Peer Networking
- Internet Packet Exchange (IPX)

The OSA-2 features provide connection to Ethernet, Asynchronous Transfer Mode (ATM), Token Ring and Fiber Distributed Data Interface (FDDI) networks. OSA-Express provides connection to Ethernet networks supporting Fast Ethernet (FENET), 1000Base-T Ethernet and Gigabit, as well as Token Ring and ATM.

OSA/SF provides a user-friendly interface for monitoring and controlling the OSA features. Beginning in z/OS V1R4, OSA/SF introduces support for a Java-based GUI interface, continues support for the OSA-2 features, and continues to provide the OS/2-based GUI.

Run-Time Library Extensions

Run-Time Library Extensions delivers the following libraries and utilities to support existing programs:

Common Debug Architecture (CDA) Libraries
Introduced in z/OS V1R5, CDA provides a consistent format for debug information on z/OS. The CDA Libraries provide a set of APIs to access this information.

c89 Utility
This utility compiles, assembles, and binds z/OS UNIX System Services C/C++ and assembler applications.

UNIX System Laboratories (USL) Libraries
The USL I/O Stream Library provides the standard input and output capabilities for C++. The USL Complex Mathematics Library provides the facilities to manipulate complex numbers and to perform standard mathematical operations

Note: The UNIX System Laboratories (USL) I/O Stream Library and Complex Mathematics Library are still supported on z/OS. Although support for these classes is not being removed at this time, it is recommended that you migrate to the Standard C++ iostream and complex classes. This is especially important if you are migrating other USL streaming classes to Standard C++ Library streaming classes, because combining USL and Standard C++ Library streams in one application is not recommended. For more information about the Standard C++ I/O Stream Library, see *Standard C++ Library Reference*.

SMP/E

SMP/E is a tool for installing and maintaining software, and for managing the inventory of software that has been installed. SMP/E provides a consistent and reliable method for installing and upgrading the software in a z/OS system.

Time Sharing Option/Extensions (TSO/E)

TSO Extensions is a base interactive interface that provides non-DP professionals, end users, system and application programmers, and administrators with an extensive set of commands, services, facilities and programming languages to do productive work on z/OS, and helps to ease systems management. TSO/E is an integral part of z/OS, and serves as a platform for other elements, such as BookManager READ/MVS, HCD, and ISPF.

Terminal Input Output Controller (TIOC)

TIOC is the interface between TSO and VTAM. It allows TSO to communicate with the terminal hardware.

z/OS Font Collection

The z/OS Font Collection consists of character sets, coded fonts, and Advanced Function Presentation (AFP) code pages for printing documents. The z/OS Font Collection includes these fonts:

- AFP outline fonts

- AFP raster fonts, including a complete set of IBM expanded core fonts and a set of Math, PI, and Sonoran 240-pel raster fonts
- TrueType and OpenType fonts, including a prebuilt resource access table (RAT) that can be used for AFP printing

z/OS Management Facility (z/OSMF)

IBM z/OS Management Facility (z/OSMF) provides system management functions in a task-oriented, web browser-based user interface with integrated user assistance, so that you can more easily manage the day-to-day operations and administration of your mainframe z/OS systems.

z/OSMF allows you to communicate with the z/OS system through a web browser so that you can access and manage your z/OS system at any time from any location. Multiple users can log into z/OSMF using different computers, different browsers, or multiple instances of the same browser.

z/OSMF gives you a single point of control for:
- Viewing, defining, and updating policies that affect system behavior.
- Monitoring the performance of the systems in your enterprise.
- Managing your z/OS software.
- Performing problem data management tasks.

z/OSMF also delivers a modular framework that provides the infrastructure, security, and services you need to bring together your z/OS system management applications, facilitating a smoother user experience and bringing z/OSMF one step closer to being your central z/OS management facility.

z/OS OpenSSH

z/OS OpenSSH is a port of Open Source Software release OpenSSH 6.4p1 and provides secure encryption for both remote login and file transfer.

z/OS OpenSSH includes the following utilities:
- **ssh**, a z/OS client program for logging into a z/OS shell. It can also be used to log into other platform's UNIX shells. It is an alternative to **rlogin**.
- **scp** for copying files between networks. It is an alternative to **rcp**.
- **sftp** for file transfers over an encrypted **ssh** transport. It is an interactive file transfer program similar to **ftp**.
- **sshd**, a daemon program for **ssh** that listens for connections from clients. The z/OS OpenSSH implementation of **sshd** supports both SSH protocol versions 1 and 2 simultaneously.
  The default **sshd** configuration only runs protocol version 2.

Other basic utilities such as **ssh-add**, **ssh-agent**, **ssh-keysign**, **ssh-keyscan**, **ssh-keygen** and **sftp-server** are also included.

To ensure secure encrypted communications, OpenSSH uses ciphers such as AES, Blowfish and 3DES.

z/OS OpenSSH provides the following z/OS extensions:
- System Authorization Facility (SAF) key ring. z/OS OpenSSH can be configured to allow z/OS OpenSSH keys to be stored in SAF key rings.

- Multilevel security. It is a security policy that allows the classification of data and users based on a system of hierarchical security levels combined with a system of non-hierarchical security categories.
- System Management Facility (SMF). z/OS OpenSSH can be configured to collect SMF Type 119 records for both the client and the server.
- Hardware Crypto Support. OpenSSH can be configured to choose Integrated Cryptographic Service Facility (ICSF) callable service for implementing the applicable SSH session ciphers and HMACs.

z/OS UNIX System Services (X/Open UNIX 95 functions)

z/OS UNIX System Services Application Services (Shell, Utilities, and Debugger)

Shell and Utilities provides the standard command interface familiar to interactive UNIX users. z/OS includes all of the commands and utilities specified in the X/Open Company's Single UNIX Specification, also known as UNIX 95 or XPG4.2. This feature will allow your UNIX programmers and other users to interact with z/OS as a UNIX system without necessarily having to learn the z/OS command language or other interactive interfaces. The z/OS UNIX Services Debugger provides a set of commands that allow a C language program to be debugged interactively. The command set is familiar to many UNIX users.

z/OS UNIX System Services Kernel

These services add the world of open UNIX-based computing to the z/OS operating system. With Language Environment, they support industry standards for C programming, shell and utilities, client/server applications, and the majority of the standards for thread management and the X/Open Single UNIX Specification. Application developers and interactive users using these interfaces can exploit the capabilities of z/OS without having to understand z/OS itself. The combination of open computing and z/OS allows the transparent exchange of data, easy portability of applications, cross-network management of data and applications, and the exploitation of traditional MVS system strengths in an open environment.

3270 PC File Transfer Program

This program transfers files from the host to the workstation for off-line data manipulation or transfers local data for storage on the host.

Chapter 4. z/OS optional features descriptions

The following is a description of each optional feature in z/OS.

BookManager BUILD

BookManager BUILD lets you create your own online books from files marked up with:
- GML (Generalized Markup Language) Starter Set
- IBM Publishing Systems BookMaster®

Instead of preparing the files for a printer, BookManager BUILD takes the files and produces a single file that contains the text and artwork for an online book.

Books built with BookManager BUILD can be read with any of the BookManager READ or Library Server products, such as:
- BookManager READ/MVS, which is part of the z/OS base
- IBM Softcopy Reader
- IBM Library Server, which is part of the z/OS base

Bulk Data Transfer (BDT) File-to-File

The BDT File-to-File element allows users at one z/OS system in a SNA network to copy data sets to or from another z/OS system in the network.

Bulk Data Transfer (BDT) SNA NJE

The BDT JES3 SNA NJE element allows users with the JES3 element to transmit jobs, output (SYSOUT), commands, and messages from one computer system to another within a SNA network.

Communications Server Security Level 3

This feature provides authentication and security services in an IP network environment. It provides support for packet filtering, tunnels, and network address translation (NAT), which enables secure communication over private and public networks. It uses the Triple DES (TDES) and AES encryption algorithms, and it includes SSL/TLS with TDES and AES, SNMPv3 with TDES, and IPSec with TDES and AES.

DFSMS Features (DFSMSdss, DFSMShsm, DFSMSrmm, and DFSMStvs)

There are four DFSMS features:

DFSMSdss

DFSMSdss is a DASD data and space management tool. DFSMSdss can be used to copy and move data sets between volumes; dump and restore data sets, entire volumes, or tracks; convert data sets and volumes to and from SMS management; compress partitioned data sets; release unused space in data sets; and consolidate free space and data sets on volumes.

DFSMShsm

DFSMShsm is a DASD storage management and productivity tool for

managing low-activity and inactive data. It improves DASD use by automatically managing space and data availability in a storage hierarchy. Working with SMS, DFSMShsm performs space management and availability management of data sets as directed by their management class attributes.

DFSMSrmm

DFSMSrmm allows you to manage your removable media as one enterprise-wide library across systems. DFSMSrmm manages your installation's tape volumes and the data sets on those volumes. DFSMSrmm manages all tape media, such as cartridge system tapes and 3420 reels, as well as other removable media you define to it. For example, DFSMSrmm can record the shelf location for optical disks and track their vital record status; it does not manage the objects on optical disks.

DFSMStvs

DFSMS Transactional VSAM Services, an optional feature, enables running batch jobs concurrently with CICS online transactions to allow updates to the shared VSAM data sets. Multiple batch jobs and online transactions can be run against the same VSAM data sets. DFSMStvs ensures data integrity for concurrent batch updates while CICS provides it for online updates.

DFSORT

DFSORT is IBM's high performance sort, merge, copy, analysis and reporting product for z/OS. This high-speed, flexible data processing tool provides fast and efficient sorting, merging, copying, reporting and analysis of business information, as well as versatile data manipulation at the record, field and bit level.

DFSORT is designed to optimize the efficiency and speed with which operations are completed through synergy with processor, device, and system features (for example, memory objects, hiperspace, data space, striping, compression, extended addressing, DASD and tape device architecture, processor memory, processor cache, and so on) and other products (for example, The SAS System**, COBOL, PL/I, IDCAMS BLDINDEX, and so on).

DFSORT includes the high-performance ICEGENER facility, the versatile ICETOOL utility, multiple output and reporting capability with the powerful OUTFIL feature, the time-saving ability to use Symbols for fields and constants in DFSORT and ICETOOL statements, and much more.

For more information on DFSORT, visit the DFSORT Web site.

GDDM-PGF

GDDM-PGF (Presentation Graphics Facility), a set of programs for creating presentation material in a variety of styles, provides:

Interactive Chart Utility

The Interactive Chart Utility (ICU), an easy-to-use end-user program for creating business charts.

Vector Symbol Editor

The (VSE), a means of creating and modifying symbols for use with the ICU or other GDDM functions.

An application programming interface

An application programming interface that enables programs to call either the ICU or a set of presentation-graphics routines for chart creation.

Online Presentation Services (OPS)

GDDM-PGF now incorporates an enhanced presentation-producing capability, Online Presentation Services (OPS). GDDM-OPS provides a command interface, which is simple and easy to use, yet which is also powerful enough to allow the very concise creation of high-quality presentations. These can then be used from displays (perhaps using the built-in automatic scrolling feature), or can be saved for printing or plotting.

Typical applications of GDDM-OPS are:
- Public presentations using a video monitor or projector
- Educational sessions for private or public display
- Scrollable interactive presentations of business charts
- Production of high-quality foils.

GDDM-REXX

GDDM-REXX/MVS is a productivity tool that enables programmers to prototype GDDM applications and to create small routines and utility programs quickly and easily.

Hardware Configuration Manager (HCM)

Hardware Configuration Manager (HCM) is a PWS-based client/server interface to z/OS Hardware Configuration Definition (HCD). It combines the logical and physical aspects of z/OS hardware configuration management. In addition to defining the logical connections (accomplished via HCD), you can also manage the physical aspects of your configuration. For example, you can effectively manage the flexibility offered by the ESCON infrastructure.

All updates are done with HCM's intuitive graphical user interface, and all changes are written into the IODF and fully validated for accuracy and completeness by HCD, avoiding unplanned system outages that are due to incorrect definitions.

High Level Assembler Toolkit

This toolkit provides a powerful set of capabilities to improve application development, debugging, and recovery.

The Toolkit provides six components:
- A disassembler which converts binary machine language to assembler language source statements.
- A flexible source-code analysis and cross-referencing tool to help determine variable and macro usage, analyze high-level control flows, and locate specific uses of arbitrary strings of characters in single or multiple modules.
- A workstation-based program analysis tool that displays control-flow graphs and source-code views within single programs or across entire application modules.
- A powerful and sophisticated low-level symbolic debugger for applications written in assembler and other compiled languages. It handles programs using 24, 31, and 64-bit addressing. (It does not support debugging privileged or supervisor-state code.)
- A rich set of macro instructions that implement a complete menu of the most widely used structured-programming constructs (IF/ELSE/ELSEIF, DO/ITERATE/ASMLEAVE, CASE, SEARCH, SELECT/WHEN/OTHRWISE,

etc.). These macros simplify and clarify coding, and help eliminate errors in writing additional labels and branch instructions.

- A versatile file searching and comparison tool (*SuperC*) that scans or compares single file or groups of files with an extensive set of selection and rejection criteria.

IBM Knowledge Center for z/OS

IBM Knowledge Center is IBM's strategic platform for delivering technical content. z/OS V2R2 includes IBM Knowledge Center for z/OS, which is an SMP/E packaging of the customer installable version of IBM Knowledge Center for use on the z/OS platform. The customer installable version uses an enhanced version of search technology that is available in IBM information centers.

- IBM Knowledge Center for z/OS provides the ability to display, navigate and search content in a manner similar to IBM Knowledge Center on ibm.com
- IBM Knowledge Center for z/OS serves IBM product publication content to web browser clients from the z/OS server system
- Content can be manually added to and maintained in IBM Knowledge Center for z/OS zFS repositories using information in the IBM Knowledge Center for z/OS Configuration and User Guide, SC27-6805.
- Content can be automatically added to and maintained in IBM Knowledge Center for z/OS zFS repositories using the enhanced SoftCopy Librarian V5 tool
- By adding and maintaining content, IBM Knowledge Center for z/OS can be made to serve product publications for many different IBM products

Use IBM Knowledge Center for z/OS to create your own enterprise document repository for local use. IBM Knowledge Center for z/OS is especially valuable for:

- Enterprises with no Internet access either for security reasons or as a valuable backup when Internet access is disrupted
- Personalizing or controlling the content of an enterprise library

The z/OS Softcopy Librarian, available as a download, is enhanced to make it easy to manage and update the content for IBM Knowledge Center for z/OS.

IBM Library Server continues as an element of z/OS to provide the ability to use BookManager and PDF files.

Infoprint Server

Infoprint Server consists of several components that support printing on a z/OS system:

Print Interface
This component accepts print requests from z/OS UNIX System Services and remote systems in your IP network. It allocates output data sets on the JES2 or JES3 spool for printing.

NetSpool
This component receives print output from VTAM applications and allocates output data sets on the JES2 or JES3 spool for printing.

Transform Manager
This component calls separate IBM transform products to transform data to and from Advanced Function Presentation (AFP) format. For example, IBM transform products can transform PCL, PDF, PostScript, SAP R/3, and Xerox data to AFP format, and can transform AFP data to PCL, PDF, and PostScript format.

IP PrintWay

This component sends output data from the JES2 or JES3 spool to remote printers or print servers in your IP or SNA network. IP PrintWay can also send output data to email destinations. You can run IP PrintWay in basic or extended mode. In extended mode, IP PrintWay provides better performance, improved usability, and more function.

Printer Inventory

This component provides a single set of printer definitions that all the components of Infoprint Server use. The Printer Inventory also contains printer customization information that Print Services Facility (PSF) for z/OS uses.

Infoprint Central

This component is a web application that lets help desk operators and other authorized users work with print jobs on the JES spool, printers controlled by IP PrintWay extended mode or PSF, NetSpool logical units, and job selection rules. It also lets users see Infoprint Server system status and printer definitions in the Printer Inventory.

Infoprint Port Monitor for Windows

This component sends documents and job attributes from Windows systems to Infoprint Server for printing on any printers that are defined in the Infoprint Server Printer Inventory.

JES3

You might choose to enable JES3 as an alternative to the base JES2 element. It also accepts the submission of work for the BCP. Major JES3 functions and design features include:
- The interpretation of job control language (JCL) statements
- The disposition of output
- A single system image
- Workload balancing
- Deadline scheduling
- Dependent job control
- Control flexibility

JES3 differs from JES2 in two main processing areas:
- JES3 exercises centralized control over its job processing functions. JES2 exercises independent control. With JES3, a single, global processor controls job, device, and workflow for all processors in a multi-processor environment.
- JES3 does pre-execution of job setup. JES2 does not do this.

RMF (Resource Measurement Facility)

RMF is the window on z/OS resource usage. It gathers information at sysplex, single-system or address-space level, and provides reports at any system in a sysplex. The user can choose between reports about activities and delays, and can focus on storage, I/O or processor data. A wide range of options allows selection of the relevant information, including the attainment of Workload Manager goals.

The RMF monitors present snap-shot and short-term reports real-time in ISPF dialogs with on-line help, and you can have the results printed if you wish. The RMF Postprocessor provides long-term reports for detailed analysis of historical data gathered by RMF. These reports can be printed or displayed.

In addition to host-based reporting functions in RMF, there are other components available that offer reporting capabilities at the workstation. The RMF PM Java

Edition provides an interface between the workstation and the z/OS sysplex through a TCP/IP connection that gives you the flexibility to create unique scenarios to monitor the performance of your sysplex. The Spreadsheet Reporter, running on your Windows workstation, gives you the ability to extract reports from RMF Postprocessor output to convert them into a common spreadsheet format and allows your spreadsheet application to use the RMF data. This function enables you to integrate RMF data into your business process. It also means you can easily produce presentation graphics which illustrate performance analysis results.

SDSF (System Display and Search Facility)

SDSF provides you with information to monitor, manage and control your z/OS system. SDSF provides an easy and efficient way to control job processing (hold, release, cancel and purge jobs) and to control devices (such as printers, lines and initiators). It allows you to monitor jobs while they are running and browse output without printing it. You can also browse the system log, including the sysplex-wide operations log. SDSF provides sort, filter, arrange, search, and print functions to help you locate and organize information. Single-character commands eliminate the need to learn and remember complex system commands. You can easily change characteristics of an object, such as a job or node, by typing over a displayed value. An optional action bar and pop-up windows make it easy to find and use SDSF functions. You can establish security for SDSF using SDSF's own security parameters, or with IBM's standard interface, SAF (System Authorization Facility). You can access SDSF function through REXX execs or Java programs.

SDSF provides complete online help and an interactive tutorial.

Security Server

The Security Server includes:
Resource Access Control Facility (RACF)
> RACF provides a strong security base that enables the Security Server element of z/OS to incorporate additional components that aid in securing your system as you make your business data and applications accessible by your intranet, extranets, or the Internet.

XL C/C++

This language-centered XL C/C++ application development environment on the z/OS platform includes a C compiler, a C++ compiler, and C/C++ application development utilities. This feature exploits the C/C++ runtime environment and library of runtime services available with the Language Environment and Run-Time Library Extensions elements of z/OS.

z/OS Security Level 3

z/OS Security Level 3 includes IBM Tivoli Directory Server for z/OS Security Level 3 (new in z/OS V1R8; replaces LDAP Security Level 3), Network Authentication Service Security Level 3, OCSF Security Level 3, and System Secure Sockets Layer (SSL) Security Level 3.

Appendix. Accessibility

Accessible publications for this product are offered through IBM Knowledge Center (http://www.ibm.com/support/knowledgecenter/SSLTBW/welcome).

If you experience difficulty with the accessibility of any z/OS information, send a detailed message to the "Contact us" web page for z/OS (http://www.ibm.com/systems/z/os/zos/webqs.html) 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

Accessibility features

Accessibility features help users who have physical disabilities such as restricted mobility or limited vision use software products successfully. The accessibility features in z/OS can help users do the following tasks:

- Run assistive technology such as screen readers and screen magnifier software.
- Operate specific or equivalent features by using the keyboard.
- Customize display attributes such as color, contrast, and font size.

Consult assistive technologies

Assistive technology products such as screen readers function with the user interfaces found in z/OS. Consult the product information for the specific assistive technology product that is used to access z/OS interfaces.

Keyboard navigation of the user interface

You can access z/OS user interfaces with TSO/E or ISPF. The following information describes how to use TSO/E and ISPF, including the use of keyboard shortcuts and function keys (PF keys). Each guide includes the default settings for the PF keys.

- *z/OS TSO/E Primer*
- *z/OS TSO/E User's Guide*
- *z/OS V2R2 ISPF User's Guide Vol I*

Dotted decimal syntax diagrams

Syntax diagrams are provided in dotted decimal format for users who access IBM Knowledge Center with a screen reader. In dotted decimal format, each syntax element is written on a separate line. If two or more syntax elements are always present together (or always absent together), they can appear on the same line because they are considered a single compound syntax element.

Each line starts with a dotted decimal number; for example, 3 or 3.1 or 3.1.1. To hear these numbers correctly, make sure that the screen reader is set to read out

punctuation. All the syntax elements that have the same dotted decimal number (for example, all the syntax elements that have the number 3.1) are mutually exclusive alternatives. If you hear the lines 3.1 USERID and 3.1 SYSTEMID, your syntax can include either USERID or SYSTEMID, but not both.

The dotted decimal numbering level denotes the level of nesting. For example, if a syntax element with dotted decimal number 3 is followed by a series of syntax elements with dotted decimal number 3.1, all the syntax elements numbered 3.1 are subordinate to the syntax element numbered 3.

Certain words and symbols are used next to the dotted decimal numbers to add information about the syntax elements. Occasionally, these words and symbols might occur at the beginning of the element itself. For ease of identification, if the word or symbol is a part of the syntax element, it is preceded by the backslash (\) character. The * symbol is placed next to a dotted decimal number to indicate that the syntax element repeats. For example, syntax element *FILE with dotted decimal number 3 is given the format 3 * FILE. Format 3* FILE indicates that syntax element FILE repeats. Format 3* * FILE indicates that syntax element * FILE repeats.

Characters such as commas, which are used to separate a string of syntax elements, are shown in the syntax just before the items they separate. These characters can appear on the same line as each item, or on a separate line with the same dotted decimal number as the relevant items. The line can also show another symbol to provide information about the syntax elements. For example, the lines 5.1*, 5.1 LASTRUN, and 5.1 DELETE mean that if you use more than one of the LASTRUN and DELETE syntax elements, the elements must be separated by a comma. If no separator is given, assume that you use a blank to separate each syntax element.

If a syntax element is preceded by the % symbol, it indicates a reference that is defined elsewhere. The string that follows the % symbol is the name of a syntax fragment rather than a literal. For example, the line 2.1 %OP1 means that you must refer to separate syntax fragment OP1.

The following symbols are used next to the dotted decimal numbers.

? indicates an optional syntax element
The question mark (?) symbol indicates an optional syntax element. A dotted decimal number followed by the question mark symbol (?) indicates that all the syntax elements with a corresponding dotted decimal number, and any subordinate syntax elements, are optional. If there is only one syntax element with a dotted decimal number, the ? symbol is displayed on the same line as the syntax element, (for example 5? NOTIFY). If there is more than one syntax element with a dotted decimal number, the ? symbol is displayed on a line by itself, followed by the syntax elements that are optional. For example, if you hear the lines 5 ?, 5 NOTIFY, and 5 UPDATE, you know that the syntax elements NOTIFY and UPDATE are optional. That is, you can choose one or none of them. The ? symbol is equivalent to a bypass line in a railroad diagram.

! indicates a default syntax element
The exclamation mark (!) symbol indicates a default syntax element. A dotted decimal number followed by the ! symbol and a syntax element indicate that the syntax element is the default option for all syntax elements that share the same dotted decimal number. Only one of the syntax elements that share the dotted decimal number can specify the ! symbol. For example, if you hear the lines 2? FILE, 2.1! (KEEP), and 2.1 (DELETE), you know that (KEEP) is the

default option for the FILE keyword. In the example, if you include the FILE keyword, but do not specify an option, the default option KEEP is applied. A default option also applies to the next higher dotted decimal number. In this example, if the FILE keyword is omitted, the default FILE(KEEP) is used. However, if you hear the lines 2? FILE, 2.1, 2.1.1! (KEEP), and 2.1.1 (DELETE), the default option KEEP applies only to the next higher dotted decimal number, 2.1 (which does not have an associated keyword), and does not apply to 2? FILE. Nothing is used if the keyword FILE is omitted.

* indicates an optional syntax element that is repeatable
The asterisk or glyph (*) symbol indicates a syntax element that can be repeated zero or more times. A dotted decimal number followed by the * symbol indicates that this syntax element can be used zero or more times; that is, it is optional and can be repeated. For example, if you hear the line 5.1* data area, you know that you can include one data area, more than one data area, or no data area. If you hear the lines 3* , 3 HOST, 3 STATE, you know that you can include HOST, STATE, both together, or nothing.

Notes:

1. If a dotted decimal number has an asterisk (*) next to it and there is only one item with that dotted decimal number, you can repeat that same item more than once.

2. If a dotted decimal number has an asterisk next to it and several items have that dotted decimal number, you can use more than one item from the list, but you cannot use the items more than once each. In the previous example, you can write HOST STATE, but you cannot write HOST HOST.

3. The * symbol is equivalent to a loopback line in a railroad syntax diagram.

+ indicates a syntax element that must be included
The plus (+) symbol indicates a syntax element that must be included at least once. A dotted decimal number followed by the + symbol indicates that the syntax element must be included one or more times. That is, it must be included at least once and can be repeated. For example, if you hear the line 6.1+ data area, you must include at least one data area. If you hear the lines 2+, 2 HOST, and 2 STATE, you know that you must include HOST, STATE, or both. Similar to the * symbol, the + symbol can repeat a particular item if it is the only item with that dotted decimal number. The + symbol, like the * symbol, is equivalent to a loopback line in a railroad syntax diagram.

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Various z/OS elements, such as DFSMS, HCD, 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.

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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 (http://www.ibm.com/software/support/systemsz/lifecycle/)
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