IBM Tivoli NetView for z/OS
Version 6 Release 2

Tuning Guide

SC27-2874-02

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Note
Before using this information and the product it supports, read the information in "Notices" on page 163.

This edition applies to version 6, release 2 of IBM Tivoli NetView for z/OS (product number 5697-NV6) and to all subsequent versions, releases, and modifications until otherwise indicated in new editions.

This edition replaces SC27-2874-01.

Contents

Figures

About this publication

The IBM® Tivoli® NetView® for z/OS® product provides advanced capabilities that you can use to maintain the highest degree of availability of your complex, multi-platform, multi-vendor networks and systems from a single point of control. This publication, the *IBM Tivoli NetView for z/OS Tuning Guide*, provides tuning information and techniques for the NetView product. For the purpose of this publication, *tuning* is activity that helps the NetView program and its network environment achieve a certain performance goal in areas such as response time, resource utilization, and throughput. Although this publication does not provide a precise method of tuning the NetView product, it highlights the areas that have the most effect on NetView performance and explains how you can improve performance in those areas.

Intended audience

This publication is for system programmers whose jobs involve improving the performance of the NetView program. Readers should have a thorough understanding of the NetView program. They must also have some problem diagnosis experience and an idea of what can cause a performance goal to be missed.

Publications

This section lists publications in the IBM Tivoli NetView for z/OS library and related documents. It also describes how to access Tivoli publications online and how to order Tivoli publications.

IBM Tivoli NetView for z/OS library

The following documents are available in the IBM Tivoli NetView for z/OS library:

- *Administration Reference*, SC27-2869, describes the NetView program definition statements required for system administration.
- *Application Programmer's Guide*, SC27-2870, describes the NetView program-to-program interface (PPI) and how to use the NetView application programming interfaces (APIs).
- *Automation Guide*, SC27-2846, describes how to use automated operations to improve system and network efficiency and operator productivity.
- *Command Reference Volume 1 (A-N)*, SC27-2847, and *Command Reference Volume 2 (O-Z)*, SC27-2848, describe the NetView commands, which can be used for network and system operation and in command lists and command procedures.
- *Customization Guide*, SC27-2849, describes how to customize the NetView product and points to sources of related information.
- *Data Model Reference*, SC27-2850, provides information about the Graphic Monitor Facility host subsystem (GMFHS), SNA topology manager, and MultiSystem Manager data models.
- *Installation: Configuring Additional Components*, GC27-2851, describes how to configure NetView functions beyond the base functions.
- *Installation: Configuring Graphical Components*, GC27-2852, describes how to install and configure the NetView graphics components.

- *Installation: Configuring the GDPS Active/Active Continuous Availability Solution*, SC14-7477, describes how to configure the NetView functions that are used with the GDPS Active/Active Continuous Availability solution.
- *Installation: Configuring the NetView Enterprise Management Agent*, GC27-2853, describes how to install and configure the NetView for z/OS Enterprise Management Agent.
- *Installation: Getting Started*, GI11-9443, describes how to install and configure the base NetView program.
- *Installation: Migration Guide*, GC27-2854, describes the new functions that are provided by the current release of the NetView product and the migration of the base functions from a previous release.
- *IP Management*, SC27-2855, describes how to use the NetView product to manage IP networks.
- *Messages and Codes Volume 1 (AAU-DSI)*, GC27-2856, and *Messages and Codes Volume 2 (DUI-IHS)*, GC27-2857, describe the messages for the NetView product, the NetView abend codes, the sense codes that are included in NetView messages, and generic alert code points.
- *Programming: Assembler*, SC27-2858, describes how to write exit routines, command processors, and subtasks for the NetView product using assembler language.
- *Programming: Pipes*, SC27-2859, describes how to use the NetView pipelines to customize a NetView installation.
- *Programming: PL/I and C*, SC27-2860, describes how to write command processors and installation exit routines for the NetView product using PL/I or C.
- *Programming: REXX and the NetView Command List Language*, SC27-2861, describes how to write command lists for the NetView product using the Restructured Extended Executor language (REXX) or the NetView command list language.
- *Resource Object Data Manager and GMFHS Programmer's Guide*, SC27-2862, describes the NetView Resource Object Data Manager (RODM), including how to define your non-SNA network to RODM and use RODM for network automation and for application programming.
- *Security Reference*, SC27-2863, describes how to implement authorization checking for the NetView environment.
- *SNA Topology Manager Implementation Guide*, SC27-2864, describes planning for and implementing the NetView SNA topology manager, which can be used to manage subarea, Advanced Peer-to-Peer Networking, and TN3270 resources.
- *Troubleshooting Guide*, GC27-2865, provides information about documenting, diagnosing, and solving problems that occur in the NetView product.
- *Tuning Guide*, SC27-2874, provides tuning information to help achieve certain performance goals for the NetView product and the network environment.
- *User's Guide: Automated Operations Network*, SC27-2866, describes how to use the NetView Automated Operations Network (AON) component, which provides event-driven network automation, to improve system and network efficiency. It also describes how to tailor and extend the automated operations capabilities of the AON component.
- *User's Guide: NetView*, SC27-2867, describes how to use the NetView product to manage complex, multivendor networks and systems from a single point.
- *User's Guide: NetView Enterprise Management Agent*, SC27-2876, describes how to use the NetView Enterprise Management Agent.
- *User's Guide: NetView Management Console*, SC27-2868, provides information about the NetView management console interface of the NetView product.

- *Licensed Program Specifications*, GC31-8848, provides the license information for the NetView product.
- *Program Directory for IBM Tivoli NetView for z/OS US English*, GI11-9444, contains information about the material and procedures that are associated with installing the IBM Tivoli NetView for z/OS product.
- *Program Directory for IBM Tivoli NetView for z/OS Japanese*, GI11-9445, contains information about the material and procedures that are associated with installing the IBM Tivoli NetView for z/OS product.
- *Program Directory for IBM Tivoli NetView for z/OS Enterprise Management Agent*, GI11-9446, contains information about the material and procedures that are associated with installing the IBM Tivoli NetView for z/OS Enterprise Management Agent.
- *IBM Tivoli NetView for z/OS V6R2 Online Library*, LCD7-4913, contains the publications that are in the NetView for z/OS library. The publications are available in PDF and HTML formats.

Related publications

You can find additional product information on the NetView for z/OS web site at http://www.ibm.com/software/tivoli/products/netview-zos/.

For information about the NetView Bridge function, see *Tivoli NetView for OS/390 Bridge Implementation*, SC31-8238-03 (available only in the V1R4 library).

Accessing terminology online

The IBM Terminology web site consolidates the terminology from IBM product libraries in one convenient location. You can access the Terminology web site at http://www.ibm.com/software/globalization/terminology/.

For NetView for z/OS terms and definitions, see the IBM Terminology web site. The following terms are used in this library:

NetView
For the following products:
- Tivoli NetView for z/OS version 6 release 2
- Tivoli NetView for z/OS version 6 release 1
- Tivoli NetView for z/OS version 5 release 4
- Tivoli NetView for z/OS version 5 release 3
- Tivoli NetView for OS/390® version 1 release 4
- NetView releases that are no longer supported

CNMCMD
For the CNMCMD member and the members that are included in it using the %INCLUDE statement

CNMSTYLE
For the CNMSTYLE member and the members that are included in it using the %INCLUDE statement

DSIOPF
For the DSIOPF member and the members that are included in it using the %INCLUDE statement

PARMLIB
For SYS1.PARMLIB and other data sets in the concatenation sequence

MVS™ For z/OS operating systems

MVS element
For the base control program (BCP) element of the z/OS operating system

VTAM®
For Communications Server - SNA Services

IBM Tivoli Network Manager
For either of these products:
- IBM Tivoli Network Manager
- IBM Tivoli OMNIbus and Network Manager

IBM Tivoli Netcool/OMNIbus
For either of these products:
- IBM Tivoli Netcool/OMNIbus
- IBM Tivoli OMNIbus and Network Manager

Unless otherwise indicated, topics to programs indicate the latest version and release of the programs. If only a version is indicated, the topic is to all releases within that version.

When a topic is made about using a personal computer or workstation, any programmable workstation can be used.

Using NetView for z/OS online help

The following types of NetView for z/OS mainframe online help are available, depending on your installation and configuration:
- General help and component information
- Command help
- Message help
- Sense code information
- Recommended actions

Accessing publications online

The documentation DVD, *IBM Tivoli NetView for z/OS V6R2 Online Library* contains the publications that are in the product library. The publications are available in PDF and HTML formats. Refer to the readme file on the DVD for instructions on how to access the documentation.

IBM posts publications for this and all other Tivoli products, as they become available and whenever they are updated, to the Tivoli Documentation Central website at https://www.ibm.com/developerworks/mydeveloperworks/wikis/home/wiki/Tivoli%20Documentation%20Central

Note: If you print PDF documents on other than letter-sized paper, set the option in the **File > Print** window that enables Adobe Reader to print letter-sized pages on your local paper.

Ordering publications

You can order many Tivoli publications online at http://www.ibm.com/e-business/linkweb/publications/servlet/pbi.wss

You can also order by telephone by calling one of these numbers:
- In the United States: 800-879-2755
- In Canada: 800-426-4968

In other countries, contact your software account representative to order Tivoli publications. To locate the telephone number of your local representative, perform the following steps:

1. Go to http://www.ibm.com/e-business/linkweb/publications/servlet/pbi.wss.
2. Select your country from the list and click **Go**.
3. Click **About this site** to see an information page that includes the telephone number of your local representative.

Accessibility

Accessibility features help users with a physical disability, such as restricted mobility or limited vision, to use software products successfully. Standard shortcut and accelerator keys are used by the product and are documented by the operating system. Refer to the documentation provided by your operating system for more information.

For additional information, see the Accessibility appendix in the *User's Guide: NetView*.

Service Management Connect

Connect, learn, and share with Service Management professionals: product support technical experts who provide their perspectives and expertise.

Access Service Management Connect at http://www.ibm.com/developerworks/servicemanagement/z/. Use Service Management Connect in the following ways:

- Become involved with transparent development, an ongoing, open engagement between other users and IBM developers of Tivoli products. You can access early designs, sprint demonstrations, product roadmaps, and prerelease code.
- Connect one-on-one with the experts to collaborate and network about Tivoli and the NetView community.
- Read blogs to benefit from the expertise and experience of others.
- Use wikis and forums to collaborate with the broader user community.

Tivoli technical training

For Tivoli technical training information, refer to the following IBM Tivoli Education website at http://www.ibm.com/software/tivoli/education.

Tivoli user groups

Tivoli user groups are independent, user-run membership organizations that provide Tivoli users with information to assist them in the implementation of Tivoli Software solutions. Through these groups, members can share information and learn from the knowledge and experience of other Tivoli users.

Downloads

Clients and agents, NetView product demonstrations, and several free NetView applications can be downloaded from the NetView for z/OS support web site:

http://www.ibm.com/software/sysmgmt/products/support/IBMTivoliNetViewforzOS.html

In the "Support shortcuts" pane, expand **Tivoli NetView for z/OS**, and click **Fixes (downloads)** to go to a page where you can search for or select downloads.

These applications can help with the following tasks:

- Migrating customization parameters and initialization statements from earlier releases to the CNMSTUSR member and command definitions from earlier releases to the CNMCMDU member.
- Getting statistics for your automation table and merging the statistics with a listing of the automation table
- Displaying the status of a job entry subsystem (JES) job or canceling a specified JES job
- Sending alerts to the NetView program using the program-to-program interface (PPI)
- Sending and receiving MVS commands using the PPI
- Sending Time Sharing Option (TSO) commands and receiving responses

Support information

If you have a problem with your IBM software, you want to resolve it quickly. IBM provides the following ways for you to obtain the support you need:

Online

Access the Tivoli Software Support site at http://www.ibm.com/software/sysmgmt/products/support/index.html?ibmprd=tivman. Access the IBM Software Support site at http://www.ibm.com/software/support/probsub.html.

IBM Support Assistant

The IBM Support Assistant is a free local software serviceability workbench that helps you resolve questions and problems with IBM software products. The Support Assistant provides quick access to support-related information and serviceability tools for problem determination. To install the Support Assistant software, go to http://www.ibm.com/software/support/isa/.

Troubleshooting information

For more information about resolving problems with the NetView for z/OS product, see the *IBM Tivoli NetView for z/OS Troubleshooting Guide*. Additional support for the NetView for z/OS product is available through the NetView user group on Yahoo at http://groups.yahoo.com/group/NetView/. This support is for NetView for z/OS customers only, and registration is required. This forum is monitored by NetView developers who answer questions and provide guidance. When a problem with the code is found, you are asked to open an official problem management record (PMR) to obtain resolution.

Conventions used in this publication

This section describes the conventions that are used in this publication.

Typeface conventions

This publication uses the following typeface conventions:

Bold

- Lowercase commands and mixed case commands that are otherwise difficult to distinguish from surrounding text
- Interface controls (check boxes, push buttons, radio buttons, spin buttons, fields, folders, icons, list boxes, items inside list boxes, multicolumn lists, containers, menu choices, menu names, tabs, property sheets), labels (such as **Tip:**, and **Operating system considerations**:)
- Keywords and parameters in text

Italic

- Citations (examples: titles of publications, diskettes, and CDs
- Words defined in text (example: a nonswitched line is called a *point-to-point line*)
- Emphasis of words and letters (words as words example: "Use the word *that* to introduce a restrictive clause."; letters as letters example: "The LUN address must start with the letter *L*.")
- New terms in text (except in a definition list): a *view* is a frame in a workspace that contains data.
- Variables and values you must provide: ... where *myname* represents...

`Monospace`

- Examples and code examples
- File names, programming keywords, and other elements that are difficult to distinguish from surrounding text
- Message text and prompts addressed to the user
- Text that the user must type
- Values for arguments or command options

Operating system-dependent variables and paths

For workstation components, this publication uses the UNIX convention for specifying environment variables and for directory notation.

When using the Windows command line, replace **$***variable* with **%***variable***%** for environment variables and replace each forward slash (*/*) with a backslash (\) in directory paths. The names of environment variables are not always the same in the Windows and UNIX environments. For example, %TEMP% in Windows environments is equivalent to $TMPDIR in UNIX environments.

Note: If you are using the bash shell on a Windows system, you can use the UNIX conventions.

Syntax diagrams

The following syntax elements are shown in syntax diagrams. Read syntax diagrams from left-to-right, top-to-bottom, following the horizontal line (the main path).

- "Symbols" on page xvi
- "Parameters" on page xvi
- "Punctuation and parentheses" on page xvi
- "Abbreviations" on page xvii

For examples of syntax, see “Syntax examples” on page xvii.

Symbols

The following symbols are used in syntax diagrams:

►► Marks the beginning of the command syntax.

► Indicates that the command syntax is continued.

| Marks the beginning and end of a fragment or part of the command syntax.

►◄ Marks the end of the command syntax.

Parameters

The following types of parameters are used in syntax diagrams:

Required
Required parameters are shown on the main path.

Optional
Optional parameters are shown below the main path.

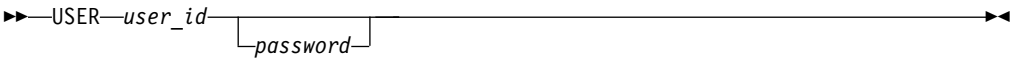
Default
Default parameters are shown above the main path. In parameter descriptions, default parameters are underlined.

Syntax diagrams do not rely on highlighting, brackets, or braces. In syntax diagrams, the position of the elements relative to the main syntax line indicates whether an element is required, optional, or the default value.

When you issue a command, spaces are required between the parameters unless a different separator, such as a comma, is specified in the syntax.

Parameters are classified as keywords or variables. Keywords are shown in uppercase letters. Variables, which represent names or values that you supply, are shown in lowercase letters and are either italicized or, in NetView help, displayed in a differentiating color.

In the following example, the USER command is a keyword, the *user_id* parameter is a required variable, and the *password* parameter is an optional variable.



Punctuation and parentheses

You must include all punctuation that is shown in the syntax diagram, such as colons, semicolons, commas, minus signs, and both single and double quotation marks.

When an operand can have more than one value, the values are typically enclosed in parentheses and separated by commas. For a single value, the parentheses typically can be omitted. For more information, see “Multiple operands or values” on page xviii.

If a command requires positional commas to separate keywords and variables, the commas are shown before the keywords or variables.

When examples of commands are shown, commas are also used to indicate the absence of a positional operand. For example, the second comma indicates that an optional operand is not being used:

```
COMMAND_NAME opt_variable_1,,opt_variable_3
```

You do not need to specify the trailing positional commas. Trailing positional and non-positional commas either are ignored or cause a command to be rejected. Restrictions for each command state whether trailing commas cause the command to be rejected.

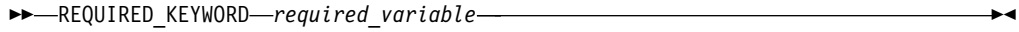
Abbreviations

Command and keyword abbreviations are listed in synonym tables after each command description.

Syntax examples

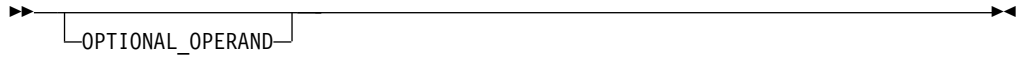
The following examples show the different uses of syntax elements:

Required syntax elements:
Required keywords and variables are shown on the main syntax line. You must code required keywords and variables.



A required choice (two or more items) is shown in a vertical stack on the main path. The items are shown in alphanumeric order.

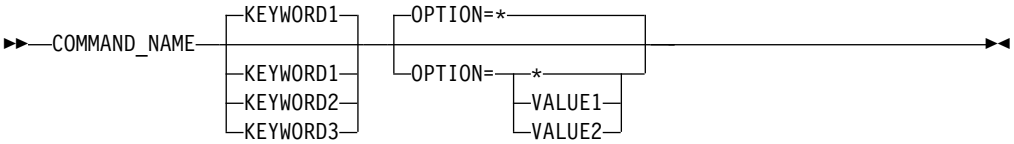
Optional syntax elements:
Optional keywords and variables are shown below the main syntax line. You can choose not to code optional keywords and variables.



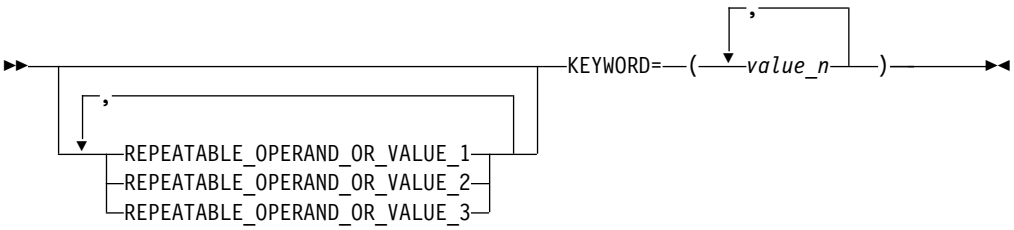
A required choice (two or more items) is shown in a vertical stack below the main path. The items are shown in alphanumeric order.

Default keywords and values:
Default keywords and values are shown above the main syntax line in one of the following ways:

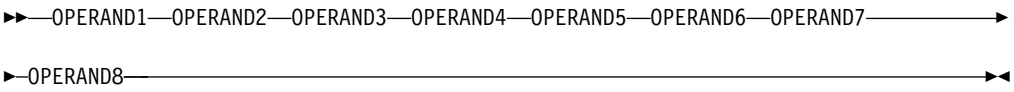
- A default keyword is shown only above the main syntax line. You can specify this keyword or allow it to default. The following syntax example shows the default keyword KEYWORD1 above the main syntax line and the rest of the optional keywords below the main syntax line.
- If an operand has a default value, the operand is shown both above and below the main syntax line. A value below the main syntax line indicates that if you specify the operand, you must also specify either the default value or another value shown. If you do not specify the operand, the default value above the main syntax line is used. The following syntax example shows the default values for operand OPTION=* above and below the main syntax line.



Multiple operands or values:
An arrow returning to the left above a group of operands or values indicates that more than one can be selected or that a single one can be repeated.

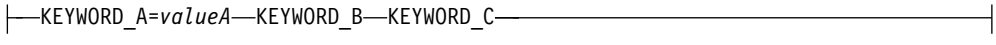


Syntax that is longer than one line:
If a diagram is longer than one line, each line that is to be continued ends with a single arrowhead and the following line begins with a single arrowhead.

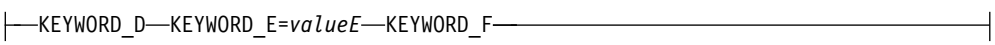


Syntax fragments:
Some syntax diagrams contain syntax fragments, which are used for lengthy, complex, or repeated sections of syntax. Syntax fragments follow the main diagram. Each syntax fragment name is mixed case and is shown in the main diagram and in the heading of the fragment. The following syntax example shows a syntax diagram with two fragments that are identified as Fragment1 and Fragment2.

Fragment1



Fragment2



Chapter 1. Improving NetView Performance

This chapter addresses many tuning-related questions asked by users of the NetView program. This chapter also provides basic tuning considerations to improve general NetView performance. Review these topics and considerations for relevancy to your environment.

Achieving Performance Goals

Tuning is any activity that helps the NetView program and its network environment achieve a certain performance goal in areas such as response time, resource utilization, and throughput. This goal or expectation can be as formal as a service level agreement or as informal as a person's perception. Regardless of the formality of the performance goal, tuning is any activity performed to meet that goal.

The task of tuning is difficult to define. People have many different perceptions and approaches to tuning. Unlike the installation task, no set sequence of steps leads to a tuned system. This book describes the areas that affect the performance of the NetView program and shows methods for controlling and optimizing that performance. It explains how the following factors affect NetView program tuning:

- Filter use
- Automation activity
- Network size
- VSAM data set design, placement, and management
- Command list use, design, and data set placement
- View size
- Workstation CPU and RAM
- Link speed

An important part of tuning is setting the performance goal. However, that goal varies from installation to installation. Some installations have more message traffic or network activity than others. Many factors uniquely define the performance goal for each installation; therefore, these factors are not discussed in this book.

This book explains how to determine certain tuning values and suggests values you should use. Each environment needs to be tuned according to the following factors:

- Automation levels
- Logon and logoff rates
- Monitoring activities
- Network component failure rates
- Network transaction rates
- Problem determination activities
- System transaction rates
- Resource status change activities

All recommendations are based on experiences and measurements done in an IBM controlled environment. The use of these recommendations is a customer responsibility and depends on the customers' ability to evaluate and integrate them into their operational environments.

Using General Techniques

If you are just getting started in tuning the NetView program, use the following general tuning techniques to improve overall NetView performance. You can handle the most frequently encountered performance and tuning considerations by using these techniques.

1. Use the RATE statement to stop rapidly recurring hardware monitor alerts from being recorded to the hardware monitor database. See "NPDA.RATE Statement Initialization Specifications" on page 52 for more information.
2. Decide which data is critical to keep for the session monitor, and set the following session monitor options and parameters accordingly:
   - Sense code values in DSICTMOD for DASD filtering
   - KCLASS DASD option
   - KCLASS AVAIL option
   - KCLASS SAW option
   - KCLASS KEEPPIU option
   - KCLASS KEEPSESS option

   See Chapter 6, "Tuning for the Session Monitor," on page 55 for more information.
3. Use the DBAUTO command to reorganize or reset the VSAM databases regularly. See "VSAM Database Maintenance" on page 101 for more information.
4. Use the following utilities to monitor performance:

   AUTOCNT
   Generates automation table usage reports. See "AUTOCNT Command" on page 9.

   COLLCTL LISTINFO
   Displays the average and maximum time it takes for the NetView program data collectors to collect data during a given data collection interval. The display includes statistics for the following data collectors:
   - DVDEF
   - DVTAD
   - DVCONN
   - DVROUT
   - INTERFACES
   - TELNET
   - APPL

   DISPPI
   Displays information about NetView program-to-program interface buffer queues, including buffer queue lengths, total buffers sent, and buffer storage usage. See "NetView Program-to-Program Interface" on page 115.

   DSRBS
   Displays statistics on data services request block (DSRB) use for NetView and user-written data services tasks (DSTs). See "Using the NPDA.DSRBO Statement" on page 50.

HLLENV
Displays information about usage of the regular and critical preinitialized environment pools by PL/I command processors. See "Running High-level Language Programs in a Preinitialized Environment" on page 36.

HMSTATS
Displays hardware monitor event and alert workload counters, and statistics about the alert cache and alerts dynamic (ALD) screen update processing. See "HMSTATS Command" on page 46.

LISTCAT
Displays VSAM database definition and performance data for NetView DSTs that have open VSAM databases. See "LISTCAT Command" on page 97.

LOGTSTAT
Logs record type 38 subtype 2 to SMF at logoff/logon/termination.

MAPCL
Provides information about preloaded CLISTs. See "Preloading Command Lists" on page 26.

NACTL LISTINFO
Displays the average and maximum time it takes for the NetView for z/OS Enterprise Management Agent data collectors to collect data during a given data collection interval. The display includes statistics for the following agent subtowers:
- HEALTH
- CONNACT
- CONINACT
- SESSACT

QRYGLOBL
Displays information about NetView global variables, including the expected number of common or task global variables and the actual number of variables found. See "Global Variables" on page 38.

RESOURCE
Provides CPU and storage statistics for the NetView address space. See "RESOURCE Command" on page 119.

SESSMDIS
Displays session monitor session counts, storage use, and workload traffic information. See "SESSMDIS Command" on page 72.

STATAPI
Generates RODM API statistics to analyze the content and activity of RODM. See "RODM API Statistics" on page 85.

STATCELL
Collects information concerning the distribution of storage cells in windows and segments. See "RODM Cell Pool Statistics" on page 87.

TASKMON
Shows CPU, storage, I/O, and message queue rate statistics for all tasks in the NetView program.

TASKURPT
A NetView sample that demonstrates how reports can be generated from the task resources data in the SMF log using REXX.

TASKUTIL
Displays task performance information, including CPU utilization, queue lengths, storage use, and active command lists. See "TASKUTIL Command" on page 126.

TOPOSNA LISTPOOL
Displays SNA Topology manager storage pool statistics.

TOPOSNA LISTRODM
Displays RODM activity and object counts. See "SNA Topology Manager" on page 122.

TOPOSNA LISTSTOR
Displays storage usage counts for SNA topology manager. See "SNA Topology Manager" on page 122.

VSAMPOOL
Displays VSAM local shared resource (LSR) pool use statistics. See "VSAMPOOL Command" on page 99.

You can add these utilities to a command list that can be run periodically to collect performance statistics. See the example in Figure 1.

```
/* REXX clist to collect performance statistics.  Can be invoked by an*/
/*   EVERY timer to run under an autotask - for example,              */
/*     EXCMD AUTO2,EVERY 00:15,V6R2PERF                               */
/* Substitute your RODMNAME for X below!  If you're not using RODM,   */
/*   delete the lines referring to X below.                           */
/*                                                                    */
/*                                                                    */
'MVS F X,STATAPI,CLEAR'
'AUTOCNT REPORT=BOTH,STATS=SUMMARY'
'COLLCTL LISTINFO'
'DISPPI'
'DSRBS AAUTSKLP'
'DSRBS BNJDSERV'
'DSRBS DSIGDS'
'HMSTATS'
'LISTCAT AAUTSKLP'
'LISTCAT BNJDSERV'
'LISTCAT DSILOG'
'MAPCL'
'MVS F X,STATCELL'
'NACTL LISTINFO'
'RESOURCE'
'SESSMDIS'
'TASKMON * *'
/* 'TASKURPT (NOWINDOW' */
'TASKUTIL'
'TOPOSNA LISTPOOL'
'TOPOSNA LISTRODM'
'TOPOSNA LISTSTOR'
'VSAMPOOL'
say 'End of V6R2PERF CLIST'
exit
```

Figure 1. Example: Using a REXX CLIST to Collect Performance Statistics

Recording performance statistics to the NetView log in this manner can provide useful historical information for trend analysis and can be invaluable in performance problem analysis.

Chapter 2. Tuning for Automated Operations

The NetView program provides functions that you can use to automate operations.

Many messages are sent to the NetView program for automation after being processed by the MVS message processing facility (MPF).

For a detailed description of NetView automation, refer to the*IBM Tivoli NetView for z/OS Automation Guide*.

Tuning Techniques

Following are the major tuning techniques for automated operations, arranged in order of expected effect on performance, with the most important tuning considerations listed first. These are described in detail in this chapter.

1. Limit the number of system messages processed by the NetView program. On MVS systems, include a `.NO_ENTRY` statement specifying AUTO(NO) in the MPFLST*xx* member of SYS1.PARMLIB. See "Limiting System Messages" on page 6.
2. Segment the automation table using BEGIN/END sections to minimize the average number of automation table statements evaluated for each message or MSU. See "Using BEGIN/END to Improve Efficiency" on page 8.
3. Order BEGIN/END sections and statements within sections in order of frequency to minimize the average number of statements evaluated for each message or MSU. See "Using BEGIN/END to Improve Efficiency" on page 8.
4. Use the AUTOCNT command to generate usage reports for the NetView automation table. See "AUTOCNT Command" on page 9.
5. Eliminate simple command procedures when the condition processing can be performed directly in the automation table. See "Using Other Techniques to Improve Efficiency" on page 8.
6. Block the hardware monitor ESREC, AREC, and OPER filters where possible for alerts that are to be automated. See "Filtering Hardware Monitor Records" on page 14.
7. Minimize the use of the CONTINUE automation table action if it causes the entire table to be scanned. See "Using Other Techniques to Improve Efficiency" on page 8.
8. Use the MSUSEG automation table condition if you plan to automate alerts. This automates the MSU directly, rather than generating the BNJ146I and BNJ030I messages using the hardware monitor OPER filter. See "Automating Hardware Monitor Records" on page 14.
9. Use multiple autotasks for MVS environments to distribute the automation workload across multiple processors. See "Automation Tasks (Autotasks)" on page 15.
10. Use the RMTCMD command, where possible, to forward commands and messages between a distributed system and a focal point. The alternative method uses OST-NNT sessions. See "Command and Message Forwarding" on page 17.

Limiting System Messages

To use NetView automation support with the NetView program, the first and most important step is to limit the number of system messages the NetView program processes. The NetView automation table is searched for most messages that pass through the NetView program. Therefore, it is important to limit the system message traffic sent to the NetView program to only those messages that should be considered for automation or those that are needed for display purposes.

When you automate the operation of distributed hosts with a focal point host, handle as much of the traffic as possible at the distributed host to minimize the overhead of forwarding messages to the focal point host for automation.

You can use the NetView Revision Table function to make finely-tuned decisions about the following:

- Which messages are passed to NetView for automation
- Which messages are eligible for further z/OS processing, including the overhead of routing to other parts of the sysplex.

Of the actions available in the Revision Table, the following three are of particular interest for limiting performance cost of system messages:

AUTOMATE
Set this to OFF for messages that are not needed by your automation tables in the NetView program.

DELETE
Set this to ON for messages that are not needed anywhere.

NETVONLY
Set this to ON for messages that should *only* be automated and not seen, logged, or routed, or until automation specifies otherwise.

Other Revision actions can also have performance benefits. For example, you might want to limit the routing codes set in some messages. See the *IBM Tivoli NetView for z/OS Automation Guide* and also sample CNMSMRT1.

If you are not using the Revision Table, use the MPFLST*xx* member of SYS1.PARMLIB to identify whether a message is eligible for automation processing. Eligible messages are passed to the NetView program over the subsystem interface or through extended multiple console support (EMCS) consoles (see "NetView Subsystem Address Space" on page 7).

When passing messages to the NetView program, note the following about MPFLST*xx*:

- Specify AUTO(YES) or AUTO(NO) to identify whether a message is eligible for automation processing.
- Specify the default values for groups of messages listed in the MPFLST*xx* member with the `.DEFAULT` statement. The `.DEFAULT` statement uses AUTO(NO) unless you specify AUTO(YES).
- Specify the default processing you want for messages that are not identified in the MPFLST*xx* member with the `.NO_ENTRY` statement.

  Note: Ensure that your MPFLST*xx* member has a `.NO_ENTRY` statement with AUTO(NO) specified. This helps limit the number of messages sent to the NetView program to only those needed for automation or display purposes.

The `.NO_ENTRY` statement uses AUTO(YES) unless you specify AUTO(NO). If you do not have a `.NO_ENTRY` statement in MPFLST*xx*, the system uses a default of AUTO(YES).

For more information about MPF, refer to the appropriate MVS publication.

Using EMCS Console Support

The NetView program uses extended multiple console support (EMCS) consoles. EMCS consoles use the CNMCSSIR task to receive all messages marked AUTO(YES) or AUTO(token) in the MPF table, or which are subject to NETVONLY or REVISE("1" AUTOMATE) revision table actions or similar.

You can assign attributes to the consoles and change the attributes of your EMCS consoles to ensure that messages with certain route codes are delivered to the consoles you specify. See the *IBM Tivoli NetView for z/OS Security Reference* for a description of the EMCS console attributes.

NetView Subsystem Address Space

The NetView subsystem address space job must be running to enable you to:

- Receive NetView commands from sources outside of the NetView program
- Start the program-to-program interface
- Receive messages that are to be delivered to the NetView program through the subsystem
- Enable the NetView Message Revision function.

Table 9 on page 142 describes how to calculate the minimum, maximum, and recommended values for use in the NetView subsystem address space job.

NetView Automation Table

Automation of system and network messages and MSUs is accomplished with automation statements (IF-THEN, END, ALWAYS, SYN, and %INCLUDE) in the NetView automation table, which is activated by the AUTOTBL command. Messages and MSUs are passed through the active NetView automation table to sequentially search one or more of the following automation table statements that indicate actions to be automatically performed for that message or MSU.

- IF-THEN contains conditions to be tested and actions to be taken if the conditions are satisfied. Actions that can be taken include a direct response to a system message, a command or command procedure to be run, or presentation modification. Multiple actions can be specified on a single IF-THEN statement.
- END indicates the end of a BEGIN/END section that can be used to logically segment automation statements.
- ALWAYS indicates that certain actions are always to be done if the sequential search through the active automation table reaches the ALWAYS statement.
- SYN defines table synonyms that represent values that can subsequently be substituted within other automation table statements.
- %INCLUDE physically segments the table into multiple members or files.

If an automation table is activated as a result of a NetView AUTOTBL command, a compact, preprocessed version of the automation table is loaded into NetView storage. This allows a quicker search of the active NetView automation table than

if the actual automation members are scanned when a message or MSU is processed. SYN and %INCLUDE statements do not affect the processing time of messages and MSUs. These statements are processed when the AUTOTBL command is processed, not when each message or MSU is processed.

You can decrease the processing time for messages and MSUs by following specific automation table design guidelines. The guidelines in the rest of this section decrease the average search time for the NetView program to locate matching statements and to perform actions.

As you make changes to improve the efficiency of the automation table, you should monitor the performance of the table using the AUTOCNT command. See "AUTOCNT Command" on page 9 for more information.

Using BEGIN/END to Improve Efficiency

- Because the NetView automation table is searched sequentially (beginning to end), logically segmenting the automation table using BEGIN/END sections provides a large performance advantage. Using BEGIN/END reduces the number of automation statements that must be scanned. You should design your automation table so that each message prefix (such as DSI), each MSU major vector (such as major vector X'0000'), and specific subvectors have BEGIN/END sections.

  If you dedicate BEGIN/END sections to the message and MSU classes, the number of statements that must be scanned is smaller than if all of the IF-THEN and ALWAYS statements are listed. If each message class has its own unique BEGIN/END section, placing ALWAYS as the last statement in a section prevents the automation table from being scanned further if no automation table match is found.
- Order BEGIN/END sections by frequency of use. If a large number of VTAM messages are received, a BEGIN/END section to handle IST messages can be at or near the beginning of the automation table to decrease the number of statements that must be evaluated before the correct BEGIN/END section is found.
- Order the statements within BEGIN/END sections by frequency of use. Minimizing the number of statements that must be searched to find the correct matching statement reduces processing.

Using Other Techniques to Improve Efficiency

The following guidelines are other techniques you can use to decrease the average search time for the NetView program to locate matching statements and to perform actions.

- Place statements for entire classes of messages or MSUs that are frequently received, but not processed near the beginning of the table or BEGIN/END sections. IF-THEN statements and ALWAYS statements can specify that no action be performed, eliminating unnecessary processing time. For example, if you do not automate commands issued at a NetView terminal, you can add the statement in the following example at the beginning of your table:

  ```
  IF HDRMTYPE = '*' THEN ;
  ```
- Some comparison items take longer to evaluate than others. Comparison items with the potential to be relatively slow include MSUSEG comparison items that specify complex locations, the DSICGLOB automation table function (ATF) program that is supplied with the NetView product, and any lengthy ATF programs you have written. Isolate these items by placing them in BEGIN/END

sections started with an IF-THEN statement so that the NetView program evaluates the items only when the comparison in the IF-THEN statement is true. You can also isolate items by placing them after a logical-AND operator (&). In this case, the NetView program evaluates the items only if the conditions before the & are met.

- Avoid unnecessary NetView automation processing by using the operating system message facility (MPF for MVS) to suppress unneeded messages. Only those system messages that require NetView automation or an operator's action should be forwarded to the NetView program. See “Limiting System Messages” on page 6 for more information.
- Eliminate simple command procedures whose function can be processed in the automation table directly. Consider the following examples:
  - Instead of calling a command list from the automation table to check the value of a NetView global variable, you can bypass the processing needed to run the command list by checking the global variable value directly in the automation table using the DSITGLOB or DSICGLOB ATFs.
  - The THRESHOLD comparison item is useful for specifying particular actions to take place when a condition has happened at least a specified number of times within a specified time period. Using THRESHOLD in the automation table is more efficient than calling a command procedure to make a similar determination. The THRESHOLD counters are reset when a new automation table is loaded.
  - If you call a command procedure to evaluate a complex condition that the existing automation table comparison items cannot address, consider writing your own ATF to perform this processing.
- Minimize use of the CONTINUE automation table action that scans the entire table. The CONTINUE action is useful for things such as setting defaults for the table or a section of the table and then continuing the search for an additional match, as specified by the statement in the following example:

  ```
  ALWAYS  SYSLOG(Y) NETLOG(N) DISPLAY(Y) CONTINUE(Y) ;
  ```

  If specified on every statement, CONTINUE(Y) increases processing time. The entire automation table must be searched to determine all automation actions that should take place. If you use CONTINUE(Y) to determine multiple IF-THEN statements that all result in actions to be performed, design your table so that scanning does not need to continue through the entire table by doing one of the following:
  - Specify CONTINUE(N) on the last statement where you expect to find a match for a particular message or MSU.
  - Specify ALWAYS as the last statement of the BEGIN/END section to prevent continued statements from being scanned outside of an enclosing BEGIN/END section.
- If automation slows because many unsolicited messages are queued on a single task waiting for automation table processing, you can use the ASSIGN command to split the messages among several tasks. If you use the ASSIGN command, you can still use the automation table for final routing of the message; the ASSIGN command just gets the message to the automation table faster.

For more information about the NetView automation table, message routing, and ASSIGN processing, refer to *IBM Tivoli NetView for z/OS Automation Guide*.

AUTOCNT Command

The AUTOCNT command produces a report describing the usage of automation table statements in the active NetView automation table. You can also use the

AUTOCNT command to reset the automation table usage counters. You can display the report as multiline messages or place the information in a file.

The AUTOCNT command can request information and statistics on message-type automation statements, on MSU-type automation statements, or both. You can request summary information or detail. The detailed information tells you how many messages and MSUs were compared to each automation table statement, and how many matched.

Message CNM493I is written to the network log each time a match is found in the NetView automation table that results in the scheduling of a command or command list for execution with the EXEC action. The sequence number (if any) and the member name of the statement that ran the command or command list are included in the CNM493I message. Use this message to determine how frequently commands are run from the automation table and by which automation table statements. If you use the AUTOCNT command to analyze automation table activity, you might want to prevent the CNM493I message from being written to the network log. You can use the CNM493I parameter of the DEFAULTS and OVERRIDE commands or the CNM493I action in the automation table to control whether the message is written.

If you use the AUTOCNT command to analyze automation table activity, you might want to prevent the CNM493I message from being written to the network log. You can use the CNM493I parameter of the DEFAULTS and OVERRIDE commands or the CNM493I action in the automation table to control whether the message is written.

For syntax and other information about the AUTOCNT command, and for information about the CNM493I action of the automation table, refer to the *IBM Tivoli NetView for z/OS Automation Guide*. For information on the CNM493I option of the DEFAULTS and OVERRIDE commands, refer to the NetView online help.

Detail Reports

Figure 2 illustrates the output of a detail report for MSG-type automation table statements. Detail reports for MSU-type automation table statements provide the same types of data.

```
- DWO800I AUTOMATION TABLE MSG DETAIL REPORT BY OPER1

DWO803I ------------( AUTOSEG1 MESSAGE DETAILS  03/30/13 14:32:42 )------------
DWO805I                                                    |-- PERCENTAGES --|
DWO806I STMT   SEQ      MEMBER    COMPARE    MATCH  E  C  A MATCH/ COMP/ MATCH/
DWO807I NUMBER NUMBER   NAME      COUNT      COUNT  C  I  I COMP   TOTAL TOTAL
DWO808I ---------------------------------------------------------------------
DWO809I 00001  00000800 AUTOSEG1     2304      798           34.6  100.0  34.6
DWO809I 00002  00001000 AUTOSEG1      798      177           22.2   34.6   7.7
DWO809I 00003  00001400 AUTOSEG1      621        9  1         1.4   27.0   0.4
DWO809I 00004  00001600 AUTOSEG1      612        0  1         0.0   26.6   0.0
DWO809I 00005  00002000 AUTOSEG1      612      612        X 100.0   26.6  26.6
DWO809I 00007  00002700 AUTOSEG1     1506      160          10.6   65.4   6.9
DWO809I 00008  00002900 AUTOSEG1      160       52          32.5    6.9   2.3
DWO809I 00009  00003400 AUTOSEG1      108        1           0.9    4.7   0.0
DWO809I 00010  00003700 AUTOSEG1      107      107        X 100.0    4.6   4.6
DWO808I ---------------------------------------------------------------------
```

Figure 2. Message Detail Report.

This is an automation table detail report.

In addition to the statement number, sequence number, and member name, the detail report contains the following information for each automation table statement.

- Conditional comparisons (COMPARE COUNT)

  The counter that increments when the associated conditional statement is selected for evaluation.
- Evaluation matches (MATCH COUNT)

  The counter that increments when the associated conditional statement is evaluated as true, resulting in execution of all automation actions specified on the statement.
- Executed commands (E C)

  This column reports the number of commands that are run for this automation statement when there is an evaluation match. If the number of EXEC actions with CMD keywords is greater than 99, an asterisk (*) appears in the column.
- Continue indicator (C I)

  A report column marked X indicates that the conditional statement contained a CONTINUE action, causing the NetView program to continue to scan the automation table. CONTINUE(Y) actions cause additional conditional processing for later statements in the table, and can enable a conditional match on additional statements.
- Always statement indicator (A I)

  A report column marked X indicates that the statement was an ALWAYS. For ALWAYS statements, the MATCH/COMP field is always 100%.
- Match to compare percentage (MATCH/COMP)

  A statistic calculated by dividing the ratio of MATCH COUNT by the COMPARE COUNT of the conditional statement, multiplied by 100. If the number of matches and the number of comparisons are both zero, the ratio is shown as **-.-** to indicate division by zero.
- Compare percentage (COMP/TOTAL)

  A statistic calculated by dividing the ratio of COMPARE COUNT of the conditional statement by the total number of messages or MSUs, multiplied by 100. If the number of comparisons against this statement and the total number of messages or MSUs processed by automation are both zero, the ratio is shown as **-.-** to indicate division by zero.
- Match percentage (MATCH/TOTAL)

  A statistic calculated by dividing the ratio of MATCH COUNT of the conditional statement by the total number of messages or MSUs, multiplied by 100. If the number of matches for this statement and the total number of messages or MSUs processed by automation are both zero, the ratio is shown as **-.-** to indicate division by zero.

Any numeric column value that exceeds 99999999 is overwritten with eight asterisks (*).

Suggestions for Using Detail Reports

- The report output represents a snapshot of the automation table data, and that automation might be in progress for some messages or MSUs while the data is being collected. There might be minor discrepancies between totals in a summary report and values in a detail report produced at the same time.
- The percentage fields can be interpreted intuitively.

  - COMP/TOTAL is the percentage of messages or MSUs processed through the table that compare against this statement. The first statement always has a COMP/TOTAL percentage of 100%, because all messages or MSUs compare against the first statement.
  - MATCH/TOTAL is the percentage of messages or MSUs processed through the table that match on this statement.
  - COMP/MATCH is the percentage of messages or MSUs compared against this statement that match.
- Smaller COMP/TOTAL percentages indicate better performance. You can reduce the COMP/TOTAL percentages by using BEGIN/END sections and by ordering statements within sections by match frequency or MATCH/TOTAL percentage. In other words, statements with higher MATCH/TOTAL percentages should be located early in their BEGIN/END sections. Likewise, BEGIN-END sections with higher MATCH/TOTAL percentages should be located early in the automation table.
- COMP/MATCH percentages of 100% are expected on ALWAYS statements. The ALWAYS indicator field (A I) is included in the report so that you can spot these without referring to a LISTING file. If you have other statements with a COMP/MATCH percentage of 100%, you should determine whether the statement is coded correctly.
- The executed commands field (E C) multiplied by the MATCH COUNT field equals the number of commands run as a result of matches on the automation table statement. This product (E C times MATCH COUNT), summed for all automation table statements, represents the total number of commands run from the automation table. This total is shown as the TOTAL COMMANDS EXECUTED field in the summary report.
- Examine statements with high MATCH COUNT values that execute commands.
  - Use the LOADCL command to preload command lists that are executed frequently.
  - For command processors that are executed frequently, ensure that RES=N is not coded on the CMDDEF statement in initialization member CNMCMD.

  For more information on making command lists and command processors resident, see "Preloading Command Lists" on page 26 and "Command Processors" on page 35.

Summary Reports

Figure 3 on page 13 illustrates the output of a summary report for MSG-type automation table statements. Summary reports for MSU-type automation table statements provide the same types of data, except for TOTAL ROUTES EXECUTED, because the ROUTE keyword of the EXEC action is not applicable to MSUs.

```
- DWO801I AUTOMATION TABLE MSG SUMMARY REPORT BY OPER1

DWO810I ------------( AUTOSEG1 MESSAGE SUMMARY  03/30/13 14:32:42 )-------
DWO812I STATISTICS STARTED          = 03/30/13  13:32
DWO813I TOTAL MSGS PROCESSED        =     2304
DWO814I MSGS MATCHED                =      958
DWO815I MSGS RESULTING IN COMMANDS  =        9
DWO816I TOTAL COMMANDS EXECUTED     =        9
DWO817I TOTAL ROUTES EXECUTED       =        1
DWO818I AVERAGE COMPARES/MSG        =        2.58
DWO819I TOTAL MSGS/MINUTE           =       38
DWO820I MINUTES ELAPSED             =       60
DWO808I ------------------------------------------------------------------
```

Figure 3. Message Summary Report

The summary report contains the following information.

- Date and time of usage report generation.

  The date is in the format *mm/dd/yy*. The time is in the format *hh:mm:ss*, where *hh* is based on a 24 hour clock. The date and time are reported in the label message for the SUMMARY statistics (messages DWO810I and DWO811I).
- Date and time of start of usage count monitoring.

  The date is in the format *mm/dd/yy*. The time is in the format *hh:mm:ss*, where *hh* is based on a 24 hour clock. The date and time are reported in message DWO812I.
- Total number of messages or MSUs processed.

  A count of all the messages or MSUs that have passed through the automation table.
- Total number of messages or MSUs matched.

  The number of messages or MSUs that were acted upon by at least one automation table statement. An ALWAYS statement causes a message or MSU to be considered a match.
- Number of messages or MSUs resulting in command execution.

  A count of the number of messages or MSUs that resulted in one or more commands being executed from automation table statements.
- Total commands executed for messages or MSUs.

  The total number of commands executed by all automation table statements during the period when statistics were taken. The EXEC action with the CMD keyword indicates a command is executed from the automation table.
- Total routes executed for messages.

  The total number of routes executed by all automation table statements during the period when statistics were taken. The EXEC action with the ROUTE keyword (and without the CMD keyword) indicates a route is executed from the automation table.
- Average number of compares per message or MSU.

  The number of compares divided by the number of messages or MSUs that had passed through the automation table.
- Average number of messages or MSUs processed per minute.

  The number of messages or MSUs processed by the NetView automation table divided by the number of minutes since the last reset or load of the automation table.
- Number of minutes elapsed.

  The amount of time, in minutes, since the last AUTOCNT RESET command or since the current active automation table was activated.

Using Summary Reports

The following suggestions can help you use the information in the summary tables:

- The AVERAGE COMPARES/MSG field or AVERAGE COMPARES/MSU field is a good indicator of the efficiency of the automation table. Performance improvements to the automation table, such as increased use of BEGIN/END sections, usually result in a decrease in the AVERAGE COMPARES/MSG value. Monitor this value before and after making changes to the automation table to ensure that your changes do not have a negative effect on performance.
- The TOTAL MSGS/MINUTE field or TOTAL MSUS/MINUTE field is the TOTAL MSGS PROCESSED field divided by the MINUTES ELAPSED field. You can calculate other rates, such as total commands executed per minute or total routes per minute, by performing the arithmetic on the appropriate fields. Increased filtering by the operating system message processing facility should reduce the TOTAL MSGS/MINUTE rate.
- Consider setting an EVERY timer under an autotask to invoke the AUTOCNT command periodically. The AUTOCNT output can be used as important historical data in spotting trends in automation activity. Because summary reports are shorter than detail reports, you might create them more frequently, perhaps every hour, to monitor activity rates.
- The automation table statistics are set to zero when an automation table is loaded. Prior to loading a new table, you might want to issue the AUTOCNT command for the old table to collect its statistics.

Automating Hardware Monitor Records

You can automate problem notifications sent to the hardware monitor by generating messages and sending the messages to the automation table for processing. Many problem records sent to the hardware monitor are management service units (MSUs). You can generate messages from the MSUs or automate MSUs directly using the MSUSEG and HIER conditions in the NetView automation table. Direct automation is more efficient than automation of records converted to messages.

Refer to *IBM Tivoli NetView for z/OS Automation Guide* for more information about automating MSUs.

Filtering Hardware Monitor Records

Filtering unnecessary hardware monitor records prevents processing by the NetView program, VSAM, and your hardware monitor operators. The following filter types are available:

- The ESREC filter determines whether the record should be sent to the events and statistics database and whether the record is eligible for the remaining filters.
- The AREC filter determines whether the record should be sent to the alerts database, and thus be made available to operators viewing the hardware monitor alerts panels. The AREC filter also determines whether the record is eligible for the remaining two filters.
- The OPER filter determines whether BNJ146I and BNJ030I messages should be created from the alert for automation.
- The ROUTE filter determines whether the alert should be forwarded to the hardware monitor focal point.

You can set each of the filter types to BLOCK or PASS. A filter set to BLOCK prevents the filter or any filters dependent on it from taking effect. For example, an AREC filter set to BLOCK prevents the OPER and ROUTE filters from receiving the alert.

You can set the hardware monitor recording filters using the hardware monitor SRFILTER command. You can set filters for MSUs that undergo automation processing using the SRF automation table action. You can use the automation table to override settings made using SRFILTER. Both SRFILTER and the automation table can set color and other highlighting attributes.

Filtering unnecessary hardware monitor records from the events and statistics database and the alerts database can increase the productivity of operators and save substantial processing time. Use the following guidelines when setting filter options:

- Allow required events to pass the ESREC and AREC filters.
- Set the ROUTE filter to PASS only for alerts that must be passed to a focal point system.
- Set the OPER filter to PASS only for alerts that you want to automate by creating BNJ146I and BNJ030I messages.

For more information on hardware monitor filters, see "Hardware Monitor Filters" on page 41.

Automation Tasks (Autotasks)

An automation task (autotask) is an operator station task (OST) that is not associated with a terminal. Autotasks can be used to monitor status and to issue responses to system messages.

Do not use the following under an autotask:

- The &PAUSE statement for the NetView command list language.
- The PARSE PULL and PARSE EXTERNAL statements for REXX.
- The WAIT FOR OPINPUT statement for high-level languages.

These statements do not provide a timeout facility. If you pause in a command list executed under an autotask, use a facility that includes a GO command, because the GO command breaks the wait implied by the paused statement.

Using Multiple Autotasks

Using multiple autotasks has the following advantages:

- **Improved reliability**

  If you have only one autotask and it is logged off or disabled, this can affect the entire automation process. Having multiple autotasks minimizes the impact of an autotask failure.
- **Improved problem determination**

  For example, if VTAM fails, having an autotask specifically designed for VTAM processing makes it easy for an operator to determine the autotask recovery stage.
- **Improved audit trail**

  It is easier to determine what work has been done by an autotask (for example, by looking at the network log) when the work is divided among multiple tasks.

For an MVS environment, you can use multiple autotasks to distribute the automation workload across multiple processors, thus taking advantage of multitasking to improve throughput. Throughput for an automation workload can be constrained by contention for host processors or by contention for the command list data control block (DCB), which synchronizes input and output (I/O) to the command list data set.

For an automation workload in which the command lists have been preloaded using the LOADCL command, no I/O is necessary to the command list data set; therefore, processor capacity is the only constraint on automation throughput. When an *n*-way processor (where *n* is the number of processing engines) is used with such a workload, additional autotasks beyond the number *n* probably do not offer a significant throughput improvement.

This does not imply, however, that there is no value in using more than *n* autotasks in an *n*-way processor environment. For example, it can be useful to separate the automation of critical messages from the rest of the automation workload by assigning them to their own autotask.

Using Full-Screen Automation

Using full-screen automation, a REXX, PL/I, or C program can perform any NetView full-screen component tasks that a NetView operator could perform using the same component and a 3270 display. Full-screen automation is intended to be used as an automation tool. It is not intended to be used by NetView operators to create fast paths or to simplify commands.

Using full-screen automation, an application program is able to:

- Read data from a NetView application panel
- Write data to a NetView application panel
- Execute the PF, PA, Enter, and Clear function keys on a NetView application panel

Sample CNMS1098 is included with the NetView program. This sample provides an example for coding and using the full-screen automation function. CNMS1098 uses a BGNSESS command to logon to TSO from the NetView program and display data from the TSO log on the NetView users panel.

Full-screen automation uses a VOST (virtual OST) task. The VOST is like an OST, except that the session is a pipe to an owning task. Full-screen automation provides two commands (ATTACH and DETACH) to enable procedures to invoke, control, and end full-screen applications.

The ATTACH command is used to begin a VOST and assign (queue) work to it. The DETACH command causes a VOST started by an ATTACH to terminate.

Two commands show status of VOSTs currently active.

- LIST STATUS=VOST will show a line like the following:

```
TASKNAME: DSI#0001 OWNER: OPER2    ATTACHN: NLDM     STATUS: ACTIVE
```

- TASKUTIL will show tasks with TYPE=VOST if there are VOSTs active:

```
TASKNAME TYPE DPR    CPU-TIME N-CPU% S-CPU% MESSAGEQ STORAGE-K    CMD
-------- ---- --- ----------- ------ ------ -------- --------- --------
DSI#0001 VOST 250        0.01  42.29   0.10        0       120 NLDM
DSIMONIT OPT  255        2.78  16.45   0.04      N/A         4      N/A
AAUTSKLP DST  247        0.17  14.54   0.03        0      1552      N/A
```

```
CNM01PPT PPT  255        3.29  12.52   0.03        0       164 **NONE**
DSILOG   DST  254        0.15   4.31   0.01        0        19      N/A
OPER2    OST  251        1.73   3.87   0.01        0       287 **NONE**
```

Note:

1. DSI#xxxx is not an available choice; it is assigned by the NetView program when an ATTACH command is issued.
2. The example shows only one VOST active at this time. TASKUTIL shows all active tasks, including VOSTs. The TYPE column shows the type of each active task.

On average, full-screen automation uses more processor resources than manual execution of commands or procedures. All storage allocated during the ATTACH phase of full-screen automation is released during the DETACH step, except for the normal storage growth seen when an OST logs on. The OST storage growth is released when the task from which the ATTACH was issued is terminated. Because of the potential below-the-line storage growth if many VOSTs are active at once, careful consideration should be used when determining what to automate using full-screen automation. This is true in cases where full-screen automation is used with tasks that are not normally logged off.

Command and Message Forwarding

You can transmit commands and messages between a distributed system and a focal point by using the RMTCMD command. This command can communicate with remote systems by using either TCP/IP or LU 6.2.

Separation of the Automation Workload from Other NetView Workloads

In some environments, separating the automation workload from other NetView workloads can offer advantages in automation responsiveness and availability.

You can separate workloads by:

- Running multiple copies of the NetView program
- Using z/OS Work Load Manager (WLM) enclaves to separate system and network automation workloads within a single NetView address space

Multiple NetView Programs

You can use one copy for system automation and another copy for network automation and problem determination.

Although separating the automation workload from other NetView workloads can offer advantages, a disadvantage is that dividing the NetView workloads between different address spaces might not decrease the overall NetView host processor utilization and it might increase overall NetView storage use.

If you plan to use multiple copies of the NetView program, consider setting the dispatching priority of the NetView program that performs system automation above VTAM and the subsystems being automated. The NetView program performing network automation and problem determination should have a dispatcher priority below VTAM and critical applications.

Refer to *IBM Tivoli NetView for z/OS Automation Guide* for more information about running multiple copies of the NetView program.

Single NetView Program Using WLM Enclaves

To use the Work Load Manager (WLM) for separating system and network automation workloads within the NetView program, perform the following steps:

1. Either code or uncomment the WLM statement.

   Note: If the WLM statement is not coded or uncommented, the NetView program does not use the WLM services. A sample WLM statement is included in the CNMSTYLE member but is commented out.

   For more information, refer to *IBM Tivoli NetView for z/OS Installation: Configuring Additional Components*.

   Use the CNMSTUSR or C*xx*STGEN member to code the WLM statement. See the sample statement in the CNMSTYLE member. The name that you code for the SubSystemName keyword is the subsystem that WLM recognizes as the specific instance of the NetView program. . For information about changing CNMSTYLE statements, see *IBM Tivoli NetView for z/OS Installation: Getting Started*.

   Uncommenting the statement sets the WLM subsystem name to the NetView domain ID.

2. *Before* you start the NetView program, create a WLM service definition. The service definition consists of at least the following:
   - A service policy
   - A workload
   - A service class

     When separating the management of the network and system automation (SA) subtasks, the NetView program creates z/OS enclaves to manage those two sets of subtasks so that users can assign different performance goals to the enclaves. System automation subtasks include all those not connected with network management.

     These two types of NetView enclaves should be classified to service classes with velocity goals and relative importance assigned. The goals should have approximately the same velocity value, but the goal assigned to NetView system automation enclaves should be more important than the goal assigned to any NetView network enclaves. There is no need to define a separate service class for NetView, if existing service classes in your service definition satisfy these conditions.

     If SA/390 or other system automation is used, a *high* velocity goal and importance could be assigned. For non-system automation NetView subtasks, a *medium* velocity goal and importance could be assigned. For example, a goal of velocity = 50 and an importance of 1 could be assigned. For non-system automation NetView subtasks, a goal of velocity = 40 and an importance of 2 could be assigned to give appropriate weighting to the system automation NetView subtasks.

     For instructions on defining performance goals and service classes to z/OS, refer to the IBM publication *z/OS MVS Planning: Workload Management*.
   - Service classification rules

     NetView subtasks are classified into a service class based on one or more of the following work qualifiers:

     – Subsystem type

       NETV

     – Subsystem instance (SI)

The NetView WLM SubSystemName statement value

- NETID (NET)

  The NetView network ID

- Transaction class (TC)

  The NetView subtask type: AOST, DST, HCT, MNT, NNT, OPT, OST, or PPT

  Note: Virtual OSTs (VOSTs) execute in the same enclave as their owning OST.

- Transaction name (TN)

  The NetView subtask module name

- User ID (UI)

  The NetView subtask ID

- Logical unit name (LU)

  The NetView subtask LU name

- Priority (PRI)

  The NetView subtask priority

The WLM service definition must be installed on a WLM couple data set, and a WLM service policy using that WLM service definition must be activated.

After the NetView program is started, every NetView subtask is classified into a WLM service class (based on the customer coded WLM classification rules for the NETV subsystem type). The NetView program joins the subtask to a WLM enclave with the same service class.

If a WLM enclave for the service class does not exist, the NetView program tells WLM to create one. When the NetView subtask ends, the NetView program tells WLM to delete the enclave.

If no NetView subtask is joined to a particular enclave (created by the NetView program), the enclave is deleted.

Chapter 3. Tuning for AON

AON performance considerations are described in this chapter.

Tuning Techniques

Consider the following NetView techniques when tuning AON:

- Perform NetView tuning according to the applicable information for your release of the NetView product. You should pay particular attention to session monitor tuning and to VSAM tuning.
- In any online system, I/O to databases is of primary importance. Do not put the NetView logs, the session monitor databases, the AON automation log (if used) and the AON status file all on the same DASD, or on DASD that is highly utilized.
- Do not specify secondary extents for logs if you are using the AUTOFLIP keyword.

CNMCMD Resident Option

The resident option can potentially improve performance. For any module defined as RES=Y in the CNMCMD initialization member, ensure that you do not override this attribute in the CNMCMDU member. Additionally, do not override AON modules defined as RES=Y in the EZLCMENT sample.

You can make programs and REXX procedures resident with the NetView LOADCL command. This is done automatically at AON initialization if the programs and procedures are specified with the RESIDENT entry in the control file. A number of such entries are included in the EZLCFG01 and FKVCFG01 samples. This list can be added to, or can be reduced, if analysis of the MAPCL output shows infrequently used procedures.

Ensure other programs and procedures are resident as appropriate. Look in the NetView log at message CNM493I. This message indicates that a command procedure was issued out of the automation table. All such procedures should be resident for maximum performance. You can also use tracing to observe the flow of AON tasks.

Note: Tracing temporarily increases system usage. Consider making resident any procedures you see that are not already resident.

DSICLD Library

In addition to program residency, DSICLD library concatenation can also affect performance. Keep the number of libraries to a minimum, to reduce program search time. You might want to have two user program libraries, a small one concatenated ahead of CNMCLST and a larger one after CNMCLST. For maximum efficiency each library should reside on a different storage directory.

Automation Table

You can use the BEGIN/END feature to group all of your messages together in short sections. This cuts automation table processing time considerably. Change the order of the IF THEN statements in the automation table, so that the statements

are ordered by frequency, which places the most frequently processed message at the beginning. You can determine this by issuing the AUTOCNT command. For more information about the AUTOCNT command, see the *IBM Tivoli NetView for z/OS Command Reference Volume 1 (A-N)* or the NetView online help.

Code `early outs` in the automation table. That is, if you are aware of messages that are being passed to the NetView program and are not driving programs out of the automation table, code IF THEN statements to exit near the beginning of your table. For example, if you know that there are no message triggers for IEF messages (and these messages are not being stopped by MPF list with AUTO=N), you can code the following statement at the beginning of your automation table:

```
IF TEXT(1)='IEF'. THEN DISPLAY(N)
```

Ordinarily, messages such as these require an entry in the MPF list specifying AUTO=N, so that the NetView product does not have to process the messages at all. If you are using another NetView program for console automation, these messages must come over the subsystem interface (SSI). In these cases, `early outs` are necessary in the AON automation table.

To further tune message processing, follow all of the preceding suggestions and then at the end of your automation table, code an entry that traps on all other messages (IF MSGID=.) and runs a program that writes that message to a file. Then, do whatever possible to omit them from processing.

DDF Tree and Panel

Ensure that EZLPNLS contains all DDF panels that you want to access. This slows down DDF initialization just a bit, but speeds up operator access and DDF update later.

Use the dynamic updating of resources by type (as included with AON) as much as possible. Avoid hard coding resources onto panels and avoid having them as unique entries in EZLTREE. Keep EZLTREE as small as possible.

Node Automation

AON does not know when a resource goes away suddenly, or if the outage was intentional, unless an operator has specified it as inactive. For example, You might have specified a switched PU on a token ring or an X.25 line is to be dropped after business hours. If your network has many such devices, use RECOVERY control file entries with the NOAUTO parameter to forestall pointless recovery attempts during off hours. You can code these statements generically with wildcard names, if you have a naming convention, to decrease the number of statements required.

Operations

If you must recycle the AON NetView program during peak times of the day, do not code DDFREFRESH=Y on the ENVIRON SETUP control file entry. This means that DDF does not know about resources that are already down, but it is updated when they are running again. You can add them later by a restricted NETSTAT call, or manually with DDFADD.

NETSTAT uses considerable cycles if TYPE=PHYSICAL is required. To manually add an AON resource to DDF, you need to know the status you want it to show, which is determined by priority. The priority value is found on the DDF entry in the control file (PR=*nnn*). For example, the priority for inactive is 150 (DDF INA*,PR=150,CLEAR=Y). When you add the resource to DDF with an inactive

status, you want to do so in such a way that DDF deletes it automatically when the resource comes active. This requires that you specify on the DDFADD the same basic information that AON does. Specify the information in the following format:

```
DDFADD sysname.resource_name(resource_type),
RV=resource_name,IN=/resource_name/,DA='some text',
PR=nnn
```

The DA field must contain some message text but it need not be the same text AON uses.

Use DBMAINT sparingly online. It is important to clean up and reorganize your databases to maximize performance, but DBMAINT uses a lot of cycles and should not be used during peak periods. Set a timer to run it during off hours.

Keep the number of operators who are notification operators to a minimum to save CPU cycles. Many operators often prefer DDF to the messages.

TCP/IP Support for AON

To reduce monitoring overhead, avoid monitoring noncritical resources. Define low monitor intervals only for the highly critical resources and define greater monitor intervals for resources which might be less critical.

Monitor the TASKUTIL message queues and DISPPI buffer queues and increase the number of TSO servers and AUTTCP tasks and AUTMSG tasks as required to reduce the backlog of queues.

Chapter 4. Tuning for Command Procedures

A command list is a list of commands and statements designed to perform a specific function for the user. For the NetView program, command lists can be written using the NetView command list language or REXX. In the NetView program, a command processor is a module written in a high-level language (HLL) or assembler language and is invoked as a command. A command procedure is either a command list or a command processor written in PL/I or C.

For more information on command lists and command processors, see the following publications:

- *IBM Tivoli NetView for z/OS Customization Guide*
- *IBM Tivoli NetView for z/OS Programming: Assembler*
- *IBM Tivoli NetView for z/OS Programming: PL/I and C*
- *IBM Tivoli NetView for z/OS Programming: REXX and the NetView Command List Language*

Tuning Techniques

Following are the major tuning techniques for command procedures, arranged in order of expected improvement on performance; the most important tuning considerations are listed first. These are described in detail in this chapter.

1. Preload frequently used command lists using the LOADCL command. Consider invoking a command list to issue LOADCL, loading the most frequently used command lists last. See "Command Lists" on page 26.
2. For systems using PL/I command processors, define preinitialized environments for your frequently run PL/I programs. You can use the HLLENV LIST STATS command to help you decide how many preinitialized environments you need. See "Running High-level Language Programs in a Preinitialized Environment" on page 36.
3. For systems using PL/I or C command processors, minimize or eliminate the I/O needed to find and read the runtime routines during command processor execution. See "Command Processors" on page 35.
4. Preload frequently used command processors by not specifying RES=N on their CMDDEF statements in the CNMCMDU initialization member. See "Command Processors" on page 35.
5. Consider using the REXX/370 compiler to compile REXX command lists. Compiled REXX command lists are more efficient than interpreted REXX command lists. See "Compiled REXX/370 Command Lists" on page 29.
6. Avoid using nested command lists for subroutines where possible. See "Subroutines" on page 28.
7. For systems using REXX command lists, group frequently used external functions and subroutines in REXX function packages. You can also modify the sample file CNMSJM11 to minimize the search time for NetView system functions. See "REXX Function Packages" on page 30.
8. Use task global variables instead of common global variables where possible. The processing demands of task global variables are smaller than the processing demands of common global variables. See "Global Variables" on page 38.

9. If you expect to use more than 200 task or common global variables, specify the expected number of variables in the NetView constants module DSICTMOD. You can use the QRYGLOBL command to display the expected number of variables coded in DSICTMOD, as well as the actual number of variables found. See “Global Variables” on page 38.
10. Consider using or adapting the AUTODROP command list (CNMS8003) to manage preloaded command lists. See “Managing Command Lists with AUTODROP” on page 27.

Command Lists

Command lists that are written using the NetView command list language or REXX are interpreted. That is, statements in the command list are translated and executed one at a time.

Before being interpreted, the entire command list is read into storage (unless you used LOADCL). However, trailing blanks are removed from command lists to save storage. Each time a command list is invoked, it is read from the command list data set (DSICLD). When users modify command lists, changes are put into effect immediately. Nested command lists are read into storage as they are invoked.

Preloading Command Lists

You can preload frequently used command lists into storage with the LOADCL command. Preloading command lists saves time. When a preloaded command list is invoked, it executes immediately. There is no I/O delay. Preloaded command lists are placed above the 16 MB line in MVS. If command lists are preloaded, every operator uses the same copy. If command lists are not preloaded, multiple copies of the same command list can be loaded when invoked by different operators. This can cause storage problems depending on the size of the command list and the frequency of invocations.

The DROPCL command removes a command list that was previously loaded into storage by the LOADCL command. The MAPCL command displays the command lists that have been preloaded, the date and time each was loaded into storage, and the number of invocations for each command list since it was loaded.

If you plan to preload several command lists using the LOADCL command, consider writing a command list to issue the LOADCL command invocations. Order the LOADCL command invocations so that the most frequently used command lists are loaded last.

You can use the detail report produced by the AUTOCNT command to select command lists for preloading. Look for automation table statements with a high match count that execute commands. Preload command lists that are executed by these statements.

You can also use the PIPE stage INSTORE to add, delete, or replace frequently used command lists into a pool of storage. The in-storage members are read from storage instead of disk by DSIDKS disk services or any NetView process based on DSIDKS, such as BROWSE or the < stage.

Using the STRIP stage with PIPE INSTORE enables you to strip trailing blanks before loading, thus reducing storage demand. When the CRYPTO parameter is used with PIPE INSTORE, the member is encrypted when it is loaded into memory. This should be used only when the security of the member is important,

because additional processing is required to encrypt the data when this stage is executed and decrypt the data each time the member is read.

The INSTORE stage is used by the REXX CLIST CNME1054 (MEMSTORE) to automatically load frequently used members. MEMSTORE will use the LIST MEMSTAT command to monitor members with elevated disk usage, load these members into memory, or unload members that have relatively low usage from memory.

Using the two parameters for MEMSTORE allows you to control the amount of storage allocated to in-storage members, which resides above the 16 MB line in MVS, and the monitoring interval used to obtain member usage information.

The amount of processing for MEMSTORE is directly related to the monitoring interval. LOADCL might run a CLIST slightly faster, but storage usage can be optimized better with MEMSTORE. Also, MEMSTORE monitors and adjusts CLIST loading based upon usage without user intervention.

Note that the NetView program authority checks all REXX procedures and command lists before any are loaded. If REXX procedures or command lists do not show as being loaded (using the MAPCL command), users must verify that the operator attempting to load them has the proper authority. See the *IBM Tivoli NetView for z/OS Security Reference* for more information.

Managing Command Lists with AUTODROP

A sample command list, AUTODROP (CNMS8003), provided by the NetView program can help you manage the number of command lists that have been preloaded into storage using the LOADCL command. AUTODROP uses the MAPCL and DROPCL commands to conditionally drop command lists from storage.

AUTODROP uses the following parameters:

Uses Specifies the minimum number of times the command list must be used to remain in storage. The default is 0.

Days Specifies the minimum number of days the command list must be loaded to be dropped from storage. The default is 0.

Hours Specifies the minimum number of hours the command list must be loaded to be dropped from storage. The default is 1.

Example: Using the AUTODROP command

The AUTODROP command drops any preloaded command lists with a use count of five or less that has been loaded for three hours or more, as shown in the following example:

```
AUTODROP 5 0 3
```

A command is not dropped from storage unless both the minimum time specified by the days and hours parameters has elapsed and the command list has been invoked the minimum number of times necessary (or less) since the command list was loaded.

Determining Command Lists to Drop

You can use the AUTODROP command list to manage commands preloaded with LOADCL. Use the following steps to determine the subset of the most frequently used command lists:

1. Preload a large subset of your command lists and then issue AUTODROP from a timer to remove infrequently used command lists.
2. Drop and reload the command lists that are to stay resident to reset their load times and use counts.

   Note: Reload the command lists in ascending order of frequency, with the most heavily used ones last.
3. Preload another large subset and repeat the procedure until all command lists have been processed.

If the storage requirement for the most frequently used command lists is too high, consider making the AUTODROP criteria more stringent, with a higher use count or a shorter time interval.

Subroutines

Instead of using nested command lists for subroutines, consider calling the subroutine, as shown in the following examples:

- for the NetView command list language:

```
&RETURN = -RI
&GOTO -SUB1
-RI
⋮
&EXIT
-SUB1
⋮
&GOTO &RETURN
```

- for REXX:

```
CALL SUB1
⋮
EXIT
SUB1: PROCEDURE
⋮
RETURN
```

If you use nested REXX command lists, do not use the CALL statement to invoke them. Instead, place the command list name in single quotation marks. The CALL statement causes the system libraries to be searched before the NetView command list library. When the command list name is in single quotation marks, the command list name is passed to the NetView program, and only the NetView library is searched.

REXX Command Lists

Most command lists written in REXX perform more efficiently than command lists written in the NetView command list language. This is true for command lists that perform mathematical functions or string manipulation. However, processing global variables in REXX command lists can require more processing time than NetView command list language command lists. Note the following considerations:

- When global variables are identified in NetView command lists by &TGLOBAL and &CGLOBAL statements, all subsequent assignments to the variables cause updates to the global variables. In REXX, the programmer has explicit control over access to global variables using the NetView GLOBALV command.
- When the NetView program processes a GLOBALV command issued from within a REXX command list, it accesses both the global variable and the REXX local variable corresponding to the global variable. Accessing the REXX local

variable during NetView GLOBALV command processing requires processing time not needed for NetView command lists.

- You can minimize the use of the GLOBALV command in REXX to optimize the NetView global variable processing. With REXX command lists, the REXX local variable corresponding to the global variable can be manipulated many times without updating the global variable.

REXX local variables are accessed while processing other NetView commands, such as GETMTYPE, GETMSIZE, and PARSEL2R. These commands pass information back to the REXX command list by updating the REXX local variables. These NetView commands require more processing time when invoked from REXX command lists than when invoked from NetView command lists.

How to Compile REXX Procedures

You can compile AON REXX programs for improved performance. The REXX programs in the RESIDENT entries of the AON control file are good choices for compiling.

Note: Module level tracing is not available for compiled REXX programs, although entry and exit tracing is available. You might need to reinstate the interpreted versions of the REXX programs to obtain traces for problem diagnosis.

For more information about using the REXX compiler, refer to the *IBM REXX/370 Compiler and Library User's Guide and Reference*.

Compiled REXX/370 Command Lists

You can use the REXX/370 compiler to compile REXX command lists written for execution on the NetView program. Compiled REXX command lists are more efficient than interpreted REXX command lists. When compiling REXX command lists, specify the compiled EXEC (CEXEC) output format. You can do the compilation on a separate MVS system with the REXX/370 compiler installed.

Storage Considerations

The size of a compiled REXX command list often exceeds the size of the source command list. The CONDENSE compiler option enables you to significantly reduce the size of the CEXEC type output. Use the CONDENSE compiler option to:

- Reduce the amount of disk space required by compiled REXX command lists.
- Reduce the amount of virtual storage required by compiled REXX command lists preloaded with the LOADCL command.
- Reduce the amount of I/O activity required to load compiled REXX command lists.

When a condensed compiled REXX command list is invoked, the command list is automatically uncondensed. A condensed compiled REXX command list requires more storage while it is running, for the following reasons:

- During the uncondense operation, an additional 128 KB of storage is required.
- While a condensed compiled REXX command list is running, both the condensed and uncondensed copy exist in storage.

Additional CPU time is required to uncondense the compiled REXX command list. Otherwise, the performance characteristics of a condensed compiled command list are the same as those of an uncondensed compiled command list.

Performance Considerations

The performance improvements that you can expect when you run a compiled REXX command list depend on the type of command list. A program that performs many arithmetic operations shows the greatest improvement. A program that mainly issues commands (such as NetView, VTAM, or MVS commands) shows limited improvement, because the compiler cannot decrease the time taken in processing the commands.

REXX Function Packages

REXX function packages are groups of external functions and subroutines that are packaged together. When the REXX language processor processes a function call or a call to a subroutine, the language processor searches the function packages before searching load libraries. Grouping frequently used external functions and subroutines in a function package allows faster access to the functions and subroutines, resulting in better performance.

Both the NetView program and REXX interpreter can have user, local, and system function packages. The functions for REXX that are supplied with the NetView product are in the NetView system function package. When a function is called, the function package search order is:

1. NetView user
2. REXX interpreter user
3. NetView local
4. REXX interpreter local
5. NetView system
6. REXX interpreter system

You can improve the performance of NetView system functions by making the NetView system function package higher in the search order so that it can be found sooner. Take the following steps to modify the function package section of the NetView sample file CNMSJM11. The labels in the following steps refer to the examples in Figure 4 on page 31, Figure 5 on page 32, and Figure 6 on page 33.

1. Move `PACKTB_NAME` from the bottom of the list to either replace or follow `PACKTB_USER_NAME` (Figure 4 on page 31 shows the initial order), depending on if you have defined your own user function package.
2. Adjust the NetView function package table header counters.
   - If you replace `PACKTB_USER_NAME` with `PACKTB_NAME`, change `PACKTB_SYSTEM_TOTAL` and `PACKTB_SYSTEM_USED` from "1" to "0" (see Figure 5 on page 32).
   - If you have `PACKTB_NAME` following `PACKTB_USER_NAME`, change `PACKTB_USER_TOTAL` and `PACKTB_USER_USED` from "1" to "2", and `PACKTB_SYSTEM_TOTAL` and `PACKTB_SYSTEM_USED` from "1" to "0" (see Figure 6 on page 33).
3. Assemble and link edit the sample file.

The following figures illustrate how you can change the search order of function packages. The first figure represents the sample file as it is included with the NetView program. The second and third figures show how to modify the file if you did not define a user function package, or if you did define a user function package, respectively.

```
*/*****************************************************************/
*/*                                                               */
*/* PACKTB_HEADER - Tivoli NetView REXX Function Package Table Header*/
*/*                                                               */
*/*****************************************************************/
         SPACE 3
*************************************************************************
* NOTE: Do NOT change any of the following address constant fields.
*       The total number and number of used PACKTB entries may be
*       changed as needed.
*************************************************************************
          SPACE
PACKTB_HEADER DS 0C                    REXX Function Package Table HDR
PACKTB_USER_FIRST DC A(PACKTB_USER_ENTRY) Address of first USER
*                                          PACKTB entry
PACKTB_USER_TOTAL DC F'1'              Total number of USER PACKTB
*                                        entries
PACKTB_USER_USED  DC F'1'              Number of used USER PACKTB
*                                        entries
PACKTB_LOCAL_FIRST DC A(PACKTB_LOCAL_ENTRY) Address of first LOCAL
*                                           PACKTB entry
PACKTB_LOCAL_TOTAL DC F'1'             Total number of LOCAL PACKTB
*                                        entries
PACKTB_LOCAL_USED  DC F'1'             Number of used LOCAL PACKTB
*                                        entries
PACKTB_SYSTEM_FIRST DC A(PACKTB_SYSTEM) Address of first SYSTEM
*                                         PACKTB entry
PACKTB_SYSTEM_TOTAL DC F'1'            Total number of SYSTEM PACKTB
*                                        entries
PACKTB_SYSTEM_USED  DC F'1'            Number of used SYSTEM PACKTB
*                                        entries
PACKTB_LENGTH       DC F'8'            Length of each PACKTB entry
PACKTB_FFFF         DC XL8'FFFFFFFFFFFFFFFF' End marker
         SPACE 3
*/*****************************************************************/
*/*                                                               */
*/* PACKTB_ENTRY - Tivoli NetView REXX Function Package Table Entries*/
*/*                                                               */
*/*****************************************************************/
         SPACE 2
*************************************************************************
* NOTE: Do NOT change the NetView SYSTEM Function Package name. The
*       LOCAL and USER Function Package names may be changed and
*       additional SYSTEM Function Package Table entries may be made.
*************************************************************************
          SPACE
PACKTB_USER_ENTRY  DS 0C               REXX USER Function Package Table
*                                        Entry
PACKTB_USER_NAME     DC CL8'DSIRXUFP'  Name of USER Function Package
PACKTB_LOCAL_ENTRY DS 0C               REXX LOCAL Function Package
*                                        Table Entry
PACKTB_LOCAL_NAME    DC CL8'DSIRXLFP'  Name of LOCAL Function Package
PACKTB_SYSTEM      DS 0C               REXX SYSTEM Function Package
*                                        Table Entry
PACKTB_NAME          DC CL8'DSIRXFPG'  Name of SYSTEM Function Package
         SPACE 3
         END DSIRXPRM                  End of DSIRXPRM module
```

Figure 4. CNMSJM11 before Modification to Switch Function Package Search Order

```
*/*****************************************************************/
*/*                                                               */
*/* PACKTB_HEADER - Tivoli NetView REXX Function Package Table Header*/
*/*                                                               */
*/*****************************************************************/
         SPACE 3
*************************************************************************
* NOTE: Do NOT change any of the following address constant fields.
*       The total number and number of used PACKTB entries may be
*       changed as needed.
*************************************************************************
          SPACE
PACKTB_HEADER DS 0C                   REXX Function Package Table HDR
PACKTB_USER_FIRST DC A(PACKTB_USER_ENTRY) Address of first USER
*                                        PACKTB entry
PACKTB_USER_TOTAL DC F'1'             Total number of USER PACKTB
*                                       entries
PACKTB_USER_USED  DC F'1'             Number of used USER PACKTB
*                                       entries
PACKTB_LOCAL_FIRST DC A(PACKTB_LOCAL_ENTRY) Address of first LOCAL
*                                          PACKTB entry
PACKTB_LOCAL_TOTAL DC F'1'            Total number of LOCAL PACKTB
*                                       entries
PACKTB_LOCAL_USED  DC F'1'            Number of used LOCAL PACKTB
*                                       entries
PACKTB_SYSTEM_FIRST DC A(PACKTB_SYSTEM) Address of first SYSTEM
*                                       PACKTB entry
PACKTB_SYSTEM_TOTAL DC F'0'           Total number of SYSTEM PACKTB
*                                       entries
PACKTB_SYSTEM_USED  DC F'0'           Number of used SYSTEM PACKTB
*                                       entries
PACKTB_LENGTH       DC F'8'           Length of each PACKTB entry
PACKTB_FFFF         DC XL8'FFFFFFFFFFFFFFFF' End marker
         SPACE 3
*/*****************************************************************/
*/*                                                               */
*/* PACKTB_ENTRY - Tivoli NetView REXX Function Package Table Entries*/
*/*                                                               */
*/*****************************************************************/
         SPACE 2
*************************************************************************
* NOTE: Do NOT change the NetView SYSTEM Function Package name. The
*       LOCAL and USER Function Package names may be changed and
*       additional SYSTEM Function Package Table entries may be made.
*************************************************************************
          SPACE
PACKTB_USER_ENTRY  DS 0C              REXX USER Function Package Table
*                                       Entry
PACKTB_NAME          DC CL8'DSIRXFPG'  Name of SYSTEM Function Package
PACKTB_LOCAL_ENTRY DS 0C              REXX LOCAL Function Package
*                                       Table Entry
PACKTB_LOCAL_NAME    DC CL8'DSIRXLFP'  Name of LOCAL Function Package
PACKTB_SYSTEM      DS 0C              REXX SYSTEM Function Package
*                                       Table Entry
         SPACE 3
         END DSIRXPRM                 End of DSIRXPRM module
```

Figure 5. CNMSJM11 After Modification with No User Function Package Defined

```
*/*****************************************************************/
*/*                                                               */
*/* PACKTB_HEADER - Tivoli NetView REXX Function Package Table Header*/
*/*                                                               */
*/*****************************************************************/
         SPACE 3
*************************************************************************
* NOTE: Do NOT change any of the following address constant fields.
*       The total number and number of used PACKTB entries may be
*       changed as needed.
*************************************************************************
          SPACE
PACKTB_HEADER DS 0C                    REXX Function Package Table HDR
PACKTB_USER_FIRST DC A(PACKTB_USER_ENTRY) Address of first USER
*                                          PACKTB entry
PACKTB_USER_TOTAL DC F'2'              Total number of USER PACKTB
*                                        entries
PACKTB_USER_USED  DC F'2'              Number of used USER PACKTB
*                                        entries
PACKTB_LOCAL_FIRST DC A(PACKTB_LOCAL_ENTRY) Address of first LOCAL
*                                            PACKTB entry
PACKTB_LOCAL_TOTAL DC F'1'             Total number of LOCAL PACKTB
*                                        entries
PACKTB_LOCAL_USED  DC F'1'             Number of used LOCAL PACKTB
*                                        entries
PACKTB_SYSTEM_FIRST DC A(PACKTB_SYSTEM) Address of first SYSTEM
*                                        PACKTB entry
PACKTB_SYSTEM_TOTAL DC F'0'            Total number of SYSTEM PACKTB
*                                        entries
PACKTB_SYSTEM_USED  DC F'0'            Number of used SYSTEM PACKTB
*                                        entries
PACKTB_LENGTH       DC F'8'            Length of each PACKTB entry
PACKTB_FFFF         DC XL8'FFFFFFFFFFFFFFFF' End marker
         SPACE 3
*/*****************************************************************/
*/*                                                               */
*/* PACKTB_ENTRY - Tivoli NetView REXX Function Package Table Entries*/
*/*                                                               */
*/*****************************************************************/
         SPACE 2
*************************************************************************
* NOTE: Do NOT change the NetView SYSTEM Function Package name. The
*       LOCAL and USER Function Package names may be changed and
*       additional SYSTEM Function Package Table entries may be made.
*************************************************************************
          SPACE
PACKTB_USER_ENTRY  DS 0C               REXX USER Function Package Table
*                                        Entry
PACKTB_USER_NAME     DC CL8'DSIRXUFP'  Name of USER Function Package
PACKTB_NAME          DC CL8'DSIRXFPG'  Name of SYSTEM Function Package
PACKTB_LOCAL_ENTRY DS 0C               REXX LOCAL Function Package
*                                        Table Entry
PACKTB_LOCAL_NAME    DC CL8'DSIRXLFP'  Name of LOCAL Function Package
PACKTB_SYSTEM      DS 0C               REXX SYSTEM Function Package
*                                        Table Entry
         SPACE 3
         END DSIRXPRM                  End of DSIRXPRM module
```

Figure 6. CNMSJM11 After Modification with a User Function Package Defined

Refer to *IBM Tivoli NetView for z/OS Programming: Assembler* for information about adding functions to the NetView function packages.

Tuning REXX Environments

Before the REXX language processor can process a REXX command list, a REXX ***language processor environment*** must exist. A REXX language processor environment is the environment in which the REXX language processor interprets or processes the command list. This environment defines characteristics relating to how the command list is processed and how the language processor accesses system services.

When a REXX command list is executed in the NetView program, the REXX interpreter sets up a language processor environment for the NetView program. When the command list ends, this unique environment can be held for reuse by the same task. The NetView program retains these REXX environments to improve REXX environment initialization performance.

Three operands of the DEFAULTS and OVERRIDE commands affect how REXX environments are handled:

- REXXENV is the maximum number of REXX environments retained for a task. If you set this number to zero, the NetView program does not save any REXX environment. This adversely affects the performance of all NetView REXX command lists.
- REXXSTOR is the amount of storage allocated when a REXX environment is initialized. The default amount is determined by the REXX interpreter, and is sufficient for REXX command lists with up to six levels of nested invocations. If you set this number to zero, storage is acquired as needed, but performance is degraded for the first command list using a given REXX environment.
- REXXSLMT is the maximum amount of storage that a REXX environment is allowed to accumulate before being ended, after its current use is completed. Storage associated with a REXX environment can increase, depending on the needs of the REXX command lists that have been interpreted under the environment. Because each REXX command list can have different storage needs, REXX environments can grow to meet the storage needs of the most demanding REXX command list. If the storage for an environment grows to exceed the amount of storage specified by REXXSLMT, the environment is freed when the REXX command list finishes executing.

Note: The values for REXXENV, REXXSLMT, and REXXSTOR do not apply to Data REXX environments.

REXXSTOR is the lower limit of storage in each environment. REXXSLMT is an upper threshold to prevent environments that grow very large from being allocated and not freed until the owning task terminates.

The following are tuning considerations for the REXXENV, REXXSTOR and REXXSLMT operands of the DEFAULTS and OVERRIDE commands:

- For most situations, a small REXXENV value (1 or 2) is sufficient, because most operators will have only one or two REXX command lists active at once.
- Consider setting REXXSTOR to zero, because it affects only the first REXX command list interpreted under a REXX environment. A value of zero minimizes the potential for storage waste.
- Set a value for REXXSLMT so that REXX environment storage does not grow indefinitely.
- If you want to minimize storage at the expense of extra processing time, set both REXXENV and REXXSTOR to zero. With these settings, storage for REXX environments is allocated only when needed, and is freed as soon as possible.

- Use the TASKUTIL command to monitor the amount of queued storage allocated for different tasks. REXX environments are allocated as queued storage under operator station tasks (OSTs) or autotasks. The environments are part of the storage total for the task shown in output from the TASKUTIL command. If you notice a significant storage growth for a task that is executing many REXX command lists, consider adjusting the values for REXXENV, REXXSTOR, and REXXSLMT.

Note:

1. An entry (2 slots) in the REXX anchor table, IRXANCHR, is required for each non-nested REXX command list to run.
2. If a REXX command list is called from another REXX command list, a new environment is not required. The nested command list uses the environment of the primary command list.

If you want information about...	Refer to...
The DEFAULTS and OVERRIDE commands	*IBM Tivoli NetView for z/OS Command Reference Volume 1 (A-N)*
Nesting REXX command lists from the assembler, PL/I, or C languages	*IBM Tivoli NetView for z/OS Programming: REXX and the NetView Command List Language*
Estimating and setting the number of REXX environments	*IBM Tivoli NetView for z/OS Installation: Configuring Additional Components*

Command Processors

Each command processor must have a CMDDEF statement in the CNMCMD initialization member. Do not specify RES=N on the CMDDEF statements for frequently used command processors. If you do not specify RES=N, the modules are made resident, eliminating the I/O needed to load them every time they are called.

You can use the AUTOCNT command to identify command procedures that are executed frequently from the automation table. See "AUTOCNT Command" on page 9 for more information.

If you are using the generic automation receiver (NVAUTO), modify the CMDDEF statement for DSINVGRP to make the command processor resident.

Command Processors Written in a High-Level Language

Command processors that are written in an HLL are compiled rather than interpreted. In terms of performance, compiled command procedures are usually processed much faster than interpreted command procedures. If you are using PL/I programs, consider running them in a preinitialized environment. See "Running High-level Language Programs in a Preinitialized Environment" on page 36 for more information.

You can improve initialization overhead for command processors that do not use preinitialized environments by avoiding I/O in searching for and fetching the HLL runtime libraries. Consider the following:

- If your NetView startup job control language (JCL) has a STEPLIB DD statement, eliminate it as discussed in "STEPLIB DD Statements" on page 124. This

eliminates the I/O needed to search the STEPLIB for each LOAD, LINK, or XCTL system macro executed. If a STEPLIB DD statement exists, I/O is required to search for the HLL runtime libraries.

- If you use command processors written in PL/I or C, you can preload the PL/I and C runtime libraries by coding the following CMDDEF statements in CNMCMDU:

```
CMDDEF.IBMBLIIA.MOD=IBMBLIIA
CMDDEF.IBMBLIIA.TYPE=R
CMDDEF.IBMBLIIA.RES=Y

CMDDEF.EDCXV.MOD=EDCXV
CMDDEF.EDCXV.TYPE=R
CMDDEF.EDCXV.RES=Y

CMDDEF.EDCX24.MOD=EDCX24
CMDDEF.EDCX24.TYPE=R
CMDDEF.EDCX24.RES=Y
```

  Preloading the HLL runtime libraries eliminates I/O for the directory search and the fetch for runtime libraries.

See the appropriate MVS publication for more information about improving production library performance.

Set the STACK and HEAP sizes carefully for your HLL command processors. For best performance, the initial stack allocation should be large enough to satisfy all requests for stack storage. Likewise, the initial heap segment should be large enough to satisfy all requests for heap storage. Use the facilities provided by the HLL for tuning the STACK and HEAP sizes.

Running High-level Language Programs in a Preinitialized Environment

Before a command processor written in a high-level language (HLL) can be executed, a runtime environment (or execution environment) must exist. A runtime environment is a set of resources that are used to support the execution of a program. Preinitialization allows the runtime environment to be initialized once and used for multiple program executions. Without preinitialization, the runtime environment is created and terminated for each program execution.

You can use the HLLENV command to define the number of preinitialized environments that are allocated by the NetView program. The HLLENV command enables you to specify two pools of preinitialized environments using the REGENVS and CRITENVS keywords.

- Regular environments (REGENVS) are allocated when the HLLENV command is issued, and are available to any PL/I or C command processor that is capable of using preinitialized environments.
  - If you want a PL/I command processor to use a preinitialized environment, link the command processor with the DSIEXAPP interface module instead of the DSIEXANP interface module.
  - If you want a C command processor to use a preinitialized environment, link the command processor with the DSIEXAPC interface module instead of the DSIEXANC interface module.
- Critical environments (CRITENVS) are available only to PL/I and C command processors capable of using preinitialized environments that also have bit 4 in the HLLOPTS variable set to 1. Critical environments are not allocated when the HLLENV command is issued, but are allocated as needed.

Allocation of environments from the two pools works as follows:

- For command processors that are capable of using preinitialized environments but that do not have bit 4 set in HLLOPTS:
  - If an environment is available from the regular pool, it is used.
  - Otherwise, a new environment is created for this command processor, and the environment is terminated when the command processor completes execution.
- For command processors that are capable of using preinitialized environments and that have bit 4 set in HLLOPTS (critical command processors):
  - If an environment is available from the regular pool, it is used.
  - If an environment is not available from the regular pool but is available from the critical pool, it is used.
  - Otherwise, a new environment is created for this command processor, and the environment is terminated when the command processor completes execution. If the number of environments in the critical pool is less than the CRITENVS value specified with the HLLENV command, a new environment is created and added to the critical pool. This makes it more likely that a preinitialized environment will be available the next time a critical command processor is executed.

Preinitialized language environment support in the Tivoli NetView for z/OS program can help improve the performance of NetView high-level language (HLL) programs. Users can request language environment initializations from IBM z/OS Language Environment® through the Tivoli NetView for z/OS program, keep these language environments, and then assign these environments to NetView HLL programs when needed. The initialization of a language environment occurs only once, rather than every time an HLL program is called.

Two preinitialized language environment characteristics that you can control are the size of the primary stack frame extent (stack extent), which houses program saveareas and autodata, and the size of the primary heap extent (HLL program-obtained storage). These controls are provided by the PSTACK and PHEAP keywords of the HLLENV command. The default value for these keywords is 4K (4096) bytes. You can modify these values for performance considerations. The maximum value for either PSTACK or PHEAP is 128K bytes.

Note: The default 4KB byte values are somewhat small for many NetView HLL programs. When a stack frame extent or heap extent fills, Language Environment creates another extent, which is freed when it is no longer used. This spends processor cycles on something other than the HLL program, reducing the benefit gained by preinitializing the language environment.

The secondary stack and heap extent sizes each have a hard coded value of 4K bytes.

For more information about preinitialized environments and the HLLENV command, see *IBM Tivoli NetView for z/OS Programming: PL/I and C*.

Suggestions for Using Preinitialized Environments

- Review your PL/I and C command processors and decide which ones are good candidates for using preinitialized environments. Good candidates include installation exits and frequently used command processors, such as those issued from the NetView automation table. Some restrictions apply to command

processors using preinitialized environments. Refer to the *IBM Tivoli NetView for z/OS Programming: PL/I and C* for more details.

- Modify the CNMSTUSR or C*xx*STGEN member to issue the HLLENV command to set up the environment pools.
- Use the HLLENV LIST STATS command to monitor usage of the regular and critical environment pools. Figure 7 contains sample output for the preinitialized PL/I environment and Figure 8 contains sample output for the preinitialized C environment.

```
BNH040I IBMADPLI PREINITIALIZED ENVIRONMENT STATISTICS
BNH041I STATISTICS RESET AT:  03/30/13 16:44:04
BNH042I PSTACK: 131072  PHEAP: 131072  DEFAULT: NOTPREINIT
BNH043I NUMBER REQUESTED.  REGENVS: 4 CRITENVS: 2
BNH044I ALLOCATED.         REGENVS: 4 CRITENVS: 1
BNH045I IN USE.            REGENVS: 4 CRITENVS: 1
BNH046I MOST NEEDED.       REGENVS: 4 CRITENVS: 1
BNH047I TIMES USED.        REGENVS: 4 CRITENVS: 1
BNH048I TIMES UNAVAILABLE. REGENVS: 0 CRITENVS: 1
BNH049I AVERAGE NEEDED.    REGENVS: 2.50 CRITENVS: 1.00
```

Figure 7. Sample Output of the HLLENV, TYPE=IBMADPLI,LIST,STATS,RESET Command

```
BNH040I IBMADC PREINITIALIZED ENVIRONMENT STATISTICS
BNH041I STATISTICS RESET AT:  03/30/13 16:44:04
BNH042I PSTACK: 131072  PHEAP: 131072  DEFAULT: NOTPREINIT
BNH043I NUMBER REQUESTED.  REGENVS: 4 CRITENVS: 2
BNH044I ALLOCATED.         REGENVS: 4 CRITENVS: 1
BNH045I IN USE.            REGENVS: 4 CRITENVS: 1
BNH046I MOST NEEDED.       REGENVS: 4 CRITENVS: 1
BNH047I TIMES USED.        REGENVS: 4 CRITENVS: 1
BNH048I TIMES UNAVAILABLE. REGENVS: 0 CRITENVS: 1
BNH049I AVERAGE NEEDED.    REGENVS: 2.50 CRITENVS: 1.00
```

Figure 8. Sample Output of the HLLENV LIST STATUS TYPE=IBMADC

The goal of tuning the regular and critical pool allocations is to minimize the number of times that preinitialized environments are not available when they are needed.

- Use of preinitialized environments is a processing versus storage trade-off. For the additional storage requirement of preinitialized environments, you have a reduction in system processing. You can monitor NetView storage usage with the RESOURCE command. Some environment storage (stack storage) is allocated below the 16 MB line. Therefore, even if you do not have a 31 bit storage constraint, you should monitor 24 bit storage usage.
- The storage associated with each preinitialized environment can grow over time, depending on the needs of the PL/I or C command processors using them. Because the storage requirements for different PL/I or C command processors vary, all the preinitialized environments eventually grow over time to meet the needs of the most demanding PL/I or C command processor. To limit this growth, periodically change the number of allocated environments to zero with the HLLENV command, allowing them to be available. Then reset the requested number of environments with the HLLENV command to have them reallocated.

For more information on preinitialized environments and the HLLENV command, refer to the *IBM Tivoli NetView for z/OS Programming: PL/I and C*.

Global Variables

The following are classes of NetView global variables:

- Task global variables are accessible to any command procedure running under the task, as well as from the automation table using the DSITGLOB automation table function (ATF). Task global variables can be set to null, but when the variables are created, some storage is allocated for the variables until the task ends.
- Common global variables are accessible by any command procedure running under the NetView program from the automation table using the DSICGLOB ATF. Common global variables can be set to null, but when the variables are created, some storage is allocated for the variables until the NetView program ends. Common global variables can be updated directly from any task. Access to the common global variables is serialized to provide data integrity using the system enqueue and dequeue facility.

Accessing task global variables is faster than accessing common global variables, because task global variables do not require overhead of the system enqueue and dequeue facility. Keep this in mind when deciding whether to use task or common global variables for an application.

Enhancing Performance

Specify the number of task and common global variables you expect to use in the NetView constants module DSICTMOD. Increasing the expected number of variables improves the access time for the variables by optimizing the control block search algorithm. If you specify a larger number, more storage is required. For common global variables, the amount of additional storage should not exceed 64 K, even if you expect more than 100000 variables.

For task global variables, set the number of expected variables carefully. Additional storage is allocated for every task that uses task global variables. For example, an expected number of 1000 variables would require about 2.5 K of additional storage for each task using task global variables. If you expect 5000 task global variables, about 6 K of additional storage is required per task.

For more information about setting values in DSICTMOD, refer to the *IBM Tivoli NetView for z/OS Installation: Configuring Additional Components*.

You can use the QRYGLOBL command to determine the actual number of task or common global variables. Use this information to help you determine which values should be specified in the NetView constants module. This will improve system performance related to global variable retrieval. See the *IBM Tivoli NetView for z/OS Command Reference Volume 1 (A-N)* or the NetView online help for the QRYGLOBL command syntax.

If you are writing an assembler command processor that updates multiple global variables, consider using the NUMVARS option of the DSIVARS macro. This updates multiple global variables with a single macro invocation.

Save/Restore Processing

In using the Save/Restore function for global variables (GLOBALV SAVEC, SAVET, RESTT, and RESTC), keep in mind that a separate VSAM I/O is required for saving each variable, regardless of whether you specify groups of variables using a wildcard character (*). The Save/Restore VSAM data set uses local shared resources (LSR) by default. Restore operations can be buffered together, resulting in reduced I/O. Save operations use VSAM writes, which are not deferred with LSR. If you consider using the deferred write (DFR) performance option, see Chapter 9,

"Tuning for VSAM," on page 93 for a discussion of the potential risk of losing data contained in the buffers in the event of an abnormal end of the NetView program.

Do not save every global variable each time it is used in a command procedure. Save only the most critical global variables in that manner. The processing required for GLOBALV SAVE and RESTORE is an order of magnitude greater than the processing for GLOBALV GET and PUT.

Chapter 5. Tuning for the Hardware Monitor

The hardware monitor is the component responsible for managing host and network problem information. The hardware monitor manages this information using a filtering mechanism that controls data recording and the generation of alerts to the operator.

Tuning Techniques

Following are the major tuning techniques for the hardware monitor, arranged in order of expected effect on performance, with the most important tuning considerations listed first. These are described in detail in this chapter.

1. Use the ESREC and AREC filters to control what data is logged to the hardware monitor database as events, statistics, and alerts. For records that are automated using the NetView automation table, consider blocking the recording filters from the automation table. See "Hardware Monitor Filters."
2. Use the ALCACHE statement to specify the number of alerts to be kept in storage. See "Using the NPDA.ALCACHE Statement" on page 44.
3. For environments with more than 10 alerts a minute, use the viewing filter to minimize the number of Alerts-Dynamic panels that are updated for each alert. See "Alerts-Dynamic Panel" on page 43.
4. Reorganize the VSAM database frequently to avoid control interval (CI) and control area (CA) splits. Use the LISTCAT command to determine whether splits are occurring. You can use this information to reorganize the database if necessary. See "VSAM Database Maintenance" on page 101 and "LISTCAT Command" on page 97.
5. Use the HMSTATS command to monitor the amount of hardware monitor work being done on your system. HMSTATS displays event and alert workload counters, and statistics about the alert cache and alerts dynamic (ALD) screen update processing. See "HMSTATS Command" on page 46.
6. For environments in which alerts are forwarded to a focal point host, use the LU 6.2 method of forwarding alerts where possible, rather than LUC alert forwarding or the alert notification forwarding mechanism that is based on message BNJ146I. See "Using the NPDA.ALERTFWD Statement" on page 45.
7. Use the RATE statement to stop database logging of rapidly recurring events for a resource. See "NPDA.RATE Statement Initialization Specifications" on page 52.
8. Code NPDA.MACRF=DFR in the CNMSTUSR or C*xx*STGEN member, instead of using the LSR option. See "Local Shared Resources (LSR) and Deferred Write (DFR)" on page 93.

Refer to "Automating Hardware Monitor Records" on page 14 and "Filtering Hardware Monitor Records" on page 14 for more information about alert automation.

Hardware Monitor Filters

The hardware monitor uses several filters in processing statistical records and events from the network. Use the SRFILTER command to set the following filters:

Event and statistical recording (ESREC) filter
Determines which event and statistical records are recorded in the database. Unimportant events can be filtered using ESREC (example: NPDA SRF ESREC BLOCK xxxx).

Alert recording (AREC) filter
Determines which event records are also recorded as alerts.

Operator (OPER) filter
Determines which alerts produce messages BNJ030I and BNJ146I for the authorized receiver.

Route (ROUTE) filter
Determines whether alerts are to be forwarded to the alert focal point (provided an alert focal point exists).

Color (COLOR) filter
Determines the color in which an alert is displayed when the alert is presented on the Alerts-Dynamic, Alerts-Static, or Alerts-History panels.

TECROUTE filter
Sets a filter for converting alerts to Event Integration Facility (EIF) events and forwarding the events to the designated event server. An alert must pass the ESREC and AREC filters before the TECROUTE filter is applied to the alert.

Use the SVFILTER command to determine which alerts can be viewed by a particular operator, as well as controlling viewing of the Total Events and Total Statistics panels.

Refer to the *IBM Tivoli NetView for z/OS Command Reference Volume 1 (A-N)* for syntax and use of the SRFILTER and SVFILTER commands.

Effective use of filters can have a significant effect on the hardware monitor resource requirements. You can use many criteria to filter data. Your environment determines which are appropriate.

You can automate records using the MSUSEG and HIER conditions in the NetView automation table. If you do not need to record automated records to the hardware monitor VSAM database, you can save processing time by blocking the recording filters (ESREC, AREC, OPER, and ROUTE) in the automation table. Refer to "Automating Hardware Monitor Records" on page 14 and "Filtering Hardware Monitor Records" on page 14 for more information about automating problem records and blocking recording filters.

Figure 9 on page 43 represents the hardware monitor filter structure.

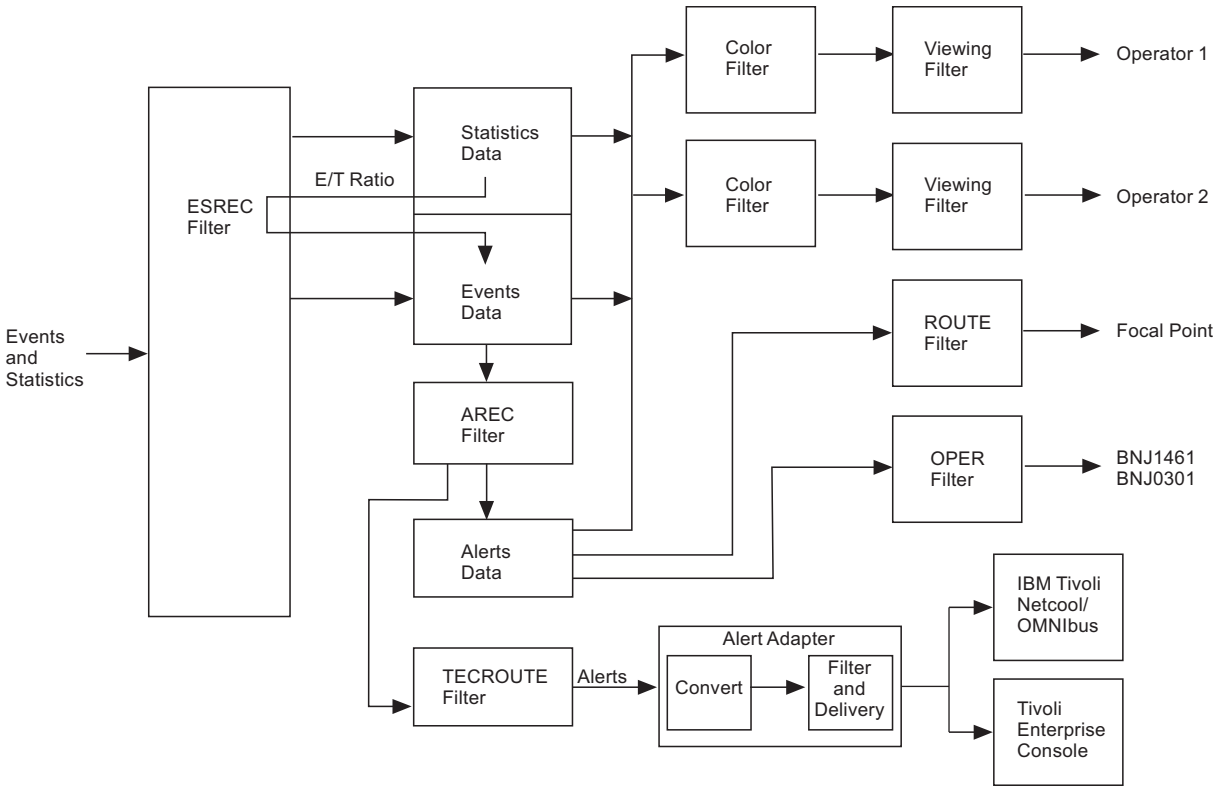


Figure 9. Hardware Monitor Database and Filters

Alerts-Dynamic Panel

For each alert that it processes, the hardware monitor checks to see if operators are on the Alerts-Dynamic panel. For each operator on the Alerts-Dynamic panel, the hardware monitor checks the operator's viewing filter to determine if the operator's panel should be updated. The processing required for Alerts-Dynamic panel updates can be significant if several operators are on the Alerts-Dynamic panel, and each must be updated with every alert. Minimize the average number of Alerts-Dynamic panels that are updated for each alert using the viewing filter. If your installation has more than 10 alerts per minute or a large number of Alerts-Dynamic panels active, use the viewing filter aggressively.

The following are considerations to reduce the amount of processing required for Alerts-Dynamic panel updates:

- Before you leave your workstation, exit the Alerts-Dynamic panel. It is not a productive use of system resources to update an unattended panel.
- If you are on the Alerts-Dynamic panel and you experience a burst of panel updates (a rapidly rolling screen). By reentering the ALD command to go back to the Alerts-Dynamic panel, the screen will be updated with only the most recent alerts.

The HMSTATS command displays statistics about ALD screen update processing on your system, including the average number of screen updates per alert (UPDATES/ALERT) and the total view filtering percentage (% FILTERED). Refer to "HMSTATS Command" on page 46 for more information.

Using the NPDA.ALCACHE Statement

You can use the NPDA.ALCACHE statement in the CNMSTYLE member to improve hardware monitor performance, if your NetView operators do the following activities:

- Receive many alerts (either at steady rates or in bursts)
- Frequently monitor the Alerts-Dynamic panel

The NPDA.ALCACHE statement is part of the CNMSTYLE initialization member and you can specify the number of alerts kept in storage. By keeping alert records in storage, all VSAM I/O to retrieve those alerts from the hardware monitor database is eliminated. This allows the Alerts Dynamic Panel to be updated without the additional overhead of the VSAM I/O. Also, the hardware monitor main task, BNJDSERV, uses less processor time when alerts are kept in storage through ALCACHE. In general, the more storage you allocate for alerts, the better the hardware monitor's performance.

Table 1 shows examples of how the NPDA.ALCACHE statement can affect the performance of your hardware monitor. Use the information to determine the appropriate NPDA.ALCACHE statement for your system. This table assumes that one alert requires 500 bytes of storage.

Table 1. Determining the Best ALCACHE Statement for Your System

System Usage Characteristic	ALCACHE Statement	Storage Allocated	Performance Benefit	Comments
Hardware monitor performance is important because your NetView operators frequently monitor the Alerts-Dynamic panel.	ALCACHE WRAPCNT	Storage that is allocated depends on the alert wrap count. You can specify the alert wrap count with the W(wrap) statement in the CNMSTUSR member, or with the SWRAP command. For example, if you specify `W AL 50`, then 25000 bytes of storage (500 bytes x 50 alerts) are allocated for alerts.	Performance benefit for monitoring the Alerts-Dynamic panel for both bursts of alerts and a steady stream.	The storage that is allocated depends on the amount of alert-cache storage acceptable to your system.
NetView operators rarely monitor the Alerts-Dynamic panel.	ALCACHE NONE	None	None	If the Alerts-Dynamic panel is rarely used, putting alerts into storage does not help your performance. Therefore, do not use storage for alerts.
Your system receives an average of 10 alerts per minute and bursts of up to 60 alerts at once.	ALCACHE 10	500 bytes x 10 alerts = 5000 bytes of storage	Performance benefit during steady states.	Although you can save on storage and performance during steady states, performance during bursts is not as good as it would be if you defined a larger alert-cache size.

Table 1. Determining the Best ALCACHE Statement for Your System (continued)

System Usage Characteristic	ALCACHE Statement	Storage Allocated	Performance Benefit	Comments
Your system receives an average of 10 alerts per minute and bursts of up to 60 alerts at once.	ALCACHE 60	500 bytes x 60 alerts = 30000 bytes of storage	Performance benefit during both alert bursts and steady states.	Performance is improved during bursts, but more storage is used.
System utilization percentage is low.	ALCACHE NONE	None	None	The performance gained by keeping alerts in storage is minimal because system utilization is low. Therefore, do not use storage for alerts.
Your system can spare only a small amount of storage for alerts.	ALCACHE 10	500 bytes x 10 alerts = 5000 bytes of storage	Performance benefit during steady states.	The storage allocated depends on the amount of alert-cache storage acceptable to your system.

The HMSTATS command displays the current ALCACHE setting and statistics on the alert cache usage. A good ALCACHE setting will have a "% SATISFIED" value near 100% without wasting storage. Refer to "HMSTATS Command" on page 46 for more information.

Using the NPDA.ALERTLOG Statement

The NPDA.ALERTLOG statement in the CNMSTYLE member enables you to make a VSAM performance versus processor time decision in regards to reading and writing records to the hardware monitor VSAM data base. With RSTDRANG, alert records are logged in one key range in the data base, and non-alert records are logged in another key range in the data base. With RANDRANG, the default value, alerts are logged throughout the data base, they are not restricted to a single key range. The ALERTLOG statement is processed only for new (empty) data bases, and it is ignored for existing data bases. Performance is quite comparable for RSTDRANG and RANDRANG in both small databases or until the wrap count is exceeded. When the wrap count is exceeded or in databases with more than 10,000 alerts being held, Hardware Monitor initialization time will take up to four times longer if RSTDRANG is coded.

Note: Hardware Monitor does not support key-ranged databases. Unpredictable results can occur.

Using the NPDA.ALERTFWD Statement

The following methods provide alert forwarding:

- Using an LU 6.2 session.
- Using an LUC session.
  - Does not support intermediate node (nested) focal points.
- Converting the alert to a message (BNJ146I) and then forwarding the message over a NetView-NetView task (NNT) to the focal point. The message is then converted back to an alert.

The NPDA.ALERTFWD statement in the CNMSTYLE member controls which alert forwarding method is used. Forwarding over LU 6.2 sessions is extremely

beneficial for hardware monitor performance for networks that incorporate forwarding alerts across an intermediate focal point.

CPU usage is less than half when implementing LU 6.2 intermediate alert forwarding instead of converting the message BNJ146I. This CPU reduction is recognized both in steady state and bursts of alerts. When an intermediate focal point is not used, LU 6.2 alert forwarding provides comparable performance to LUC forwarding.

Both the LU 6.2 and the LUC methods reduce VSAM recording at the host and have other usability advantages. The LU 6.2 alert forwarding method is the preferred method. For additional information refer to the *IBM Tivoli NetView for z/OS Installation: Configuring Additional Components* and the *IBM Tivoli NetView for z/OS Automation Guide*.

HMSTATS Command

HMSTATS is an unsupported, internal serviceability tool that is helpful in tuning the Hardware Monitor. Use the HMSTATS command to monitor the amount of hardware monitor work being done on your system. HMSTATS displays event and alert workload counters, and statistics about the alert cache and alerts dynamic (ALD) screen update processing. Figure 10 on page 47 shows a sample of output generated from the HMSTATS command.

```
HARDWARE MONITOR STATISTICS DISPLAY
               ********* RECEIVED COUNTS *********
      TOTAL TRAFFIC:     289792
            FROM EP:          0
           RECORDED:     274545
RECORDED (GMFALERT):          0
               ********** FILTER COUNTS **********
                     TOTAL  LVL1%  LVL2%  LVL3%  LVL4%  LVL5%
  EVENTS/STATS:     277528      0      1     78     18      0
        ALERTS:      65000             % NON-GENERIC:         21%
          OPER:          0
         ROUTE:          0
               ********** MISCELLANEOUS **********
  EXTERNAL LOG:     274529               RATE VALUE:         12
   CORRELATORS:      94238         PURGE IN PROGRESS: NO
               *********** ALERT CACHE ***********
ALERT CACHE -
       ALCACHE: WRAPCNT               ALERT WRAPCNT:        112
 TABLE ENTRIES:        112             TABLE STORAGE:         46K
      REQUESTS:     842908                RETRIEVALS:     425701
   % SATISFIED:        100%
               *********** ALD COUNTS ************
NUMBER OF ALDS:          8               ALDS BEHIND:          1
 TOTAL UPDATES:      11334            TOTAL FILTERED:     414421
 UPDATES/ALERT:        0.2               % FILTERED:         97%
OPERID   DOMAIN        BEHIND    UPDATES   FILTERED  FILTER%
------   ------        ------    -------   --------  -------
VOICE    CNM12              0         67      64324      99%
KIOSK    CNM12              0        365      47505      99%
BIGSGS   CNM12              0        891      14894      94%
OPER20   CNM12              0        119       3038      96%
OPER02   CNM12              0        201       2857      93%
OPER12   CNM12              0         38       3076      98%
DAVE     CNM12           1252         56       1544      96%
ABRAHAM  CNM12              0        543       1085      66%
END OF HARDWARE MONITOR STATISTICS DISPLAY
```

Figure 10. Example of Output from HMSTATS Command

The HMSTATS command also has a RESET option, which sets all of the workload counters to zero.

The following information is displayed with the HMSTATS command:

RECEIVED COUNTS:

TOTAL TRAFFIC
The total number of items that have been received by the hardware monitor.

FROM EP
The total number of alerts received that were forwarded from NetView entry points.

RECORDED
The total number of items that have been recorded to the hardware monitor database.

RECORDED (GMFALERT)
The total number of items that have been recorded for GMFHS.

FILTER COUNTS:

EVENTS/STATS
The total number of events and statistics which have been recorded to the hardware monitor database.

Level 1–5 %
The percentage of the events/statistics records that were written at the given level in the resource hierarchy.

ALERTS
The total number of alerts which have been recorded to the hardware monitor database.

% NON GENERIC
The percentage of the alerts recorded which are not in generic format.

OPER The total number of alerts which passed the OPER filter to generate messages BNJ030I and BNJ146I.

ROUTE
The total number of alerts which passed the ROUTE filter and will be forwarded to the alert focal point.

MISCELLANEOUS:

EXTERNAL LOG
The total number of external log records that have been written.

CORRELATORS
The total number of correlators received.

RATE VALUE
The value used for the RATE statement (in seconds) in the CNMSTYLE member.

PURGE IN PROGRESS
Indicates whether a database purge is in progress.

ALERT CACHE:

ALCACHE
The value coded on the NPDA.ALCACHE statement in the CNMSTYLE member (or the default value), which is NONE, WRAPCNT, or a numeric value.

ALERT WRAPCNT
The current alert wrap count value.

TABLE ENTRIES
The number of entries in the alert cache table.

TABLE STORAGE
The number of kilobytes of storage allocated for the alert cache table.

REQUESTS
The number of attempts made to retrieve an alert from the alert cache.

RETRIEVALS
The number of successful attempts to retrieve an alert from the alert cache.

% SATISFIED
The percentage of alert cache requests that were satisfied. A request can be satisfied by either retrieving the alert, or by determining that no next alert exists.

ALD COUNTS:

NUMBER OF ALDS
The number of operators that have an alerts dynamic (ALD) display active.

ALDS BEHIND
The number of ALD screens that are behind. An ALD screen is considered behind if there are alerts recorded to the database that have not yet been checked against the operator's VIEW filter.

TOTAL UPDATES
The total number of times an ALD screen has been updated with an alert. This is a cumulative count for all ALD screens, including those that are no longer active.

TOTAL FILTERED
The total number of times an alert was blocked by an operator's VIEW filter. This is a cumulative count for all ALD screens, including those that are no longer active.

UPDATES/ALERT
The average number of ALD screens that are updated for each alert. This number is calculated by dividing the total number of times an ALD screen has been updated with an alert (TOTAL UPDATES) by the total number of alerts that have been recorded to the database (the ALERTS field in the FILTER COUNT section). This result is intended to be a long running average, and does not account for alerts that have been recorded to the database but not yet checked against operator VIEW filters.

% FILTERED
The average VIEW filtering percentage. This number is calculated by dividing the TOTAL FILTERED field by the sum of the TOTAL UPDATES and TOTAL FILTERED fields.

For each operator that has an ALD screen active:

OPERID
The operator's ID.

DOMAIN
The domain the operator is in.

BEHIND
The number of alerts which have been recorded to the database, but have not yet been checked against the operator's VIEW filter.

UPDATES
The number of alerts that have passed the operator's VIEW filter and been sent to the operator's ALD screen.

FILTERED
The number of alerts that have been blocked by the operator's VIEW filter.

FILTER %
The operator's VIEW filtering percentage. This number is calculated by dividing the FILTERED field by the sum of the UPDATES and FILTERED fields.

Using the NPDA.DSRBO Statement

For the hardware monitor, the solicited data services request block (DSRBO) value specifies the projected number of concurrent user requests for services from the BNJDSERV data services task. To determine the number of DSRBOs that BNJDSERV needs on this host, consider the number of cross-domain conversations in which this host can be involved at any given time, and the number of operators performing distributed database retrieval from this host.

You can set the DSRBO value using the NPDA.DSRBO statement in the CNMSTUSR or C*xx*STGEN member. The default value is 5. You can use the DSRBS command specifying the BNJDSERV data services task to display the current use of the hardware monitor data services request blocks (DSRBs). Refer to "Data Services Request Blocks (DSRBs)" on page 109 for more information about tuning the DSRB allocation for a data services task and for more detail about the DSRBS command.

Wrap Counts

Events, statistical data, and alerts are all logged to the hardware monitor database. The defaults for the number of event and statistical records that are logged are 25 records for each resource. After 25 records, the data is wrapped. For alerts, the number of records logged before wrapping is 100. You can decrease the default values to make the hardware monitor database smaller. Use the SWRAP command to change the wrap count of the records.

SWRAP Command

The SWRAP (SW) command establishes the number of event or statistical records to be retained for a specified resource or the total number of alert records to be retained on the hardware monitor database. You can issue the command only for resources against which data has been logged on the hardware monitor database.

When this command requests a reduction in wrap count, the oldest records are deleted immediately. If the wrap count is small, it might appear that the oldest record is not being wrapped off, because the new set of records fits on the panel without deleting the old records.

For more information about the SWRAP command, see the *IBM Tivoli NetView for z/OS Command Reference Volume 1 (A-N)* or the NetView online help.

Note: The SWRAP command can result in loss of error data.

Example: Using the SWRAP Command

The following SWRAP command sets the event wrap count to 5 for resource UNIT1:

```
SW EV 5 N UNIT1
```

Initialization Specifications

To set wrap counts at initialization for resources that are not yet in the database, use the NPDA.W statement in the CNMSTUSR or C*xx*STGEN member. The NPDA.W statement does not alter the wrap count for resources already existing on the hardware monitor database. The NPDA.W statement assigns initial wrap values when the first error record for a particular resource is received.

The following WRAP command sets the wrap count to 10 for event records for a line:

```
W EV 010 LINE
```

Note: An alert wrap count that is too low can trigger the NPDA.R statement.

For more information about the NPDA.W and NPDA.R statements, see the *IBM Tivoli NetView for z/OS Administration Reference*.

Error-to-Traffic (E/T) Ratio Thresholds

The hardware monitor calculates ratios of temporary errors to traffic. The hardware monitor determines this ratio for statistical data that it receives regarding communication lines attached to a 37x5 and other channel-attached controllers. This ratio provides a warning when a line might be experiencing many temporary errors. The hardware monitor provides this warning by issuing an event with the description as the following example shows:

```
ERROR TO TRAFFIC RATIO EXCEEDED
```

The hardware monitor generates an event notification whenever it receives statistical data in which the ratio of temporary errors to traffic is greater than the threshold values.

The error-to-traffic (E/T) threshold defaults to a value of 3% for communication lines and to 1% for all channel-attached communication controllers.

The default threshold of 3% is not appropriate for all lines. Lines vary widely in the ratio of temporary errors to traffic. Some lines can have a normal range of 3% to 11%. For other lines, the threshold should be at least 15% so that an event is generated for an abnormal condition only. Not only do meaningless E/T ratio events clutter up the hardware monitor events panels, they also degrade performance. More data is sent to the hardware monitor database when an event notification is generated from statistical data.

You can change the E/T thresholds in the hardware monitor by issuing the SRATIO operator command and specifying the thresholds in the hardware monitor initialization program.

SRFILTER and SRATIO Commands

The SRATIO operator command changes the threshold for any resource that has existing statistical data on the hardware monitor database. Changes to the thresholds are not maintained if the database is reinitialized. You might want to write a command procedure containing SRATIO commands for all lines where the default threshold is not appropriate. You can then execute this command procedure when you reinitialize the hardware monitor database.

When you specify a line name in the command, all controllers on that line use the new threshold you supply. The SRATIO command in the following example changes the E/T threshold for a line named LINE1234 to 15.0%.

```
NPDA SRATIO 150 N LINE1234
```

The value 150 means 15.0%.

Use the following SRATIO command to prevent alerts from being generated based on statistical data for a given line. The SRATIO command in the following example prevents alerts from being generated for LINE1234.

```
NPDA SRATIO OFF N LINE1234
```

Use the following hardware monitor SRFILTER (SRF) commands to disable thresholds for **all** resources in your network, for example, to display no warning facility for statistical data.

```
NPDA SRF ESREC BLOCK C 044E0
NPDA SRF ESREC BLOCK C FEE40
NPDA SRF ESREC BLOCK C FEE64
NPDA SRF ESREC BLOCK C FEF45
NPDA SRF ESREC BLOCK C FFD45
NPDA SRF ESREC BLOCK C FFD46
```

The SRFILTER commands in this example prevent the logging of events and alerts based on exceeding E/T ratios. The statistical data is still logged.

As with all set recording filter (SRFILTER) commands, the filter settings are lost when you shut down the NetView program. Use a command procedure to execute your SRFILTER commands each time the NetView program is activated, or code your initial automation table to set your filters when the hardware monitor is initialized.

If you place SRFILTER commands in a NetView initialization command list, you need to add a short timer delay, perhaps 1 or 2 minutes, to ensure that the hardware monitor initialization has been completed before the command list is executed. Refer to the sample NetView automation table DSIDNMAT (CNMS7003) for information on how to invoke filters during hardware monitor initialization.

RATIO Statement Initialization Specifications

You can also specify thresholds for the hardware monitor at initialization using the NPDA.R statement in the CNMSTUSR or C*xx*STGEN member. These thresholds do not change for resources that already have statistical data logged on the hardware monitor database. Therefore, for resources already on the database, the new thresholds do not take effect until the next time you reinitialize the database. If you periodically reinitialize the database, specify E/T thresholds in the NPDA.R statement.

To change thresholds for the hardware monitor, add an NPDA.R statement in the CNMSTUSR or C*xx*STGEN member for each line.

The RATIO command in the following example changes the threshold for a line named LINE1234 to 15.0%.

```
R LINE LINE1234 150
```

The value 150 means 15.0%. The resource type (LINE) is required in a RATIO statement.

NPDA.RATE Statement Initialization Specifications

You can also specify the maximum rate at which events can be logged to the hardware monitor database. The purpose of this function is to stop database logging of repetitive events for a resource, such as alert flooding or alert streaming. The RATE function compares the time between an event being wrapped off the database and the new event record being recorded on the database. A filter is set to

block the recording of events from the resource if the difference is less than the time specified on the NPDA.RATE statement in the CNMSTYLE member. The NPDA.RATE statement filters by resource name. When the filter is set, the BNJ045I message is issued. Determine why the filter was set and correct the cause of the stream of alerts. The filter entry can then be deleted.

The preferred rate is one event per second for the predominant wrap count. This works out to 25 seconds for the default wrap count of 25. If an NPDA.RATE statement is not coded in the CNMSTYLE member, the rate value is set to zero. A zero value turns off the RATE function. See the *IBM Tivoli NetView for z/OS Administration Reference* for more information about coding these statements.

Note: An event that is blocked by a recording filter set by the NPDA.RATE statement is not sent to automation. If automation is required for these alerts, code an NPDA.AUTORATE statement in the CNMSTUSR or C*xx*STGEN member.

Event/Automation Service

Set the connection mode in the alert adapter configuration file member IHSAACFG and in the message adapter configuration file member IHSAMCFG to *connection_oriented* for the event delivery method. The default value is *connection_less* which specifies that a new connection should be established (and ended) for each event that is sent. *Connection_oriented* specifies that a connection should be established when the adapter is initialized and maintained for all events sent. A new connection is established only if the connection is lost. The connection is ended when the adapter is terminated.

Make the same change on the designated event server desktop. When creating your desktop rule base files, change *tec_forward.conf* in TEC_RULES to *connection_oriented*.

Set the trace_level in the Event/Automation Service initialization file member IHSAINIT to OFF.

Chapter 6. Tuning for the Session Monitor

The session monitor component of the NetView program collects information about Systems Network Architecture (SNA) sessions. The base data about a session is called session awareness (SAW) data. See "SAW Data" on page 56 for more information. Other types of data that can be collected about sessions include:

- Accounting data
- Availability data
- Session path information unit (PIU)
- Network control program (NCP) trace data
- Response time monitor (RTM) data

Major Tuning Techniques for the Session Monitor

Following are the major tuning techniques for the session monitor, arranged in order of expected effect on performance, with the most important tuning considerations listed first. These are described in detail in this chapter.

1. Evaluate the requirements for and use of session history data at your installation. Filter unnecessary data using either the KCLASS DASD parameter or the DASD sense code filter. You can use sample CNMSJM10 (described in the *IBM Tivoli NetView for z/OS Installation: Configuring Additional Components*) to analyze your session monitor database and determine which sense codes occur most frequently. Session ends that are filtered do not require VSAM I/O activity. See "DASD Option" on page 67 and "DASD Filtering" on page 69.
2. Evaluate the requirements for and use of session awareness data at your installation. Filter unnecessary data using either the VTAM SAW filter (in ISTMGC10) or the NetView SAW filter, which uses the KCLASS SAW option. Use of the VTAM SAW filter is preferable, because it eliminates NetView processing for filtered sessions. See "SAW Data" on page 56 and "SAW Option" on page 65.
3. Purge and reorganize the database off-shift on a regular basis to reclaim free space in the database. If you can discard all of the session history data in the database, clear the session monitor database while the NetView program is active using the RESETDB command. Clearing the database with RESETDB is faster than purging and reorganizing the database. See "Managing the Session Monitor Database" on page 69.
4. Use selective trace rather than global trace for PIU tracing. Trace only the sessions for which you need trace data. See "Estimating Storage Usage" on page 133 to estimate the data's storage requirements. See "Trace Data" on page 59 and "KEEPPIU Parameter" on page 62.
5. Use KCLASS KEEPSESS values greater than zero *only* for session pairs or groups of sessions with a high incidence of session ends to keep those sessions from filling up the database. The KEEPSESS option requires additional I/O processing for session ends. See "KEEPSESS Option" on page 68 and "DGROUP Option" on page 69.
6. If you do not use the PURGE command or the PURGEDB command list to manage your VSAM database, set the PURGE parameter in AAUPRMLP to DASD. Otherwise, use the default setting of SPEED. See "PURGE Parameter" on page 71.

7. Evaluate the requirements for, and use of, availability data and accounting data at your installation. Filter unnecessary data using the SESSTATS parameter on the INITMOD statement. See "AVAIL Option" on page 66.
8. Use the SESSMDIS command to monitor the amount of session monitor work being done on your system. SESSMDIS provides session counts, storage by data type, and traffic counts. See "SESSMDIS Command" on page 72.
9. Minimize processing during network activation by starting the session monitor after the network is active (a session monitor *warm start*). Fewer SAW buffers are required to get session awareness data for the network, and PIU data for control sessions is not sent. See "SAW Buffer Allocation and Tuning" on page 57.
10. If you are collecting PIU trace data or using accounting, tune the PIU buffer allocation to achieve buffer fullness between 80% and 95%. See "Trace Data" on page 59.
11. Set the LUCOUNT parameter to the number of logical units (LUs) in your network. The value of LUCOUNT is used to optimize control block search algorithms and allocate session-related storage. See "LUCOUNT Parameter" on page 75.
12. If you are collecting PIU trace data, use KEEPPIU values that are even divisors of 84 to avoid wasting storage. See "KEEPPIU Parameter" on page 62 and "KEEPPIU Option" on page 66.
13. Use different KEEPPIU values for each keep class where possible to improve the locality of reference for PIU data. See "KEEPPIU Option" on page 66.
14. If you issue the COLLECT RTM command to gather response time data from PUs with the RTM feature, issue separate COLLECT commands for subsets of the PUs. Collecting from all of the PUs at once can cause a large amount of request units to flow in the network at once. Stagger separate COLLECT commands to spread out the flow of RUs over a longer period of time. See "RTM Data Collection" on page 75.
15. Use the CANCEL command only as a last resort. If CANCEL must be issued, try to close the active NLDM VSAM database (AAUVSPL or AAUVSSL) by issuing the SWITCH AAUTSKLP,T command. This does not actually do a switch, but closes the active VSAM database. If that is not effective, issue the NetView STOP FORCE command for each active VSAM task. If it is necessary to use the MVS CANCEL command to bring down NetView and you have DFR specified, it might be necessary to delete and redefine the affected database. See "Local Shared Resources (LSR) and Deferred Write (DFR)" on page 93.

SAW Data

SAW data gives session status, session partners, and configuration data about these types of sessions:

- LU-LU
- SSCP-LU
- SSCP-PU
- SSCP-SSCP
- CP-CP

SAW data collection requires 310 to 500 bytes per session, depending on whether the session is in the same domain, cross-domain, or cross-network.

The session monitor does not collect any other data about a session (for example, RTM or trace data) if it does not have SAW data for the session.

You can keep SAW data selectively using either the SAW option of the KCLASS statement, the VTAM SAW filter, or the SAW Filter Exit (DSIEX20). See "SAW Option" on page 65 for more information about session awareness filtering.

SAW Buffer Allocation and Tuning

Define the SAW buffer allocation using the NLDM.SAWNUM and NLDM.SAWSIZE statements in the CNMSTUSR or C*xx*STGEN member.

SAW buffers are allocated in VTAM private storage. VTAM allocates the buffers above the 16 MB line.

The DSIAMLUT task receives the SAW buffers from VTAM and forwards them to the AAUTSKLP task for processing.

The SAW buffering ratio, the average number of SAW notifications sent per buffer, helps to characterize VTAM SAW buffering behavior. You can calculate the SAW buffering ratio for your system with the following formula, using fields that are displayed with the SESSMDIS command. To calculate the SAW buffering ratio over an interval using two observations of the SESSMDIS command, take the differences in the session start, session end, and SAW buffer counts and use the following formula to calculate.

$$\text{SAW buffering ratio} = \frac{\text{(session starts + session ends)}}{\text{SAW buffers}}$$

See "SESSMDIS Command" on page 72 for more information.

An understanding of how VTAM buffers session awareness notifications is helpful in tuning the SAW buffer allocation.

Tuning the SAW Buffer Allocation

VTAM SAW buffering behavior occurs in the following ways:

- During steady state periods when the session monitor is keeping up with the SAW data sent from VTAM, the SAW buffering ratio is close to 1.
- During a session monitor warm start, VTAM packs SAW buffers.

A data space (ISTNMSDS) is used for transferring SAW data between VTAM and the session monitor. The following VTAM start options control VTAM SAW buffering behavior. Refer to the appropriate VTAM publication for more information on the VTAM start options.

SAW Data Space Packing Factor

The SAW data space packing factor (start option SAWMXQPK or ISTRACON constant RACSAWPK) calculates the number of SAW data space buffers to queue before packing SAW buffers. The packing threshold equals SAWMXQPK times the number of SAW buffers in VTAM private storage (defined by the SAW BUFNUM parameter in AAUPRMLP). The default value is zero. The default value causes VTAM to pack SAW buffers if the data space is not empty. This occurs if an earlier SAW buffer sent by VTAM was not received by the session monitor. This packing behavior improves performance because as traffic increases, the buffering efficiency increases. Use the default value of zero for SAWMXQPK.

SAW Data Space Limit Factor

The SAW data space limit factor (start option SAWMAXDS or ISTRACON constant RACSAWLM) calculates the maximum buffer limit for the SAW data space. The maximum number of SAW data space buffers equals SAWMAXDS times the number of SAW buffers in VTAM private storage (defined by the SAW BUFNUM parameter in AAUPRMLP). The default value for SAWMAXDS is 100. If the session monitor is unable to keep up with the SAW traffic, VTAM queues SAW buffers in the SAW data space. VTAM continues adding SAW buffers to the data space until the maximum buffer limit is reached.

SAW Buffer Limit

The SAW buffer limit (start option MXSAWBUF or ISTRACON constant RACMXBUF) sets the maximum number of SAW buffers that can be allocated in VTAM private storage. SAW buffers back up in VTAM private storage only after the SAW data space has reached its maximum buffer limit (controlled by SAWMAXDS). When this happens, VTAM tries to conserve SAW buffers by placing only SAW data associated with termination into the buffers. When the SAW buffer limit is reached, VTAM ends the session awareness function, releasing the SAW data space and the allocated buffers. When buffers back up in VTAM private storage, extra VTAM processing time is needed to conserve SAW buffers and allocate new buffers from VTAM private storage.

Considerations for Defining the SAW Buffer Allocation

In defining the SAW buffer allocation, data space, and limits, you can control the maximum amount of SAW data that is allowed to be kept in the system prior to the session monitor processing the data. Use the data space to keep unprocessed SAW data and avoid letting SAW data back up into VTAM private storage. The following are considerations.

- Use the default value of zero for SAWMXQPK. This gives the best SAW buffering ratio.
- Use a BUFSIZE that is a multiple of 4 K (4 K—32 K). When VTAM is packing buffers, a larger BUFSIZE allows more SAW notifications to be sent for each buffer. You can monitor the SAW buffering ratio using fields from the SESSMDIS command.
- Use a small value such as 2 for BUFNUM. Because the data space is used to store unprocessed buffers, you do not need to define a large number of SAW buffers.
- Set SAWMAXDS in conjunction with the SAW BUFSIZE and BUFNUM parameters in AAUPRMLP to reflect the amount of data space storage that you are willing to devote to a backlog of SAW data. To determine the peak size of the SAW data space, multiply SAWMAXDS by BUFSIZE and BUFNUM. For example, if AAUPRMLP defines two 4K SAW buffers and SAWMAXDS is equal to 100, the maximum size of the SAW data space is 800K (2 * 4K * 100). Consider using a large number for SAWMAXDS to keep all unprocessed SAW buffers in the data space and avoid a backup into VTAM private storage. Small values for SAWMAXDS and MXSAWBUF result in VTAM ending the session awareness function prematurely.
- Set MXSAWBUF to a relatively low number (200 or less). If you define SAWMAXDS properly, a backup into VTAM private storage should not occur. If a backup does occur, a small value for MXSAWBUF causes VTAM to end the session awareness function before the backup is significant.

Trace Data

The session monitor provides two trace modes:

- Global
- Specific

Global Tracing

The global trace mode traces all sessions. The TRACESC and TRACELU parameters on the INITMOD statement in AAUPRMLP are used to specify whether global tracing is performed. These parameters are specified with the statements as shown in the following example.

```
NLDM.TRACESC=YES|NO
NLDM.TRACELU=YES|NO
```

Note: The default values are underlined.

TRACESC=YES indicates global tracing of SSCP/CP sessions (SSCP-LU, SSCP-PU, SSCP-SSCP, and CP-CP). TRACELU=YES indicates global tracing of LU-LU sessions. Global tracing can require a large amount of virtual and DASD storage. See "Estimating Storage Usage" on page 133 to determine the storage requirements before using global trace.

You can use the NLDM TRACE DISP command to determine which sessions are being traced. Global NLDM TRACE defaults can be changed dynamically.

Selective Tracing

If you do not want to use global trace, you can specify selective trace with the session monitor TRACE command. For example, if you want to trace only SSCP-SSCP sessions, do the following:

1. Specify TRACESC=NO and TRACELU=NO in initialization member AAUPRMLP. You can code this as shown in the following example.

   ```
   NLDM.TRACESC=NO
   NLDM.TRACELU=NO
   ```

2. Issue a TRACE START command for each SSCP that will be in session with VTAM. Assuming three other SSCPs whose names are CDRM1, CDRM2, and CDRM3, the session monitor TRACE commands are shown in the following example.

   ```
   NLDM TRACE START CDRM1
   NLDM TRACE START CDRM2
   NLDM TRACE START CDRM3
   ```

   You can code these commands in a NetView command list. You can also code a NetView command list that dynamically determines the SSCPs and starts the TRACE command for them. You can issue the VTAM display command, as shown in the following example, in a command list to identify the SSCPs.

   ```
   (D NET,ID=VTAM,E)
   ```

   Then issue NLDM TRACE START commands in the same command list for those SSCPs.

If your network experiences a high level of session failures, consider tracing the SSCP sessions. Using the KEEPPIU option of the KCLASS statement, keep more PIUs for the following:

- SSCP-SSCP sessions
- SSCP-PU sessions for gateway NCPs

- SSCP-LU sessions for VTAM applications

For all other SSCP sessions, keep fewer PIUs. For networks with hung terminals and protocol problems, consider tracing LU-LU sessions.

The type of information available from PIU tracing varies depending on the session type. The following are some examples:

- Session initiations (INITs) for SSCP-LU sessions for applications
- Cross-network session resource allocation (RNAAs, SETCVs) for SSCP-PU sessions for gateway NCPs
- Cross-domain and cross-network session initiations (CDINITs) for SSCP-SSCP sessions

Activate trace for other session types or resources when needed to reproduce a problem or to monitor selected sessions.

The accounting function summarizes the PIU data by session. When you use the accounting function, specified with SESSTATS=YES in AAUPRMLP, the session monitor receives and processes the same amount of PIU trace data as if global trace had been specified. If you specify a trace for the session with the TRACESC or TRACELU parameters or the TRACE command, the PIU data is available for viewing and recording. Tracing does not have to be active to use the accounting function.

If you use the availability function, specified with SESSTATS=AVAIL in initialization member AAUPRMLP, rather than the accounting function, the session monitor does not require tracing to be active. Therefore, the processing and storage associated with global tracing can be eliminated by specifying TRACESC=NO and TRACELU=NO in member AAUPRMLP.

The amount of host processing required for the accounting function is similar to that required for global trace. Global trace can require considerably more storage than accounting, however, depending on the number of PIUs kept in storage for each session. See “KEEPPIU Parameter” on page 62 for information about how to specify the number of PIUs to keep for a traced session.

Note: When you filter SAW data with VTAM, VTAM does not send PIU data for filtered sessions to the session monitor. If you filter SAW data with the session monitor KCLASS statement instead of the VTAM SAW filter, VTAM sends PIU data for filtered sessions to the session monitor and the data is discarded. See “SAW Option” on page 65 for more information on session awareness filtering.

If you want to use global trace or accounting and restrict the number of sessions for which PIU data is processed, you can use the VTAM SAW filter to filter unneeded sessions. Keep in mind that if you filter a session, no other data can be collected for that session.

PIU Buffer Allocation and Tuning

Define trace buffers using the NLDM.PIUTNUM and NLDM.PIUTSIZE statements in the CNMSTUSR or C*xx*STGEN member.

The DSIAMLUT task receives the PIU buffers from VTAM and forwards them to the AAUTSKLP task for processing. The storage for PIU buffers is common storage page fixed. If VTAM does not have enough trace buffers and starts overlaying them, the NetView program issues message AAU024I indicating the number of lost

buffers. Losing PIU buffers is usually not a problem unless you are using the session monitor accounting function or are not getting the desired trace data.

Three goals for tuning the PIU buffer allocation are:

- Maximize the number of PIUs that are sent per buffer.
- Avoid losing PIU buffers.
- Avoid over allocating buffers, which wastes storage.

VTAM sends full PIU buffers unless the NetView program solicits a buffer, as it might when processing a session-end notification or when processing an operator request. Therefore, the optimum PIU buffer allocation depends on the rate at which session-end notifications are processed and the frequency of operator requests for PIU trace data.

In tuning the PIU buffer allocation, determine the optimum size of the buffers for your environment. Then adjust the number of buffers to allocate so that PIU buffers are not lost during periods of peak activity.

The SESSMDIS command and the external log record created by the NLDM RECORD STRGDATA command provide information that you can use to tune the PIU buffer allocation for your system. The SESSMDIS command displays session monitor traffic data and event counters, while the NLDM RECORD STRGDATA command writes similar information to the NetView external log. The NLDM RECORD STRGDATA command creates SMF record type 39, subvector X'0008'. See the *IBM Tivoli NetView for z/OS Command Reference Volume 1 (A-N)* or the NetView online help for information about the syntax and use of those commands. See the *IBM Tivoli NetView for z/OS Application Programmer's Guide* for the format of the external log record.

Estimating PIU Buffer Fullness

Both the SESSMDIS and NLDM RECORD STRGDATA commands provide counters for the number of PIU buffers processed and the number of PIUs processed by the NetView program. Use the counters to estimate the fullness of the PIU buffers sent from VTAM to the NetView program using the following steps:

1. Collect the PIU buffer counts and PIU counts (with the SESSMDIS command) from the NetView program over a period of 1 to 2 hours during peak activity for your system.
2. Using your current PIU buffer size and the PIU buffer and PIU counts from your period of peak activity, estimate the average percent fullness of your PIU buffers using the following formula:

$$\%\ \text{full} = \frac{(\text{PIU count} \times 48)}{(\text{PIU buffer count} \times \text{current PIU buffer size})} \times 100$$

   The constant 48 represents the size in bytes of the vast majority of PIUs that the NetView program processes. Because the PIU buffer contains some buffer header information, the buffer fullness percentage will approach but never equal 100%.

In general tune your buffer size to achieve buffer fullness of 80% or more. If your PIU buffers are less than 80% full and storage is a constraint on your system, you can decrease the buffer size.

If your PIU buffers are 95% full or more, you might benefit from increasing the PIU buffer size. A larger buffer size might allow you to get more PIUs sent in each buffer.

The samples contain a starting allocation of two 4 K PIU buffers. If you are in a large environment, you might want to use four 8 K PIU buffers for your starting allocation.

In the process of tuning your PIU buffer size, adjust the number of buffers so that the total size of your PIU buffer allocation (number of buffers multiplied by buffer size) does not vary significantly. When you have arrived at a satisfactory PIU buffer size, you can adjust the number of PIU buffers so that you do not lose buffers during periods of peak activity, such as during a major node recovery.

If you still receive message AAU024I (indicating lost buffers) after tuning the PIU buffer allocation, the session monitor might not be dispatched frequently enough to sustain its workload. This is an indication of a performance problem, where higher priority work on your system (either in the NetView Program or in other address spaces) has high CPU usage. Raising the dispatch priority for AAUTSKLP (specified in CNMSTASK with the PRI parameter) from the default of 8 to 5 might help relieve this problem. However, you should try to address the underlying problem of high CPU usage with the TASKUTIL command and system performance monitoring tools, such as RMF™.

PIU Data Space

A data space (ISTNMPDS) is used to transfer PIU trace data between VTAM and the session monitor. Using the data space does not affect selecting the proper PIU buffer size for your environment, but does affect the number of PIU buffers that you should specify.

The VTAM PIUMAXDS start option (or ISTRACON constant RACPIULM) is the PIU data space limit factor used to calculate the maximum buffer limit for the PIU data space. The maximum number of PIU data space buffers equals PIUMAXDS times the number of PIU buffers in VTAM private storage (defined by the PIU BUFNUM parameter in AAUPRMLP). The default value for PIUMAXDS is 200. If the session monitor is unable to keep up with the PIU traffic, VTAM queues PIU buffers in the PIU data space. VTAM continues to add PIU buffers to the data space until the maximum buffer limit is reached. VTAM then discards PIU data until buffers become available. When the session monitor detects that PIU buffers were lost, message AAU024I is issued.

Set PIUMAXDS in conjunction with the PIU BUFSIZE and BUFNUM parameters in AAUPRMLP to reflect the amount of data space storage that you are willing to devote to a backlog of PIU data. To estimate the peak size of the PIU data space, multiply PIUMAXDS by BUFSIZE and BUFNUM. For example, if AAUPRMLP defines four 8K PIU buffers and PIUMAXDS is equal to 200, the maximum size of the PIU data space is 6400 K ($4 \times 8\ K \times 200$).

KEEPPIU Parameter

The KEEPPIU parameter in AAUPRMLP specifies the number of PIUs to keep for a traced session and affects virtual storage, processor storage, and DASD storage. The value provided in the samples is 7. KEEPPIU affects the amount of virtual storage the session monitor uses for the period a session is active, and the amount of DASD storage used when a session is deactivated. For each PIU kept, 50 bytes of virtual storage are used per session.

The session PIUs are kept in a wraparound area in virtual storage while the session is active and are stored in the database when the session ends. When the first PIU for a session is received, the entire KEEPPIU storage for that session is allocated. Specifying a large KEEPPIU value for sessions that do not have much

traffic, such as SSCP-LU and SSCP-PU sessions, could result in wasted storage. See "KEEPPIU Option" on page 66 for information on tailoring the KEEPPIU value for different keep classes.

Use the NetView SESSMDIS command to display the amount of storage allocated for the PIU trace data. This information is helpful in determining a good value for KEEPPIU. See "SESSMDIS Command" on page 72 for a description of the syntax and use of this command.

TRACEGW Parameter

The TRACEGW parameter in AAUPRMLP specifies whether NCP gateway trace data is to be collected for cross-network sessions. If TRACEGW is set to YES, when the session monitor receives a session-start notification for an NCP, it requests the NCP to collect gateway trace data for cross-network sessions that pass through it. When cross-network sessions end, the NCP sends the data to the session monitor for recording to the VSAM database. If you do not use this trace data for problem determination or other purposes, you can set TRACEGW to NO and eliminate the extra processing and VSAM storage.

Keep Classes

You can use keep classes to keep selective SAW data for active sessions in addition to recording selective session data on sessions that have ended. Keep classes can also control the amount of trace data collected. As mentioned in "SAW Data" on page 56, if you plan to keep SAW data selectively, consider filtering SAW data with the VTAM SAW filter.

KCLASS and MAPSESS statements are used to define the selectivity of keep classes, as shown in Figure 11 on page 64. These statements are in a separate DSIPARM data set member, which is defined by the NLDM.KEEPMEM statement in the CNMSTYLE member.

KCLASS defines selective processing options (AVAIL, SAW, DASD, KEEPSESS, DGROUP, and KEEPPIU). MAPSESS defines which sessions use a specified KCLASS.

KCLASS and MAPSESS definitions are loaded during session monitor initialization. You can change these definitions dynamically using the session monitor RELOAD command to load new members. Active sessions are not affected by the RELOAD command.

Keep-class processing is done on a session basis and options are applied when the session monitor receives a session start. The session partner names are used as criteria to search the MAPSESS statements until a match is found. You can use the question mark (?) and asterisk (*) for matching names when you follow naming conventions. These are called *pattern-matching* or *wildcard* characters. The ? wildcard character holds a place in the column, specifying that any character can be there. The * wildcard character specifies a match with any character in the column along with any characters to the end of the name.

Network Resource Naming Conventions

Network resource naming conventions enable keep-class coding. The following are example naming conventions:

CDRM*nnnn*
CDRM names

NCPGW*nnn*
Gateway NCP names

NCP*nnnnn*
NCP names

*nnn***PU***nnn*
PU names

*nnn***LU***nnn*
SNA LU names

*nnn***LU***nn***B**
Bisynchronous LU names

CICS*nnnn*
CICS® applications

TSO*nnnnn*
TSO applications

Figure 11 uses this naming convention to specify processing options for different classes of sessions. The PLU name for SSCP sessions is VTAM in this figure.

```
SSCPSSCP KCLASS SAW=YES,DASD=YES,KEEPPIU=84
SSCPGWN  KCLASS SAW=YES,DASD=YES,KEEPPIU=84
SSCPNCP  KCLASS SAW=YES,DASD=YES,KEEPPIU=42
SSCPPU   KCLASS SAW=YES,DASD=NO,KEEPPIU=6
SSCPCICS KCLASS SAW=YES,DASD=YES,KEEPPIU=21
SSCPOTHR KCLASS SAW=YES,DASD=NO,KEEPPIU=4
BSYLULU  KCLASS SAW=YES,DASD=(DATA,FAILURES),KEEPPIU=14
SNALULU  KCLASS SAW=YES,DASD=(DATA,FAILURES),KEEPPIU=12
TSOLULU  KCLASS SAW=YES,DASD=NO,KEEPPIU=12
ALLOTHER KCLASS SAW=YES,DASD=(FAILURES),KEEPPIU=7
M1P      MAPSESS KCLASS=SSCPSSCP,PRI=*,SEC=CDRM*
MIS      MAPSESS KCLASS=SSCPSSCP,PRI=CDRM*,SEC=*
M2       MAPSESS KCLASS=SSCPGWN,PRI=VTAM,SEC=NCPGW*
M3       MAPSESS KCLASS=SSCPNCP,PRI=VTAM,SEC=NCP*
M4       MAPSESS KCLASS=SSCPPU,PRI=VTAM,SEC=???PU*
M5       MAPSESS KCLASS=SSCPCICS,PRI=VTAM,SEC=CICS*
M6       MAPSESS KCLASS=SSCPOTHR,PRI=VTAM,SEC=*
M7       MAPSESS KCLASS=TSOLULU,PRI=TSO*,SEC=*
M8       MAPSESS KCLASS=BSYLULU,PRI=*,SEC=???LU??B
M9       MAPSESS KCLASS=SNALULU,PRI=*,SEC=???LU*
M10      MAPSESS KCLASS=ALLOTHER,PRI=*,SEC=*
```

Figure 11. Example of KCLASS and MAPSESS Statements

The search order against the MAPSESS statements is from top to bottom. The order of the MAPSESS statements and the accuracy of the PLU and SLU names are important. The first match is used for the keep-class member. When a session's PLU and SLU names match a MAPSESS statement, the search ends and the keep-class processing is determined by the KCLASS to which the MAPSESS points.

Use the session monitor DISKEEP PIU command to verify that the intended sessions are being mapped to the desired KCLASS statements. Refer to the *IBM Tivoli NetView for z/OS Installation: Configuring Additional Components* for more information about keep-class processing.

SAW Option

You can keep SAW data selectively by using either the SAW option of the KCLASS statement or the VTAM SAW filter. If you plan to keep SAW data selectively, filter SAW data with the VTAM SAW filter. When SAW data is filtered by the session monitor, VTAM transports the data to the session monitor, which discards the data. Filtering SAW data with VTAM avoids the overhead of transporting the filtered data. When sessions are filtered by the VTAM SAW filter, PIU data for the filtered sessions is not sent to the session monitor. VTAM session awareness filtering is described in *VTAM Network Implementation Guide*.

If you decide to filter SAW data, use care in deciding which sessions to filter. If the SAW data for a session is filtered, no other data can be collected for that session. Consider the following when filtering SAW data:

- SAW filtering with the session monitor KCLASS statement applies only to SSCP-LU and LU-LU sessions. You cannot filter SSCP-PU and SSCP-SSCP SAW data for the session monitor, because session awareness data for these sessions is required in many session monitor functions, such as the response time monitor (RTM), gateway trace, and boundary function trace.
- The VTAM SAW filter enables you to filter SSCP-PU and SSCP-SSCP sessions. Do not filter SSCP-PU and SSCP-SSCP session awareness data unless you are certain that you do not require this data for your environment. If you collect RTM data using the COLLECT RTM * command, filtering SSCP-PU session awareness for a subarea PU causes data from RTM devices in that subarea to be omitted from the collected data.
- RTM data requires session awareness data (SAW=YES) for the related SSCP-PU, SSCP-LU, and LU-LU sessions.
- Non-RTM SSCP-LU sessions and low-priority, stable LU-LU sessions are good candidates for SAW filtering.

DSIEX20-SAW Filter Exit

Installation exit DSIEX20 allows more granular processing of NetView session awareness (SAW) data records. This exit allows the user to accept or discard SAW records based on their content. The exit causes SAW data received from VTAM to be filtered by NetView Session Monitor prior to filtering associated with a KEEPMEM defined with an INITMOD statement in AAUPRMLP containing KCLASS and MAPSESS statements.

The sample DSIEX20 that is included with the NetView product filters out all SSCP-LU session data at session start. The sample DSIEX20 is meant to be used as an example. It should be customized to meet your individual needs. For more information on Exit 20, see *IBM Tivoli NetView for z/OS Programming: Assembler*.

Using DSIEX20 can greatly reduce the CPU and storage resources used by the Session Monitor, primarily with the main NLDM task, AAUTSKLP. However, careful consideration should be given when coding and using this exit. SAW data filtered at initialization might cause certain other functions within session monitor not to have the required data needed for the function. For example, the DSIEX20 sample that is included with the NetView product filters all SSCP-LU data. Having this data filtered at initialization would cause RTM data to be unavailable for the filtered sessions, because RTM must have SSCP-LU data.

KEEPPIU Option

If you are tracing, tailor the number of PIUs kept for different session types to optimize processing and control the amount of trace data kept. The KEEPPIU parameter value is determined as follows:

- If the KEEPMEM member has been coded and the session is mapped to a KCLASS, use the KEEPPIU value coded on the KCLASS statements.
- If the KEEPMEM member has not been coded, use the KEEPPIU value coded on the INITMOD statement in AAUPRMLP (or equivalent). The value in the samples is 7.

Where possible, each keep class should have a different KEEPPIU value. The PIU wrap areas for sessions with the same KEEPPIU value are grouped on the same pages of virtual storage. Separating keep classes by using different KEEPPIU values can improve the locality of reference for PIU data.

To minimize wasted storage, the values you specify for KEEPPIU should be even divisors of 84 (2, 3, 4, 6, 7, 12, 14, 21, 28, or 42). Avoid using values greater than 84. Larger values increase virtual storage requirement of the session monitor and cause the PIU wrap area to span more than one page of virtual storage, requiring a GETMAIN rather than using pooled storage. Small KEEPPIU values keep the virtual storage requirement of the session monitor to a minimum.

The following are some suggested KEEPPIU values for different types of sessions:

LU-LU (APPL-APPL) sessions
42

LU-LU sessions for bisynchronous terminals
14

LU-LU sessions for SNA terminals
12 or 7 (depending on available storage)

SSCP-LU sessions for applications
21

SSCP-LU sessions for terminals
4

SSCP-PU sessions for gateway (GW) NCPs
84

SSCP-PU sessions for other NCPs
42

SSCP-PU sessions for other PUs
6

SSCP-SSCP sessions
84

CP-CP sessions
84

AVAIL Option

The SESSTATS and LOG parameters in initialization member AAUPRMLP specify whether session start and session end records are written to the external log. The records are used to track session accounting (availability and PIU counts) or session availability. If you do not need session accounting, which includes PIU

trace counts, specify SESSTATS=AVAIL on the INITMOD statement in member AAUPRMLP. If you specify the availability option at initialization, you can define whether availability data should be kept for a class of sessions using the AVAIL parameter on the KCLASS statement. You can use the RELOAD command to dynamically change availability by keep class.

When global tracing is not requested (TRACESC=NO and TRACELU=NO) and the availability option is used rather than accounting, the session monitor CPU utilization and working-set size are reduced.

DASD Option

Data for a session is written to the VSAM database when the session ends. This data includes SAW data plus any optional trace and RTM data. For large networks or networks with a high incidence of session ends, the processing required for data recording can be substantial. An important tuning consideration is to evaluate your requirements and use of session history data. If there is history data you know you do not need, filter it out using the KCLASS DASD option.

The following is the list of values for the DASD option of keep-class processing:

DASD=BINDFAIL
Record only if session fails during BIND (BINDF).

DASD=DATA
Record only if trace or RTM data is present.

DASD=FAILURES
Record if session fails or abnormal UNBIND occurs.

DASD=INITFAIL
Record only if session fails before BIND (INITF).

DASD=NO
Do not record any session data.

DASD=RTMDATA
Record only if RTM data is present for this session.

DASD=SESSFAIL
Record only if abnormal UNBIND occurs.

DASD=SESSNORM
Record only if normal UNBIND occurs for this session.

DASD=TRACDATA
Record only if trace data is present for this session.

DASD=YES
Always record the session data (default).

The following is an example of coding multiple options on a KCLASS DASD statement.

```
DASD=(BINDFAIL,RTMDATA,INITFAIL)
```

You can code multiple conditions in a single specification. This example of the DASD option specifies that session data is recorded:

- If the session fails during BIND (BINDF)
- If RTM data is present for this session
- If the session fails before BIND (INITF)

Filtering with the KCLASS DASD Option

By filtering data recording with the KCLASS DASD option, you can reduce host processor utilization, VSAM I/O, and DASD storage used by the session monitor. Analyze the network problems your installation encounters and determine the types and amounts of session monitor information needed to diagnose the problems. For LU-LU sessions, consider using DASD=DATA, DASD=FAILURES, or DASD=RTMDATA. For SSCP sessions for which you do not need information, use DASD=NO. For more information, see "DASD Filtering" on page 69.

If you issue the FORCE command, the session data is recorded regardless of how you coded the DASD parameter.

Special Relationships between the SAW and DASD Parameters

- Unless filtered by VTAM, SAW data is always kept for SSCP-SSCP and SSCP-PU sessions, no matter what is coded on the KCLASS statement.
- If you code SAW=NO on the KCLASS statement for LU-LU sessions, only BINDF and INITF are kept as if you coded DASD=(INITFAIL,BINDFAIL).
- If you code SAW=NO with the INITMOD statement in AAUPRMLP, SAW data is not kept for any session regardless of the session type.

KEEPSESS Option

The KEEPSESS value for a session, specified with either the KEEPSESS parameter in AAUPRMLP or the KEEPSESS option on the KCLASS statement, controls the number of session incidences that are recorded on the session monitor database for a given name pair or DASD group. See "DGROUP Option" on page 69 for more information on DASD groups. The KEEPSESS value for a session is determined as follows:

- The KEEPSESS parameter on the INITMOD statement in AAUPRMLP indicates whether DASD session wrapping is used. If you do not specify a value, the default is zero and session wrapping is not used regardless of any KCLASS KEEPSESS values. Also, sessions will not be recorded into DGROUPs as defined on a KCLASS statement. If you do specify a value, the value is used as the global DASD session wrap count for sessions not mapped by MAPSESS/KCLASS statements and for mapped sessions having no KEEPSESS coded.
- If the global DASD session wrap count (the KEEPSESS parameter in AAUPRMLP) is greater than zero, the KEEPMEM member was coded, and the session is mapped into a KCLASS through a MAPSESS statement, then the value of the KEEPSESS option that is coded on the KCLASS statement is used. If the KEEPSESS option is not coded on the KCLASS statement, the global KEEPSESS value in the range of 1–999 is used for sessions mapping into this KCLASS.
- If the global DASD session wrap count is greater than zero, the KEEPMEM member was coded, and the session is not mapped to a KCLASS, then the global DASD session wrap count that is coded in AAUPRMLP is used. If the last MAPSESS statement is coded with PRI=* and SEC=* (for example, MAPSESS KCLASS=ALLOTHER,PRI=*,SEC=*), then all sessions that do not match a previous MAPSESS statement are mapped into the KCLASS specified (in this example, ALLOTHER).

See "Managing Database Size" on page 70 for considerations on controlling the size of the session monitor database.

DGROUP Option

The DGROUP option can be used in conjunction with the KEEPSESS option on the KCLASS statement to control the number of session incidences that are recorded on the session monitor database for a group of sessions. Using the KEEPSESS option alone is not effective for controlling the number of session incidences on the database for applications, such as TSO and the NetView program, where the primary LU (PLU) session partner name contains a counter (for example, TSO00001, TSO00002, NETV001, NETV002). The DGROUP option can be used to group sessions together, so that the KEEPSESS value can be applied to control the number of session incidences for the group instead of for the individual name pairs.

DGROUP specifies the grouping characteristics of all MAPSESS sessions mapping to a KCLASS statement. You can group sessions under a user-supplied name, or defer the DGROUP name until the session ends by using the *PRI or *SEC values. Deferring the DGROUP name enables the definition of multiple DGROUPs with a single KCLASS statement, with the DGROUP name being either the primary or secondary session partner name. All defined DASD GROUPs (DGRPs) can be displayed using the NLDM LIST DGRP command.

Figure 12 shows an example of how to use the KEEPSESS and DGROUP options to control the number of session incidences on the database for a group of sessions. In this figure, the NetView domain identifier is N2412, and the TSO VTAM application name is TSO12.

```
⋮
TSO      KCLASS SAW=YES,+
                DASD=FAILURES,+
                KEEPSESS=200,+
                DGROUP=(TSO,RENAME,PRI)
NETVIEW  KCLASS SAW=YES,+
                DASD=FAILURES,+
                KEEPSESS=100,+
                DGROUP=(NETVIEW,RENAME,PRI)
⋮
TSO      MAPSESS KCLASS=TSO,PRI=TSO12*,SEC=*
NETVIEW  MAPSESS KCLASS=NETVIEW,PRI=N2412*,SEC=*
⋮
```

Figure 12. Example of KCLASS and MAPSESS Statements Using the KEEPSESS and DGROUP Options

Managing the Session Monitor Database

The following sections describe techniques for managing the session monitor database.

DASD Filtering

You can filter session history recording using the DASD option of the KCLASS statement, which enables you to specify recording conditions for sessions mapped to a keep class. For example, you can record only sessions that have RTM data by specifying DASD=RTMDATA for the keep class. See “DASD Option” on page 67 for information about the DASD option.

You can also filter session history recording based on the sense codes and reason codes that accompany the session awareness notification. The sense code filter consists of 25 entries in DSICTMOD (CNMS0055). Each entry consists of an 8 byte

field specifying the sense and reason codes, and a numeric field indicating the number of bytes used for comparison in the filter. By modifying DSICTMOD, you can filter DASD recording based on up to 25 sense codes.

To analyze your session monitor database use sample CNMSJM10, these samples print a report containing the distribution of the sense codes on the database. Use this report to determine which sense codes occur most frequently and where to concentrate your filtering efforts.

Filter sense codes that occur frequently and are not useful in network problem determination. For example, X'087D0001' is a normal response to an unsuccessful cross-network session setup when you have multiple gateways and VTAM checks an incorrect gateway name first.

Refer to the *IBM Tivoli NetView for z/OS Installation: Configuring Additional Components* for information about deciding which sense codes to filter, how to add sense codes for filtering, and how to end sense code filtering.

Managing Database Size

As sessions end, the session monitor records history data to the VSAM database. The database eventually fills up. There are three principal methods to manage the size of the database.

1. Clear the entire database using the RESETDB command or the CLEAR parameter of the DBAUTO command. This method is quick, but all of the session history data is lost at once, rather than in stages. To use this method, ensure that the REUSE operand is specified for both AAUVSPL and AAUVSSL data sets on the cluster definition in member CNMSI101.
2. Purge data for sessions that ended before a specified time by using either the PURGE command or the PURGE parameter of the DBAUTO command. An advantage of this method is that the purge activity can be scheduled for an off-shift period, deferring the I/O needed to delete data and minimizing prime-shift session monitor I/O. For large databases, however, the purge activity can take a long time.
3. Use the KEEPSESS parameter or the KEEPSESS option of the KCLASS statement to control the number of session incidences on the database for a given name pair or group of sessions (specified by the DGROUP option). For example, if the KEEPSESS value for a name pair is 10, up to 10 incidences are maintained on the database. When the 11th incidence is recorded, the first incidence is erased. Using KEEPSESS requires additional I/O to delete data when sessions end. Session ends that delete data (KEEPSESS value exceeded) require approximately three times the I/O required to record sessions that do not delete data. See "KEEPSESS Option" on page 68 for more information about KEEPSESS.

Method 1 (clearing the entire database) performs better than the other two alternatives. However, if method 1 does not meet your needs, method 2 (purging the database) is preferred over method 3 (using KEEPSESS). Purging data enables you to defer session incidence deletions to off-peak hours.

Methods 2 and 3 require that you reorganize the database periodically to reclaim previously used free space. Without periodic reorganization, the VSAM data set eventually runs out of free space, causing an end-of-file condition. See "VSAM Database Maintenance" on page 101 for information about reorganizing a VSAM database.

You can control your database with KEEPSESS and purge activity in combination. If certain name pairs or groups of sessions have a high incidence of session ends and you want to keep them from filling up your database, use KEEPSESS to limit the session incidences for those session pairs, and purge the data for other sessions. Because additional processing is required to control the wrap count, purge activity is more efficient if you do not purge sessions controlled by KEEPSESS.

PURGE Parameter

The PURGE parameter in AAUPRMLP is used to control writing an end-time record to the database for use in purge processing. PURGE=SPEED (the default) writes an end-time record. Specifying PURGE=DASD instructs the session monitor to optimize DASD space and not write the end-time record. Use the following guidelines for tuning this parameter.

- Use the default of PURGE=SPEED if you use the PURGE command to control your database.
- Set PURGE=DASD if you use KEEPSESS, because purge processing is not done and the end-time records are not needed.
- Use PURGE=SPEED if you use both PURGE and KEEPSESS (using KEEPSESS selectively and using purge processing for the rest of your database). PURGE=DASD has a more adverse effect on purge processing than the extra end-time record has on session history recording.
- Set the PURGE parameter to DASD if you use the RESETDB command. There is no need for the end-time record in this case. Ensure that your NLDM VSAM cluster definition (CNMSI101) has the REUSE operand. The REUSE operand is required when using the RESETDB command.

SMDR Command

You can stop session monitor data recording by using the NLDM SMDR STOP command. Do not use this command when a purge is running, because NLDM has separate control blocks for updating and deleting records from the VSAM database in use. When the SMDR STOP command is issued, sessions on the VSAM Record Queue go through normal cleanup processing, but the session history data is discarded instead of being written to VSAM. Recording to the external log (SMF) proceeds normally and is not affected by the SMDR command. The SMDR START command resumes the recording of session history data to VSAM. Message AAU273I is sent to the NetView log stating that VSAM recording has resumed. This message also notifies the user of the total number of sessions lost (session history data discarded) because of SMDR STOP.

If a severe VSAM I/O error occurs, NLDM will automatically deactivate session monitor VSAM recording. Browse the NetView log or system log for either message AAU272I or message AAU022I. Determine the error by interpreting the major and minor return codes contained in the error message. When the VSAM I/O error is resolved, issue SMDR START to resume VSAM recording.

SMDR QUERY can be used to determine database VSAM recording status. This is helpful if SESSMDIS is showing a backup on the VSAM Record Queue.

See the *IBM Tivoli NetView for z/OS Command Reference Volume 1 (A-N)* or the NetView online help for a description of the SMDR command.

SESSMDIS Command

The SESSMDIS command displays session monitor session counts, storage use, and workload traffic information. SESSMDIS uses a view panel to display a subset of the counters that are written to the external log with the NLDM RECORD STRGDATA command. Figure 13 shows sample output of the SESSMDIS command.

```
SESSMDIS  Session Monitor Session and Storage Information 13:07:04  Page 1 of 1
 1
Options in Effect   SAW: YES  LU Trace: NO   CP/SSCP Trace: NO  SESSTATS: NO
 2
Session Counts        CP-CP   SSCP-SSCP   SSCP-PU   SSCP-LU     LU-LU  Filtered
       Current:           0           0         1        35         8         0
       Maximum:           0           0         1        35         8         0
 3
Session Monitor Storage Usage
     Resources:          8K        Sessions:      16K   Session Parms:       0K
     PIU Trace:          0K        SESSTATS:       0K             RTM:       0K
          RSCV:          0K           Other:    1299K
         Total:       1323K
 4
VSAM Record Queue
       Current:           0         Maximum:           3
 5
Session Monitor Workload since 05/26/13 15:29:59
                  SAW       Session   Session     PIU          PIUs    Sessions
                  Buffers    Starts      Ends     Buffers              Recorded
     4 seconds:         0         0         0           0         0           0
         Total:        86        89        44           0         0          44

ENTER= Refresh             PF2= End  PF3= Return
```

Figure 13. Session Monitor Session and Storage Information Panel

The following list describes the fields displayed:

1 Session monitor options in effect

SAW
Displays the setting of the SAW parameter in AAUPRMLP.

LU Trace
Displays the setting of the TRACELU parameter in AAUPRMLP.

CP/SSCP Trace
Displays the setting of the TRACESC parameter in AAUPRMLP.

SESSTATS
Displays the setting of the SESSTATS parameter in AAUPRMLP.

2 Session counts (current and maximum)

CP-CP
The number of active CP-CP sessions for which the session monitor is maintaining session awareness.

SSCP-SSCP
The number of active SSCP-SSCP sessions for which the session monitor is maintaining session awareness.

SSCP-PU
The number of active SSCP-PU sessions for which the session monitor is maintaining session awareness. This includes PU type 4 and PU type 2 sessions.

SSCP-LU
The number of active SSCP-LU sessions for which the session monitor is maintaining session awareness.

LU-LU
The number of active LU-LU sessions for which the session monitor is maintaining session awareness.

Filtered
The number of active sessions (of all types) that are being filtered by either the VTAM or the NetView SAW filters.

3 Session monitor storage usage

Resources
The number of KB of storage allocated for resource information.

Sessions
The number of KB of storage allocated for session information.

Session Parms
The number of KB of storage allocated for session parameter information. This information is kept only for sessions that are being PIU traced.

PIU Trace
The number of KB of storage allocated for PIU trace information. This storage is used for the PIU wrap areas. Modifying the KEEPPIU parameter or the KEEPPIU option of the KCLASS statement changes this number. The PIU wrap area for a session is allocated when the first PIU for the session is received.

SESSTATS
The number of KB of storage allocated for session accounting or availability information.

- If accounting is active (SESSTATS=YES), the accounting storage for a session is allocated when the first PIU for the session is received.
- If availability is active (SESSTATS=AVAIL), the availability storage for a session is allocated when the start notification for the session is received.

RTM
The number of KB of storage allocated for response time monitor (RTM) data. Modifying the KEEPRTM parameter can change this number. The RTM wrap area for a session is allocated when the first RTM data is received for the session. If you do not collect RTM data with the COLLECT command, the wrap area is allocated when the RTM data is received at session termination. A small KEEPRTM parameter is useful in that case.

RSCV
The number of KB of storage allocated for route selection control vector data.

Other
This field contains miscellaneous storage being used by the session monitor, such as work storage and internal control blocks.

Total
The total amount of storage allocated for active sessions. When sessions end, rather than freeing the storage back to the operating

system, the session monitor keeps the storage and reuses it for new sessions (to avoid dynamic storage get and free requests). Therefore, the total storage given on the SESSMDIS panel is not necessarily equal to the total virtual storage allocated by the session monitor.

4 VSAM Record Queue (current and maximum)

The number of sessions that have ended and are waiting to be recorded to VSAM. This number includes sessions that might have their session history recording filtered (see "DASD Option" on page 67). Sessions that have ended spend a few seconds on the VSAM record queue so that related data can arrive from the network. If a large number of sessions end in a short amount of time, the record queue can build up. By repeatedly refreshing the SESSMDIS panel, you can watch the queue shrink and grow.

5 Session monitor workload traffic counters (total and 4 second rate)

The "since" time stamp indicates when the last NLDM RECORD STRGDATA command was issued or when the session monitor was started. The following traffic counters represent the number of traffic items processed since the time stamp.

SAW Buffers
The number of session awareness buffers that have been processed.

Session Starts
The number of session starts that have been processed.

Session Ends
The number of session ends that have been processed.

You can use the previous three numbers to estimate the SAW buffering ratio. The buffering ratio can be calculated by summing the starts and ends, and dividing by the number of SAW buffers. The SAW buffering ratio is useful in tuning the SAW buffer allocation. See "SAW Buffer Allocation and Tuning" on page 57 for more information.

PIU Buffers
The number of PIU buffers that have been processed.

PIUs
The number of PIUs that have been processed.

You can use these numbers to estimate the PIU buffering ratio and the average fullness of the PIU buffers. For the PIU buffering ratio, divide the number of PIUs by the number of PIU buffers. See "PIU Buffer Allocation and Tuning" on page 60 for information on estimating the PIU buffer fullness percentage and tuning the PIU buffer allocation.

Sessions Recorded
The number of sessions for which VSAM recording has taken place (sessions that are not DASD filtered).

You can use the number of sessions with the Session Ends count to determine the NLDM session recording rate. If the number of sessions recorded is equal to the number of session ends, then no sessions have DASD recording filtered. If AAUTSKLP is showing high CPU usage from TASKUTIL output, consider filtering DASD recording. If the rate of session ends is constantly high, determine if certain sessions are being restarted and immediately ending again. This can be determined by running sample job CNMSJM10 and examining the output for

specific sense codes that would indicate a failure (for example: INITF, BINDF). See "DASD Filtering" on page 69 for more information.

The SESSMDIS command can be run under an autotask and its output directed to the network log. You can set a timer to run SESSMDIS under an autotask, so that you can examine the SESSMDIS output later for workload activity trends. The total current explicit route (SART) count can be viewed. To obtain SART data, the SESSMDIS command must be issued either in a window (for example, `Window SESSMDIS`) or the results of the SESSMDIS command must be sent to the log. The SART data can not be displayed on the SESSMDIS window because there is not enough space for this. An additional line of output is returned for the `Window SESSMDIS` command and it is also returned to the NetView log. It appears at the end of the SESSMDIS output in the following format:

```
TOTAL CURRENT EXPLICIT ROUTES (SARTS):          37
```

Use the SART information as a guide in setting the value of the NLDM.ERCOUNT statement in the CNMSTUSR or C*xx*STGEN member, or in the AAUPRMLP member. The complete `Window SESSMDIS` output looks similar to the following example:

```
DSI378I SESSMDIS DISPLAY
SESSMDIS  SESSION MONITOR SESSION AND STORAGE INFORMATION 13:14:26
OPTIONS IN EFFECT   SAW: YES  LU TRACE: NO   CP/SSCP TRACE: NO  SESSTATS: NO
SESSION COUNTS        CP-CP   SSCP-SSCP   SSCP-PU   SSCP-LU     LU-LU  FILTERED
       CURRENT:           0           1         1        29         5         0
       MAXIMUM:           0           1         1        29         6         0
SESSION MONITOR STORAGE USAGE
     RESOURCES:          8K        SESSIONS:      12K   SESSION PARMS:       0K
     PIU TRACE:          0K        SESSTATS:       0K             RTM:       0K
          RSCV:          0K           OTHER:    1673K
         TOTAL:       1693K
VSAM RECORD QUEUE
       CURRENT:           0         MAXIMUM:           2
SESSION MONITOR WORKLOAD SINCE 05/16/13 13:13:51
                  SAW       SESSION   SESSION     PIU          PIUS    SESSIONS
                  BUFFERS    STARTS      ENDS     BUFFERS              RECORDED
     4 SECONDS:         0         0         0           0         0           0
         TOTAL:         4        39         2           0         0           2
TOTAL CURRENT EXPLICIT ROUTES (SARTS):          1
```

RTM Data Collection

The **COLLECT RTM** command gathers response-time data from PUs with the RTM feature.

If you collect data from a large network, issue separate **COLLECT** commands for subsets of the PUs rather than collecting from all of the PUs at one time. If you use **COLLECT ***, you can cause a large burst of RUs to flow in the network. Stagger the separate **COLLECT** commands to spread out the flow of RUs over a longer period of time.

LUCOUNT Parameter

The LUCOUNT parameter is in the initialization member for the AAUTSKLP (default AAUPRMLP) member and in the CNMSTYLE initialization member.

If you use the CNMSTYLE member, modify LUCOUNT in the CNMSTUSR or C*xx*STGEN member instead of in the AAUPRMLP member. The following example shows the default entry in the CNMSTYLE member:

```
NLDM.LUCOUNT=4000
```

Accurate use of the LUCOUNT parameter is pertinent for Session Monitor performance. The LUCOUNT parameter provides the following functions:

- Specifies the number of LUs known by the session monitor. The default value is 4000.
- Optimizes control block search algorithms.
- Allocates session-related storage.

Specify the number of LUs in your network for LUCOUNT. This number should include SNA interconnection (SNI) sessions in your network. The number you specify does not have to be exact; however, too small a value could hinder access to session blocks and cause an increase in NLDM initialization time and CPU usage. A value in excess of the number of LUs can result in unused virtual storage but might improve access to session blocks. It is better to overestimate LUCOUNT than underestimate. For every 250 LUs specified, the search tables require 4K virtual storage.

Users *must* use the SESSMDIS command to determine a value for LUCOUNT. After the complete network is activated, issue the SESSMDIS command and simply add the SSCP-LU and LU-LU session counts (maximum, not current). This value provides a conservative estimate for the LUCOUNT. As most networks are expanding, periodically monitor the coding of LUCOUNT as previously outlined. Having a LUCOUNT that is coded too low is a common problem and impacts your performance.

Chapter 7. Tuning for the NetView Management Console

The NetView management console uses interactive graphics to display pictures, or *views*, that represent a network, a portion of a network, or a group of networks at various levels of detail. These views show the network resources and systems that you are monitoring. When you monitor a network, resource status changes are reflected graphically in the views.

The NetView management console consists of a two tier client-server relationship.

Client and server code is installed on each workstation and runs as a Java™ application, displaying data from RODM. The server portion of the workstation code, in turn, acts as a client requesting data from the host NetView program. The NetView management console was adapted from the graphic data server, therefore, most of the GMFHS code is unaffected.

Because the NetView management console function is accomplished through cooperative processing between the host and the programmable workstation components, this section describes tuning techniques for each component. For more information about host tuning techniques, see Chapter 7, "Tuning for the NetView Management Console."

Workstation Tuning Techniques

This section describes tuning techniques for the NetView management console that can improve performance at the workstation. These tuning techniques are arranged in order of expected effect on performance, with the most important tuning considerations listed first.

1. Determine the amount of working set storage required for the NetView management console on the workstation. See "Storage Estimates" on page 78.
2. Use powerful client workstations if there is a significant amount of view update activity and a large total number of resources are displayed in the active views. See "Hardware Requirements" on page 78 and "Client Performance" on page 79.
3. Limit the background pictures used in client workstation views. See "Using Background Pictures" on page 80.
4. Use high-speed connections instead of low-speed connections between the status focal point and the server workstation. See "Status Focal Point to Programmable Workstation Connectivity" on page 80.
5. Take advantage of the server-client configuration features. See "Server-Client Configurations" on page 80.

If you are experiencing delays when views are being built on the workstation, consider the following;

- When running on any Windows workstation, open Task Manager and select the Performance window. This window shows storage and system usages. Other platforms have similar tools. This can help determine whether data is being sent or processed in the event of a potential suspended (hung) situation.
- Be careful when clicking on a view. Watch the spinning icon on the top right of the NetView management console Client window. When it is spinning, data is being requested/processed.

- Do not click on another view until the previously selected view is completely displayed. Doing so causes the NetView management console to suspend or possibly even abend.
- If a view seems to be suspended and is not displayed, use the exit door to logoff of the NetView management console Client. Check the client, server, and NetView logs for an indication of a potential problem. If no error messages are found, attempt logging back on to the client.
- Whenever possible, try to not have background views open. Status changes are dynamic in the NetView management console. If multiple views are open, each one will be checked to determine if it needs to be updated. To close background views, right-click the background view and select the **Close** option.
- Monitor all of the clients on each server. Make sure that clients logoff when not using the NetView management console and at the end of each day. Failure to do this results in excessive network traffic and potential network performance problems.
- Have only one component of the NetView management console code client or server active on a workstation at a time to maintain stability and performance.
- If Task Manager on the client shows excessive CPU usage because of Java and the NetView management console, consider upgrading the client workstations CPU.
- For improved performance when multiple views are active or when views are being cycled, run with a minimum graphics resolution. To set the resolution, adjust the color setting in your display properties. Use a 32-bit or lower resolution (such as 32-bit High Color or 16 bit Medium Color). Do not use a 64 bit or higher resolution (such as 64 bit True Color).

In addition to the previous tuning considerations, several operands can affect the NetView management console performance.

In the server.properties file that is included with the NetView management console, the following value affects performance:
- statusUpdateAndViewChangeTicker — Default is 1000 (1 second).
- statusUpdateInterval — Default is 1.
- statusFlushCount — Default is 15.
- viewChangeInterval — Default is 3.
- viewChangeFlushCount — Default is 10.

These values should all be lowered simultaneously. The new values are picked up when the NetView management console server is recycled. Monitor the NetView management console performance after making the changes.

Storage Estimates

To ensure optimum performance of the workstation-based components of the NetView management console, minimize the amount of paging and swapping that can occur. You can do this by providing as much memory as will be used on a regular and consistent basis. There must be enough workstation memory to consistently contain the working set. If severe memory constraints exist, abends can occur.

Hardware Requirements

This section lists hardware requirements for the following environments:

- "Intel Platform Workstations" on page 79
- "UNIX Platform Workstations" on page 79

- "Servers and Consoles"

Intel Platform Workstations

For Intel platform workstations, ensure that the minimum hardware requirements as outlined in the *Tivoli NetView for z/OS Program Directory* are met.

UNIX Platform Workstations

For UNIX platform workstations, ensure that the minimum hardware requirements as outlined in the *Tivoli NetView for z/OS Program Directory* are met.

Servers and Consoles

The following requirements are additional requirements beyond the minimum requirements for Intel or UNIX platform workstations:

- 256 MB (RAM) for each console instance
- Between 256 and 384 MB of swap/page space

  The formula for calculating each console instance is: 1.5 to 2.5 times the amount of RAM for systems with 256 MB (or more).

  Note:

  1. If you have less than the minimum amount of RAM, you could easily have situations where you will page heavily. Not only will this degrade performance, but you will probably require more page/swap space for this activity. If this occurs, add another 33% to the combined total of memory and swap/page space.
  2. If you run other applications on these systems, increase the amount of installed RAM and page/swap space accordingly to provide room for the additional applications to work without adversely affecting the NetView management console.
  3. For LINUX on z/Series requirements, refer to the README file that is included with the NetView management console code.

Client Performance

If many resources are in the views displayed at a client workstation, consider using a high-performance processor for this client workstation. The activity of drawing and redrawing the views can take considerable amounts of processor resources. This resource use can be particularly high when view navigation is necessary during the arrival and display of a large number of resource status updates. This situation is likely when a large burst of status changes occurs, such as during network activation.

Ensure that the minimum hardware requirements, as outlined in the *Tivoli NetView for z/OS Program Directory* are met. If the CPU and storage requirements are not met, then performance degradation will occur.

To minimize the number of resources actively displayed at a client workstation, use views containing aggregate resources that represent the real resources you are monitoring. From aggregate resources, you can navigate to views containing failing resources by using the fast path to failing resource feature. You can customize the effect real resources have on an aggregate resource. Refer to the *IBM Tivoli NetView for z/OS User's Guide: NetView Management Console* for information about view navigation and adjusting aggregation for a resource.

Closing views that you are no longer using helps to ensure that client workstation resources are available to handle a burst of client activity.

If you use the Cycle Windows window to cycle through views you have open for monitoring, lower values for the cycle delay interval will result in higher view drawing activity.

Using Background Pictures

Adding a background picture to a view can impair client workstation performance. Including a background picture can increase response times for the initial view display and whenever the view is redrawn. The impaired performance is caused by the storage requirements of the background picture and the CPU resources needed to draw it.

The CPU and memory requirements vary depending on the detail and complexity of the background picture. If you are using detailed or complex background pictures, increased storage requirements can increase response times for any other activity on the client workstation if these requirements cause your working set storage requirements to exceed the amount of available memory.

Status Focal Point to Programmable Workstation Connectivity

The speed of the connections from the status focal point to the server workstation has a large impact on NetView management console performance for large bursts of updates.

Processing of bursts generated by network failures is affected by link speed more than is processing of bursts generated by network recovery.

These two factors combined cause the number of status changes per unit of time to be greater for network failure than for recovery. Because of these factors, the larger throughput provided by higher-speed connections is of more benefit during network failures.

Server-Client Configurations

Because the IP communication feature is being used as the communication vehicle for the NetView management console, you can connect console workstations with the server workstation in a number of ways. For example, you can have the server workstation attached to a token ring and in session with console workstations on the same ring. The client workstation can be anywhere that an IP session can be established. Also, all NetView management console workstations can be combined server-console workstations.

When you select the workstation server-console configuration, several factors can affect the overall performance. The server workstation maintains an in-storage database of the current network resource status for opened views. The activity associated with resource status changes is both CPU and memory intensive. The server workstation should be used as a standalone server workstation. Do not monitor views that can be subject to continuous or large bursts of status update activity because updating the graphical views is CPU intensive. Also, ensure that other applications that might be running on the server and console workstation are not CPU and memory intensive.

Host Tuning Techniques

This section describes tuning techniques for the NetView management console at the host.

NETCONV

You can use either IP or LU 6.2 with the NETCONV command. If you are using LU 6.2, establish an LU 6.2 communication session between the status focal point host and server workstation. When this session is established, the status focal point forwards the current status of all monitored resources to the server workstation.

If the NETCONV command is issued before the network is activated, the focal point forwards the initial status (never active) of all the monitored resources to the server workstation. When the network is activated, the current status of all monitored resources is also forwarded to the workstation.

Issue the NETCONV command after network activation to avoid processing multiple status updates at network activation time and reduce elapsed time for status display.

See the *IBM Tivoli NetView for z/OS Command Reference Volume 1 (A-N)* or the NetView online help for more information about using the NETCONV command.

DUIGINIT Parameters

The following parameters in DUIGINIT (the GMFHS initialization member) affect the NetView management console performance:

- LCON-STATUS-DELAY-MAX (The default value is 10.)
- LCON-STATUS-DELAY-TIME (The default value is 50.)
- LCON-EVCHANGE-BUFFER-INTERVAL (The default value is 500 [5 seconds]).
- LCON-AGG-BUNDLE-INTERVAL (The default is 500 [5 seconds]).

Use the following procedure to change the parameters:

- Reduce all parameters simultaneously
- Recycle GMFHS
- Monitor the NetView management console performance to determine if the changes have improved the NetView management console performance.

Refer to the *IBM Tivoli NetView for z/OS Administration Reference* for more information about these parameters.

Chapter 8. Tuning for the Resource Object Data Manager

The NetView Resource Object Data Manager (RODM) is a data cache that is designed to store network configuration and status information about system resources. You can use RODM to automate network management functions associated with the resources defined to RODM. In addition, you can write RODM applications to perform other network management and automation tasks.

For more information on the object-oriented terms used by the NetView program to describe RODM and its data model, see the *IBM Tivoli NetView for z/OS Resource Object Data Manager and GMFHS Programmer's Guide*.

Tuning Techniques

The following major tuning techniques for RODM are described in this chapter:

1. Keep RODM logging to a minimum for production systems by using LOG_LEVEL 8. See "Customization Parameters" on page 91.
2. See "Estimating Storage Usage" on page 133 to determine virtual storage use and DASD space requirements for the checkpoint data sets. See "RODM Data Sets" on page 84. Ensure that the MVS system has an adequate paging system. If your system is storage-constrained, consider moving workloads to other systems or enhancing the MVS paging system.
3. Checkpoint RODM whenever there have been significant changes to the structure or topology of the objects in RODM, such as after loading objects with the loader facility. Do not use checkpoints to capture the status of objects in RODM. When a RODM warm start is performed, the RODM applications which created the objects should update the object status when the application is initialized after the RODM warm start. A warm start is relatively fast. See "Warm Start and CHKPT Commands" on page 84.

   Note: If your only RODM applications are MultiSystem Manager and SNATM, do not use checkpoints.
4. Generate RODM API statistics to analyze the content and activity of RODM. See "RODM API Statistics" on page 85.
5. Generate RODM cell pool statistics to analyze the storage usage of RODM. See "RODM Cell Pool Statistics" on page 87.
6. Specify a minimum number of CONCURRENT_USERS. Extra storage is required for each user. See "Customization Parameters" on page 91.
7. Run RODM at the same dispatching priority as the NetView program.
8. If you are writing a RODM application, see "Programming Recommendations" on page 91.
9. The maximum number of objects supported is 2 097 135. For objects typical of the topology and status monitoring of the NetView program, the operational number of objects is estimated to be 1 500 000. No code changes have been made to increase the number of classes and the number of fields supported by RODM.

   Note: To use the larger limit on the number of objects, you must cold start RODM. Otherwise, the original limit is used if RODM is warm started. When

RODM was cold started and a checkpoint was taken, subsequent warm started instances of RODM continue to use the new maximum number of objects.

Warm Start and CHKPT Commands

A warm start takes significantly less time than a cold start. The actual data still resides on the data-in-virtual (DIV) checkpoint data set and is brought into extended storage (in 4 KB pages) as the data is referenced. The warm start provides only an in-storage map of the DIV data set.

Take a checkpoint of RODM when there have been significant changes to the structure or topology of the objects in RODM, such as after loading objects with the loader facility. The checkpoint provides a map of the latest changes to the VSAM linear data sets (LDSs). Do not use checkpoints to capture the status of objects in RODM. When a RODM warm start is performed, the RODM applications that created the objects should update the object status when the application is initialized.

Note: If your only RODM applications are MultiSystem Manager and SNATM, do not use checkpoints. If you do not use the RODM checkpoint function, you can disable it and avoid allocating the checkpoint data sets described in "RODM Data Sets." To disable the checkpoint function, comment out the DD statements for EKGMAST, EKGTRAN, and EKGD00X in your copy of the RODM startup procedure (EKGXRODM).

RODM Data Sets

There are four data definition names in the supplied RODM JCL sample EKGXRODM that define the RODM checkpoint VSAM linear data sets (LDSs). The data definition names are:

EKGMAST
The data set for the master window. Use the system defaults for the master window size, which is 4 cylinders.

EKGTRAN
This is the checkpoint data set for the segment window storage. The preferred allocation is 96 cylinders, which is the default.

EKGD001 and EKGD002
The checkpoint data sets for data window (checkpoint) storage. Allocate sufficient checkpoint storage to contain all data model storage, plus extra storage in case your system has a burst of activity that overruns the current allocation. The default space allocation is 72 cylinders.

See "Estimating Storage Usage" on page 133 to determine space allocations for these data sets. If you are migrating from an earlier release of NetView, it is likely that you will need to increase your checkpoint data set allocations.

The sample VSAM LDS definitions are in the EKGDWIND member.

You can use multiple checkpoint data sets to minimize the average size needed and provide for increased efficiency during the checkpoint. You can define additional checkpoint LDSs by adding data definition names in the EKGDWIND member (such as EKGD003 and EKGD004).

If your only RODM applications are MultiSystem Manager and SNATM, do not use checkpoints. If you do not use the RODM checkpoint function, you can disable it and avoid allocating the checkpoint data sets. To disable the checkpoint function, comment out the DD statements for EKGMAST, EKGTRAN, and EKGD00X in your copy of the RODM startup procedure (EKGXRODM).

Error Messages:

1. If you receive error message EKG1110I, increase the size of the EKGTRAN data set for segment window storage. Because you can define only one LDS for the segment window allocation, a cold start is required.
2. If you receive error message EKG1111I, increase your space allocation for the EKGD001 and EKGD002 data sets, or add VSAM checkpoint LDSs (such as EKGD003 and EKGD004).
   - Error message EKG1111I is issued even though you are not taking a checkpoint, when the size of your data model (classes and objects) grows beyond the size of the data windows present in your checkpoint data sets, another data window cannot be allocated. RODM continues to operate until the last data window is filled.
   - You can take a checkpoint and warm start RODM when adding a checkpoint LDS.
   - If the existing LDSs are reallocated with additional space, you must cold start RODM.

RODM API Statistics

RODM API statistics enable you to analyze the content and activity of RODM. Use the STATAPI parameter, of the MVS MODIFY command to generate API statistics in a type 8 log record and the CLEAR option to clear the counters.

RODM API statistics give you the number of times a call was made or a method triggered since RODM was cold started and since the counters were cleared using the MVS MODIFY *rodmname*,STATAPI,CLEAR command for the following categories:

- User API (UAPI) calls
- Method API (MAPI) calls
- Object-specific (OS) methods triggered by RODM
- Object-independent (OI) methods triggered by users of RODM

RODM API statistics also specify the number of times a call was a success or failure. These statistics also specify the type of method:

- Change
- Notify
- Query

Figure 14 on page 86 is an example of the output from the RODM log formatter for log record type 8 API statistics.

```
Log_type      : 8   (Statistics)        RBA           : 6213116
Record number : 31277                   Record Length : 1324
Transaction ID: 0000000000000000x       Timestamp     : Sat Mar 30 11:33:30 2013
User Appl ID  :
API Version   : 1
Stat Type     : 5      (API Statistics )
Last Clear Timestamp    : Fri Mar 29 19:59:03 2013
Output Timestamp        : Sat Mar 30 11:33:31 2013
No. of Query Triggered  : 0
No. of Change Triggered : 18140
No. of Notify Triggered : 2273
No. of Objdel Triggered : 0
No. of Permanent Entries: 14
  Permanent Count Data  :
    Function ID         : 1302   (Create a Class)
      Perm UAPI Count   : 0000000000000044x
      Perm MAPI Count   : 000000000000001Ex
    Function ID         : 1304   (Create a Field)
      Perm UAPI Count   : 00000000000006F6x
      Perm MAPI Count   : 000000000000008Cx
    Function ID         : 1306   (Create a Subfield)
      Perm UAPI Count   : 0000000000001B67x
      Perm MAPI Count   : 0000000000000252x
    Function ID         : 1405   (Link 2 Objects - Methods Triggered)
      Perm UAPI Count   : 000000000000A091x
      Perm MAPI Count   : 0000000000005D0Ex
    Function ID         : 1407   (Unlink 2 Objects - Methods Triggered)
      Perm UAPI Count   : 0000000000000801x
      Perm MAPI Count   : 000000000000006Dx
    Function ID         : 1409   (Create an Object)
      Perm UAPI Count   : 00000000000030ACx
      Perm MAPI Count   : 0000000000000267x
    Function ID         : 1410   (Delete an Object)
      Perm UAPI Count   : 0000000000000126x
    Function ID         : 1412   (Add Notification Subscription)
      Perm UAPI Count   : 0000000000000003x
      Perm MAPI Count   : 000000000000147Fx
    Function ID         : 1413   (Delete Notification Subscription)
      Perm MAPI Count   : 00000000000004CCx

⋮
```

Figure 14. RODM Log Record Type 8 for API Statistics (Part 1 of 2)

```
No. of Regular Entries  : 48
  Regular Count Data    :
    Function ID         : 1101   (Connect to RODM)
      Success UAPI Count: 10
    Function ID         : 1102   (Disconnect from RODM)
      Success UAPI Count: 7
    Function ID         : 1302   (Create a Class)
      Success UAPI Count: 68
      Success MAPI Count: 30
    Function ID         : 1304   (Create a Field)
      Success UAPI Count: 1782
      Success MAPI Count: 140
    Function ID         : 1306   (Create a Subfield)
      Success UAPI Count: 7015
      Success MAPI Count: 594
    Function ID         : 1401   (Change a Field)
      Success UAPI Count: 111544
      Fail UAPI Count   : 12423
      Success MAPI Count: 182551
    Function ID         : 1403   (Change a Subfield)
      Success UAPI Count: 102
      Success MAPI Count: 18151
    Function ID         : 1405   (Link 2 Objects - Methods Triggered)
      Success UAPI Count: 41105
      Fail UAPI Count   : 9931
      Success MAPI Count: 23822
      Fail MAPI Count   : 7079
    Function ID         : 1407   (Unlink 2 Objects - Methods Triggered)
      Success UAPI Count: 2049
      Success MAPI Count: 109
    Function ID         : 1409   (Create an Object)
      Success UAPI Count: 12460
      Fail UAPI Count   : 23
      Success MAPI Count: 615
    Function ID         : 1410   (Delete an Object)
      Success UAPI Count: 294
      Fail UAPI Count   : 2
```

Figure 15. RODM Log Record Type 8 for API Statistics (Part 2 of 2)

If you specify the CLEAR option when writing the API statistics, the regular count data counters are reset to zero after being written to the log (the permanent count data counters are not affected by the CLEAR option). You might find it convenient to write the API statistics on a timer basis using the NetView EVERY command. If you use the CLEAR option to clear the counters each time you write them, the counters show which API calls were made during the timer interval. Clearing the counters periodically also ensures that the counters do not overflow.

See the *IBM Tivoli NetView for z/OS Troubleshooting Guide* for a description of all of the fields in RODM log record type 8.

RODM Cell Pool Statistics

You can use RODM cell pool statistics to determine whether RODM is using storage efficiently. To access these statistics, use the MVS MODIFY command with the STATCELL parameter (MVS MODIFY *rodmname*,STATCELL) to write cell pool use information to a type 8 RODM log record. See the *IBM Tivoli NetView for z/OS Troubleshooting Guide* for a description of all of the fields in RODM log record type 8.

Figure 16 shows an example of the output from the RODM log formatter for log record type 8 segment and window statistics.

```
Log_type      : 8      (Statistics)         RBA           : 6211080
Record number : 31276                      Record Length : 2036
Transaction ID: 0000000000000000x          Timestamp     : Sat Mar 30 11:33:31 2013
User Appl ID  :
API Version   : 1
Stat Type     : 1      (Window Statistics)
Current pocket: 1
Avail. pocket : 1
No. of Entries: 33
  Cell Size ( 0):        8                              Pool Size     :        1
  No. in Use    :   154233                              High Water Mrk:   156185
  In Use Percent:       20                              Total Inuse % :       20
  High Water %  :       20
  Histogram Data :
    ( 0)         0       ( 1)         0       ( 2)         0       ( 3)         0
    ( 4)         0       ( 5)     78448       ( 6)     19212       ( 7)     69835
  Cell Size ( 1):       12                              Pool Size     :        1
  No. in Use    :   167074                              High Water Mrk:   167074
  In Use Percent:       22                              Total Inuse % :       22
  High Water %  :       22
  Histogram Data :
    ( 0)         0       ( 1)      1147       ( 2)         0       ( 3)      8285
    ( 4)         0       ( 5)         0       ( 6)         0       ( 7)    161887
  Cell Size ( 2):       16                              Pool Size     :        1
  No. in Use    :    35885                              High Water Mrk:    35885
  In Use Percent:        4                              Total Inuse % :        4
  High Water %  :        4
  Histogram Data :
    ( 0)         0       ( 1)       964       ( 2)         0       ( 3)     16281
    ( 4)         0       ( 5)       759       ( 6)         0       ( 7)     26268
  Cell Size ( 3):       24                              Pool Size     :        1
  No. in Use    :    27278                              High Water Mrk:    27279
  In Use Percent:        3                              Total Inuse % :        3
  High Water %  :        3
  Histogram Data :
    ( 0)         8       ( 1)     41631       ( 2)      1844       ( 3)         7
    ( 4)       110       ( 5)        11       ( 6)       768       ( 7)      1048
  Cell Size ( 4):       32                              Pool Size     :        1
  No. in Use    :     1801                              High Water Mrk:     1802
  In Use Percent:        0                              Total Inuse % :        0
  High Water %  :        0
  Histogram Data :
    ( 0)        12       ( 1)        43       ( 2)       130       ( 3)     15305
    ( 4)        14       ( 5)         4       ( 6)       691       ( 7)     14015

⋮
```

Figure 16. RODM Log Record Type 8 for Segment and Window Statistics

The following describe the segment and window statistic fields in log record type 8, which is shown in Figure 16.

NO. OF ENTRIES
Specifies the number of entries in the cell pool array.

CELL SIZE
Specifies the cell size in bytes as defined in member EKGCUST.

POOL SIZE
Specifies the number of 4 KB pages that are allocated when a pool extension is needed (defined in member EKGCUST).

NO. IN USE
Specifies the number of cells that are unavailable.

HIGH WATER MRK
Specifies the high-water mark for in-use cells.

IN USE PERCENT
Specifies the percentage of in-use cells.

TOTAL INUSE %
Specifies the percentage of total cells in use.

HIGH-WATER %
Specifies the percentage for the high-water mark.

HISTOGRAM DATA
Lists eight counters associated with the cell size. These counters are used to show the distribution of storage size requests satisfied by the cell pool.

To evaluate the amount of window storage currently in use, multiply the number of cells in use (NO. IN USE) by the cell size for each of the entries in the cell pool array. The sum of the products is the amount of RODM data space storage currently in use.

Using the Histogram Data

Provisions for monitoring the allocation requests and the usage of data space storage are built into the RODM storage manager. As each request for storage is received and matched to a cell, an additional calculation is made. A table is allocated at initialization that contains the following information for each cell pool defined to the system:

- The cell size in bytes
- The pool size in pages
- The number of cells available
- The number of cells in use
- The high-water mark of cells in use
- A set of eight counters to reflect the approximate size of the actual storage request (plus 4 bytes of control information) in histogram format

Figure 17 is an example of histogram data.

```
  Cell Size ( 6):       48                      Pool Size     :        1

:
  Cell Size ( 7):       64                      Pool Size     :        1
  No. in Use    :     4817                      High Water Mrk:     4817
  In Use Percent:        2                      Total Inuse % :        2
  High Water %  :        2
  Histogram Data :
   ( 0)        0      ( 1)        0      ( 2)        0      ( 3)        0
   ( 4)        6      ( 5)     4813      ( 6)        0      ( 7)        0
```

Figure 17. Histogram Data

The histogram data can be used to tune the customizable cell pool sizes. To evaluate the histogram data for Figure 17:

1. Subtract the previous cell size from the current cell size (64 - 48 = 16). This is the size of the range of storage requests that are serviced by this cell pool.
2. Divide the result by 8 (16 / 8 = 2). This is the size of the range of storage requests for each of the eight counters in the histogram data.
3. Add 1 to the position value (0–7 becomes 1–8).
4. Multiply each position in the histogram by the result from 2:

   $1 \times 2 = 2$
   $2 \times 2 = 4$
   $3 \times 2 = 6$
   $4 \times 2 = 8$
   $5 \times 2 = 10$
   $6 \times 2 = 12$
   $7 \times 2 = 14$
   $8 \times 2 = 16$
5. Add these results to the previous cell size (48) to get the maximum storage request size counted in each histogram position:

Position	**(0)**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Increment	2	4	6	8	10	12	14	16
Size	50	52	54	56	58	60	62	64

The following results are from Figure 17 on page 89:

Size Requested
Number of Requests

Greater than 48 but less than or equal to 50
0

Greater than 50 but less than or equal to 52
0

Greater than 52 but less than or equal to 54
0

Greater than 54 but less than or equal to 56
0

Greater than 56 but less than or equal to 58
6

Greater than 58 but less than or equal to 60
4813

Greater than 60 but less than or equal to 62
0

Greater than 62 but less than or equal to 64
0

The results show that 4813 requests were for storage greater than 58 bytes but less than or equal to 60 bytes (59 or 60 bytes). If a cell size of 60 had been defined to RODM, 4 bytes times 4813 requests, or 19252 bytes, would have been saved.

Any additions or modifications you make to the cell pool sizes should be specified in the CELL_POOL definitions in EKGCUST. All cell sizes must be full words. Consider how many cells fit on a page, because all pool sizes are rounded up to the next page boundary.

Customization Parameters

The defaults supplied with the NetView program in EKGCUST are adequate for most systems. However, you can alter the following settings to meet your specific requirements.

- The number of CONCURRENT_USERS is initially set to 10. You might need to increase this value, but do not make it unnecessarily high because extra storage is required for each user.
- The number of ASYNC_TASKS is initially set to 5. To save storage, you can decrease this value to 2.
- LOG_LEVEL is initially set to 8 (record errors only). This is preferred for a production environment where more than one RODM API call a second is anticipated. If the log levels were changed on a test system for debugging purposes, consider changing LOG_LEVEL and MLOG_LEVEL back to 8 when switching to production.
- Method tracing should be done only for problem solving, not during production. Set MTRACE_TYPE to X'00000000' to disable method tracing.

Programming Recommendations

This section contains programming recommendations for those writing RODM applications.

- Keep the number of RODM API calls to a minimum.
- When possible, use the following to combine multiple operations into a single API call:
  - Query multiple subfields (function ID 1508)
  - Change multiple subfields (function ID 1419)
  - Execute a list of functions (function ID 1600)
- Do not specify initial values on loader field definitions if they are not required. These values require extra processing at load time.
- Query fields by ID rather than by name when possible.
- Consider user methods similar to online CICS or IMS™ transactions. Use a minimum of processing and MAPI calls for methods that are likely to be run frequently.

Chapter 9. Tuning for VSAM

Input/output (I/O), specifically direct access storage device (DASD) I/O, is a major concern of performance and tuning, especially in a NetView environment. For databases, the NetView program uses VSAM data sets. The NetView program records messages to a log data set. The NetView program puts session data into a session monitor database, and network events and statistics into a hardware monitor database.

Tuning Techniques

Following are the major VSAM tuning techniques, arranged in order of expected effect on performance, with the most important tuning considerations listed first. These are described in detail in this chapter.

1. Use the CISIZE values that are used in the sample cluster definitions for best performance. Do *not* use the same CISIZE values for the hardware monitor and session monitor databases.
2. Start with the default LSR buffer pool allocations, and monitor the buffer miss percentage with the VSAMPOOL command. Increase the number of buffers for individual pools where needed, and reduce the number of buffers for pools that are not used frequently. See "Local Shared Resources (LSR) and Deferred Write (DFR)" and "VSAMPOOL Command" on page 99.
3. Use the DBAUTO command to reorganize databases that are not deleted and redefined regularly. See "VSAM Database Maintenance" on page 101.
4. Consider using the deferred write (DFR) performance option for the hardware monitor and 4700 support facility databases to reduce I/O activity. The sample definitions for the session monitor database have DFR specified already. See "Local Shared Resources (LSR) and Deferred Write (DFR)."
5. Monitor VSAM database performance using the LISTCAT and VSAMPOOL commands. See "Monitoring VSAM Performance" on page 97.

Local Shared Resources (LSR) and Deferred Write (DFR)

The VSAM performance options of local shared resources (LSR) and deferred write (DFR) provide major improvements in VSAM database processing. LSR enables the sharing of common control blocks (I/O control blocks, I/O buffers, and channel programs). On GET requests, buffers are searched for direct record retrievals. Without LSR, VSAM performs I/O for direct retrievals regardless of whether the control interval (CI) containing the desired record is in storage.

DFR causes VSAM to defer the write I/O when records are directly inserted or replaced in direct mode. Without DFR, VSAM does not defer the I/O for direct inserts or replacement of records. With DFR, the buffers are written in these instances:

- No more buffers are available to perform a retrieve.
- The application issues the WRTBFR macro indicating that VSAM should write out the modified buffers.
- The database is closed.

If the NetView program ends without closing the databases, the records in the DFR buffers are not written to the databases.

If you specify DFR, you get both the LSR and DFR options.

Do not cancel the NetView program except as a last resort. If you must issue a FORCE command, try to close the databases by issuing the NetView SWITCH command with the T option. This closes the active database and does not perform a switch. If this procedure does not work, issue the NetView STOP FORCE command for each active VSAM task. If you must use the MVS FORCE command to bring down the NetView program and you have specified DFR, you might have to delete and redefine the affected databases. The exposure of having records not written to the databases is minimized by the extended specify task abnormal exits (ESTAEs) that trap abends and close the databases. However, if the system operator ends the NetView program with the MVS FORCE command, the ESTAEs are not driven.

Definitions for LSR and DFR

To define LSR and DFR values, code the DSTINIT statement shown in the following example in the NetView initialization member for each data services task that uses VSAM.

```
DSTINIT MACRF=xxx
```

In this example, *xxx* is either LSR or DFR.

Table 2 lists the MACRF and CISIZE values for the NetView components and facilities that appear in the sample definitions.

Table 2. Sample MACRF and CISIZE Values for NetView Components

Component	Member	MACRF	3390 DASD	
			Index CISIZE	Data CISIZE
Central site control facility	DSIKINIT	LSR	2048	7168
Hardware monitor	CNMSTYLE	LSR	2560	18432
Network log		n/a	1024	4096
Save/Restore	DSISVRTD	LSR	4096	8192
Session monitor	AAUPRMLP	DFR	1536	24576
TCP connection management	CNMSTYLE	LSR	3584	26624
Trace log	DSITRCBK	LSR	512	16384
4700 support facility	BNJ36DST	LSR	3072	20480

Note: The CISIZE values specified for the data and index components in the samples that are included with the NetView program are based on using an IBM 3390 (using ICF catalogs). Because of the higher capacity of the 3390, different data buffer selections were made. These new selections result in a new index control interval size for one cluster. If other types of devices are used to allocate these clusters, these operands might need to be adjusted for optimal use of the device.

LSR is the default for the hardware monitor and 4700 Support Facility databases. Consider using DFR for these databases, because DFR gives better performance. LSR is used in the samples because some environments cannot tolerate losing records in the hardware monitor database, even though the possibility is remote.

Do not use LSR or DFR for the network log. The DSILOG task buffers records before writing them to DASD. Log browse does not work if LSR or DFR is used for the network log.

Buffer Pool Sizes

The VSAM buffer pool allocation is defined in module DSIZVLSR. The VSAM BLDVRP (build VSAM resource pool) macro creates the DSIZVLSR module. Figure 18 shows the sample buffer pool allocations for MVS sample member CNMSJM01.

```
DSIZVLSR CSECT
         BLDVRP                                                  *
               BUFFERS=(7168(4),         DSIKREM                 *
               8192(20),                 DSISVRT                 *
               16384(4),                 DSITRACE                *
               18432(20),                BNJDSERV                *
               20480(20),                BNJDSE36                *
               22528(20),                DSITCONT (old/migration)*
               24576(20),                AAUTSKLP                *
               26624(20)),               DSITCONT                *
               KEYLEN=96,                                        *
               MF=L,                                             *
               MODE=24,                                          *
               RMODE31=BUFF,                                     *
               SHRPOOL=0,                                        *
               STRNO=40,                                         *
               TYPE=(LSR,DATA)
*************************************************************************
* NOTE:- DO NOT ADD ANY CODE BETWEEN THE BLDVRP DEFINITIONS. THIS MAY *
*        CAUSE UNPREDICTABLE RESULTS IN NETVIEW PROCESSING.          *
*************************************************************************
         BLDVRP                                                  *
               BUFFERS=(512(3),          DSITRACE                *
               1536(30),                 AAUTSKLP                *
               2048(30),                 DSIKREM                 *
               2560(30),                 BNJDSERV                *
               3072(10),                 BNJDSE36                *
               3584(30),                 DSITCONT                *
               4096(30)),                DSISVRT                 *
               MF=L,                                             *
               MODE=24,                                          *
               RMODE31=BUFF,                                     *
               SHRPOOL=0,                                        *
               TYPE=(LSR,INDEX)
         END
```

Figure 18. Sample BLDVRP Macros Defining VSAM Buffer Pools for CNMSJM01

Note:

The buffer sizes in DSIZVLSR correspond to the default index and data CISIZE values, which are based on using 3390 DASD (using ICF catalogs).

If there are buffer sizes defined in DSIZVLSR that none of your databases use, remove them to decrease storage usage. Use the VSAMPOOL command to monitor usage of the LSR buffer pools. See "VSAMPOOL Command" on page 99.

KEYLEN Parameter

The KEYLEN parameter specifies the maximum key length of the data sets that share this pool. This keyword should be specified only on the data pool.

STRNO Parameter

The STRNO parameter specifies the potential number of requests, in the range of 1–255, that can be issued concurrently for all the data sets sharing the resource pool. Set STRNO to the total of all the DSRBO values for data services tasks that use the LSR resource pool. The sample value of 40 is sufficient for most environments. If you modify the DSRBO values for some of the DSTs, ensure that you adjust the STRNO parameter accordingly.

BUFFERS Parameter

The BUFFERS parameter specifies the size and number of buffers in each buffer pool in the resource pool. When you open a database and specify LSR or DFR, VSAM looks for a buffer pool for the INDEX and DATA components, depending on their control interval sizes. A buffer pool that is the same size as the control interval is chosen. If a buffer pool with the same size has not been defined, the next higher buffer pool size is chosen. Databases with the same control interval sizes share the same buffer pool. Allocate enough buffers of a particular size to satisfy all DSTs sharing the buffer pool.

The BLDVRP macros are specified with values that separate the index and data control intervals into separate pools. Having separate index and data pools allows the critical index records to remain resident in memory without the need to allocate an excessive number of buffers.

The size of the LSR buffer pool allocation affects VSAM performance considerably. If you want to change the buffer pool allocation, you can do so by modifying the sample definition and running the VSAM BLDVRP macro to create a new DSIZVLSR module. Refer to *IBM Tivoli NetView for z/OS Installation: Configuring Additional Components* for more information about running the VSAM BLDVRP macro.

Buffer Pool Size Recommendations

Consider the following tuning recommendations in determining the buffer pool sizes for your environment.

- Start with the default number of buffers for each buffer size in DSIZVLSR. See Figure 18 on page 95.
- Monitor the buffer usage with the VSAMPOOL command.
  - Remove buffer sizes that are never used to save storage.
  - For buffer sizes that are used infrequently, consider reducing the number of buffers to save storage.
  - For index buffers that are used frequently, the number of buffer finds (BFRFND) should be at least 10 to 20 times the number of buffer reads (BUFRDS). If this is not the case, consider increasing the number of buffers to reduce I/O activity.
  - For data buffers that are used frequently, the number of buffer finds should be greater than the number of buffer reads. If this is not the case, consider increasing the number of buffers.
  - When modifying the buffer allocations, monitor the buffer usage before and after making changes. If an increase does not result in improved performance, reduce the buffer allocation to its previous value.

  See “VSAMPOOL Command” on page 99 for information about the command and for more information on tuning LSR buffer allocations.

Allocating the Buffer Pools in an MVS Hyperspace

For MVS systems, you can allocate the VSAM buffer pools in a hyperspace*. Specifying hyperspace buffers is a method of reducing I/O to DASD by caching data in expanded storage. When you access the buffer pool, the page must first be moved from expanded storage to central storage. The alternative is to let the operating system storage manager determine the location of pages using its page replacement strategy. If your system central storage is constrained, allocating the buffer pool in a hyperspace might help relieve this contention.

To use hyperspace buffers, the buffer sizes must be in multiples of 4096. Therefore, change the corresponding CISIZE values for your databases to be multiples of 4096. Round the sizes up to the nearest multiple of 4096. For example, if the data CISIZE of a database is 22528, increase the CISIZE to 24576.

Note: *Specifying hyperspace buffers requires a modification to the VSAM BLDVRP macro (which is used to create module DSIZVLSR). See the appropriate MVS publication for a description of the syntax of the BLDVRP macro.

Monitoring VSAM Performance

NetView provides the LISTCAT and VSAMPOOL commands to assist in assessing the performance of VSAM. VSAMPOOL is available on MVS systems only.

LISTCAT Command

The LISTCAT command displays VSAM database definition and performance data for NetView data services tasks that have open VSAM databases. The information is similar to the data from the access methods services (AMS) LISTCAT command; however, the NetView LISTCAT command provides the information online, while the VSAM database is active.

The LISTCAT command is useful in tuning the VSAM databases and in validating the database definitions. This command is a full-screen command processor. After invoking the command, press the ENTER key each time you want updated information. The screens are automatically copied to the network log. If LISTCAT is run on the primary program operator interface task (PPT) or an autotask, the information is sent to the network log and command execution ends. This enables LISTCAT to run from a NetView timer command. Figure 19 on page 98 shows a sample of output from the LISTCAT command. The *IBM Tivoli NetView for z/OS Command Reference Volume 1 (A-N)* provides a brief description for each field that is displayed.

```
LISTCAT   Listcat of Active VSAM Data Base for BNJDSERV   11:28:07

  VSAM ACB Options: LSR, DFR, ADR, KEY, SEQ, DIR, OUT  1
  Cluster Information:  2
       DDNAME: BNJLGPR        KEYLEN: ..........76      RKP: ..........0
       BSTRNO: ..........0     STRNO: ..........11   STRMAX: ..........2
        BUFSP: ..........0
  DATA Component Information:  3
        LRECL: ........4086     CINV: .......18432
        BUFND: ..........12    BUFNO: ..........0
         NEXT: ..........2       FS: ..........8
         NCIS: ........1130     NSSS: ..........49
        NEXCP: ........8588    NLOGR: .......60326    NRETR: .......21326
        NINSR: .......70595    NUPDR: .......10569    NDELR: .......10278
       AVSPAC: ....12390400   ENDRBA: ....28672000  HALCRBA: ....29245440
  INDEX Component Information:  4
        LRECL: ........2553     CINV: ........2560
        BUFNI: ..........0     BUFNO: ..........0
         NEXT: ..........3      NIXL: ..........2
        NEXCP: ........2214    NLOGR: ..........51
       AVSPAC: ........2560   ENDRBA: ......130560  HALCRBA: ......133120
```

Figure 19. Sample LISTCAT Command Output Using 3390 DASD

The following fields are useful in tuning the VSAM database.

1 VSAM ACB Options

NSR No LSR and no DFR

LSR Local shared resources

DFR Local shared resources and deferred write

Under VSAM ACB options, the performance options of LSR and DFR are shown if they are in use for the data set.

2 Cluster Information

STRNO
Number of VSAM strings currently active

STRMAX
Maximum number of strings used

These fields show the VSAM string activity for the data set. The number of VSAM strings (STRNO) is defined on the VSAM BLDVRP macro. See "Definitions for LSR and DFR" on page 94 for more information about the BLDVRP macro. The correct value for STRNO is the sum of the number of DSRBOs for DSTs using the resource pool. Although no tuning is necessary here, these fields show how the high-water mark for concurrent operations (STRMAX) compares to the number of VSAM strings defined (STRNO).

3 Data Component Information

NEXT The number of extents in the data component.

NCIS The number of data control interval splits.

NSSS The number of data control area splits.

NEXCP
The number of EXCP (execute channel program - SVC 0) macros issued by VSAM against the data component.

NLOGR
The current number of records in the data component.

NRETR
The number of records that have been retrieved from the data component, whether they are for updates.

NINSR
The number of records that have been inserted into the data component before the last record. Records originally loaded and records added to the end are not included in this statistic.

NUPDR
The number of records that have been retrieved for update and rewritten. This value does not reflect records that are deleted only, but a record that is updated and then deleted is counted.

NDELR
The number of records that have been deleted from the data component.

AVSPAC
The number of bytes available in the data component.

ENDRBA
The number of bytes used in the data component.

HALCRBA
The number of bytes allocated in the data component.

4 Index Component Information

NEXT The number of extents in the index component.

NIXL The number of levels of records in the index.

NEXCP
The number of EXCP (execute channel program - SVC 0) macros issued by VSAM against the index component.

NLOGR
The current number of records in the index component.

AVSPAC
The number of bytes available in the index component.

ENDRBA
The number of bytes used in the index component.

HALCRBA
The number of bytes allocated in the index component.

Notes:

1. The logical record counts (NRETR, NINSR, NUPDR, and NDELR) show the cumulative number of total records retrieved, inserted, updated, and deleted since the file was last created, indicating the type of data set activity that has taken place.
2. If the number of levels in the index component (NIXL) is excessive, VSAM performance suffers. Reorganize the data set so that the number of index levels is three or fewer.

VSAMPOOL Command

The VSAMPOOL command displays statistics about NetView VSAM resource pool utilization when the NetView program has been defined to use local shared resources (LSR) or deferred writing of records (DFR). The LSR resource pool is

subdivided into buffer pools determined by control interval sizes. You define the LSR resource pool and buffer pools with the DSIZVLSR module. See "Definitions for LSR and DFR" on page 94 for more information.

VSAMPOOL lists all of the buffer pools that are using LSR and DFR. The output shows the total usage per control interval size (CINV). The display shows separate statistics for the DATA and INDEX VSAM LSR/DFR buffers that were defined in DSIZVLSR. Figure 20 shows a sample of output from the VSAMPOOL command.

```
CNM260I VSAM LSR/DFR RESOURCE POOL STATISTICS
BNH091I BUFFER TYPE = DATA
CNM948I   CINV   BUFNO  BFRFND   BUFRDS    NUIW    UIW   ERCT
CNM261I   7168       4       0        0       0      0      0
CNM261I   8192      20       2        1       0      0      0
CNM261I  16384       4       0        0       0      0      0
CNM261I  18432      20       0        0       0      0      0
CNM261I  20480      20       0        0       0      0      0
CNM261I  22528      20       0        0       0      0      0
CNM261I  24576      20       0        0       0      0      0
BNH090I BUFFER TYPE = INDEX
CNM948I   CINV   BUFNO  BFRFND   BUFRDS    NUIW    UIW   ERCT
CNM261I    512       3       0        0       0      0      0
CNM261I   1536      30       0        0       0      0      0
CNM261I   2048      30       0        0       0      0      0
CNM261I   2560      30       0        0       0      0      0
CNM261I   3072      10       0        0       0      0      0
CNM261I   3584      30       0        0       0      0      0
CNM261I   4096      30       2        1       0      0      0
CNM262I END OF DISPLAY
```

Figure 20. Sample Output from the VSAMPOOL Command Using 3390 DASD

The following information is displayed for each buffer pool (see Figure 20).

CINV Control interval size (or buffer size) for the buffer pool

BUFNO
The number of buffers in the buffer pool

BFRFND
The number of requests for retrieval that could be satisfied without an I/O operation (the data was found in a buffer)

BUFRDS
The number of reads to bring data into a buffer

NUIW The number of non-user initiated writes (writes that VSAM was forced to perform because no buffers were available for reading the contents of a control interval)

UIW The number of user-initiated writes (PUTs not deferred or WRTBFRs)

ERCT The number of write errors that have occurred

The VSAMPOOL command is useful in tuning the size of the LSR buffer pools.

The most useful statistic is the *lookaside hit ratio*, which is calculated as follows:

$$\text{lookaside hit ratio} = \frac{\text{BFRFND}}{\text{BUFRDS}}$$

The lookaside hit ratio gives an indication of the adequacy of the LSR buffer allocation. The optimal lookaside hit ratio depends on your environment. Consider the following in general:

- For data buffers, the lookaside hit ratio should be 1 or greater; values higher than 5 are unusual for databases with high activity.
- For index buffers, the lookaside hit ratio should be 10 or greater. The number of buffer finds (BFRFND) should be at least 10 times greater than the number of buffer reads (BUFRDS). The higher the lookaside hit ratio, the better.

The following approach is suggested for tuning the allocation for the LSR buffer pools:

- Remove buffer sizes that are not used to save storage.
- For buffer sizes that are used infrequently, consider reducing the number of buffers to save storage.
- For frequently used buffer sizes, increase the number of buffers if the lookaside hit ratio is less than 10 for index buffers, or less than 1 for data buffers.
- When increasing the buffer allocation:
  1. Monitor the lookaside hit ratio for the current buffer pool allocation.
  2. Increase the number of buffers in one or more of the buffer pools. The new buffer allocation does not take effect until the NetView program is stopped and restarted.
  3. Monitor the lookaside hit ratio for the new allocation.
  4. Repeat steps 2 and 3 until the lookaside hit ratio does not improve with an increase in the number of buffers for the buffer pool.
- When decreasing the buffer allocation:
  1. Monitor the lookaside hit ratio for the current buffer pool allocation.
  2. Decrease the number of buffers in one or more of the buffer pools. (The new buffer allocation does not take effect until the NetView program is stopped and restarted.)
  3. Monitor the lookaside hit ratio for the new allocation.
  4. Repeat steps 2 and 3 until the lookaside hit ratio degrades noticeably with a decrease in the number of buffers for the buffer pool.

Note: You must monitor the VSAM buffer pool usage using the VSAMPOOL command. This command determines whether the initial VSAM buffer allocations are sufficient. It is also a simple tool for monitoring buffer usage after any changes are made. Run the VSAMPOOL command on a timer every hour when changes are made, and use the procedure previously outlined to verify that performance is acceptable.

VSAM Database Maintenance

Use the VSAM access method services (AMS) REPRO or IMPORT and EXPORT commands to reorganize a database to recover space lost through CI and CA splits. Use of these commands can improve performance in accessing the database and in reducing database size. Free space decreases the likelihood of CI and CA splits thereby, improving performance. This, in turn, decreases the chance that VSAM will move a set of records to a different cylinder away from other records in the key sequence. When a direct insert occurs that does not result in a split, VSAM inserts the records into available free space.

When VSAM is called to delete or replace a record, it flags the space as deleted and writes a new record. However, the deleted or replaced record is not actually deleted, but is only flagged as deleted, and continues to consume space. The accumulation of these flagged records results in less available free space within a VSAM data cluster. A query against a VTOC might indicate that free space is available on a disk pack, but this does not mean that empty control intervals (CI) are available within the database cluster for new Data or Indexes records. To delete these flagged records completely, periodically run the REORG command on all VSAM clusters. To view the amount of free space that is available in a KSDS cluster, run a LISTCAT on the Cluster, then look at the values for FREESPC-BYTES in any DATA and INDEX sections. To get the number of completely empty control intervals that are still available to hold new records, divide the FREESPC-BYTES value by the CISIZE value. To get the approximate number of records that can still be written, divide the FREESPC-BYTES value by the record size (PHYREC-SIZE).

You can perform NetView VSAM database maintenance from the NetView program without having to shut down the VSAM database. Use the NetView IDCAMS command to run the AMS utility commands that are stored in a data set.

You can use the PURGEDB command to delete unneeded data from the hardware monitor and session monitor VSAM databases. If you use PURGEDB, use the VSAM AMS REPRO or IMPORT and EXPORT commands to reclaim free space.

To delete historical data from the hardware monitor or session monitor databases, use the RESETDB command to clear the databases when the NetView program is active. The RESETDB command is simpler than deleting and redefining the databases and is faster than using the PURGEDB command to purge the entire database. Ensure sure that the REUSE operand is coded on the session monitor cluster definition (CNMSI101). The RESETDB command requires the REUSE parameter.

Use the DBAUTO command to perform maintenance on your VSAM databases while the NetView program is running. The DBAUTO command works on the session monitor, hardware monitor, Save/Restore and 4700 Support Facility databases. You can perform the following operations:

- Switch to a secondary database
- Selectively purge entries in the session monitor or hardware monitor databases
- Reorganize a database
- Erase the contents of a database

See the *IBM Tivoli NetView for z/OS Command Reference Volume 1 (A-N)* or the NetView online help for a description of the syntax and use of the IDCAMS, RESETDB, DBAUTO, and PURGEDB commands.

Chapter 10. Additional Tuning Considerations

This section provides miscellaneous tuning information.

Tuning Considerations

The tuning considerations are arranged in order of expected effect on performance, with the most important listed first. These, along with other performance considerations, are described in detail in this chapter.

- For SNA topology manager, avoid using commands that cause a large number of storage references during peak periods of activity. See "SNA Topology Manager" on page 122.
- Do not use a STEPLIB DD statement in your production NetView job control language (JCL). A STEPLIB statement can cause unnecessary I/O during NetView execution. See "STEPLIB DD Statements" on page 124.
- Use the TASKUTIL command to monitor NetView task utilizations, queue lengths, storage use, and active command lists. See "TASKUTIL Command" on page 126.
- To optimize performance for command security authorization, use AUTOSEC=BYPASS and SEC=BY on CMDDEF statements for commands that do not require security checks. See "Command Security" on page 108.
- Use the OMIT operand of the STATOPT statement to control the storage requirement of the status monitor. See "Status Monitor STATOPT Filtering" on page 123.
- Use the high performance transport instead of the management services transport for LU 6.2 communication when possible. See "LU 6.2 Transport" on page 111.
- To improve CPU usage when using installation exits, do not use dummy exits, and optimize the performance of frequently invoked exits. See "Installation Exits" on page 111.
- Decide whether to use persistent or nonpersistent sessions for NetView-NetView communications. Persistent sessions are preferred for all but very low traffic environments. See "Persistent and Nonpersistent LUC Sessions" on page 118.
- You might be able to shorten the path length required to perform span of control verification by migrating to the NetView span table. For information on implementing the NetView span table, refer to the *IBM Tivoli NetView for z/OS Security Reference*.
- Use the DSRBS command to monitor the DSRB allocations for the NetView data services tasks (DSTs). See "Data Services Request Blocks (DSRBs)" on page 109.
- To save storage, delete command definitions relating to NetView functions that you do not use. See "Minimizing Storage Usage" on page 157.
- Do not specify the MAXSESS keyword on the CNMAUTH statement in DSILUCTD. This enables the NetView program to allocate as many LUC sessions as it needs for alert forwarding, remote database retrieval, and status forwarding. See "MAXSESS Keyword" on page 113.
- To reduce processor usage, consider limiting NCCF TRACE options. See "NCCF TRACE Options" on page 113.

Address Space Dispatch Priority

Because they interact closely, use the same dispatch priority for the NetView, GMFHS, RODM, and Event/Automation Service (IHSAEVNT) address spaces.

Automated Operations Network (AON) Performance Considerations

- The ENVIRON SETUP control file entry identifies attributes of NetView running AON and enables you to tailor the control file to your needs. The ENVIRON SETUP entry is optional. If not included, AON uses all of the defaults. ENVIRON SETUP parameters that might affect performance are:

  GENALERT
  GENALERT=Y is required to generate alerts. The default is N. To update the NetView management console and Resource Object Data Manager (RODM) with automation information, specify GENALERT=Y. If you do not require this information, a significant reduction in CPU time can result when GENALERT=N is specified instead of GENALERT=Y.

  RODMAIP
  RODMAIP defines whether the RODM AIP (Automation in Progress) operator status is set, causing the AIP pattern to display for the affected resource in the NetView management console. RODMAIP=NO is the default setting. Specify RODMAIP=NO in the ENVIRON SETUP entry when AIP status is not required; this will cause a reduction in the CPU time used to process the AON workload.

  TRACE
  TRACE=ON enables AON to perform tracing. The default value is NONE, which prevents program entry, exit, or tracing. A setting of TRACE=OFF enables the trace facility, but no tracing is done at this time. If you are not planning to perform tracing, setting TRACE=NONE will result in a reduction in CPU time compared to setting TRACE=OFF.
- The ENVIRON DDF control file entry defines status update characteristics for the environment. The ENVIRON DDF entry is required to implement DDF. The default is DDF=NO. When DDF=STATUS is defined, DDF colors are defined by resource automation or VTAM status in DDF entries of the control file. Specifying DDF=NO will not initialize or log events to DDF. If DDF is not being used, setting DDF=NO will reduce the CPU time used to process the AON workload.

Browse

If you have storage limitations, control the use of the data set member browse function because it reads the entire data set member into storage. See “Estimating Storage Usage” on page 133 for the storage required for the data set member browse function.

Note: This consideration does **not** apply to browsing the network log.

Using the BROWSE command, you can browse members on a remote NetView system. When a cross-domain browse request is processed, the RMTCMD command is used internally to satisfy the request. The RMTMAXL parameter of the DEFAULTS and OVERRIDE commands specifies the maximum number of lines transferred for a cross-domain member browse request. If the remote member contains more than the maximum number of lines, the BROWSE command continues with the permitted number of lines, and message CNM206I is issued.

The BROWSE command uses the RMTMAXL setting of the operator issuing the cross-domain browse request. A large value for RMTMAXL allows a cross-domain member browse request to return large amounts of data, but can cause delays with other RMTCMD LU 6.2 communications. The default value of RMTMAXL is 2500 lines.

Canzlog Archiving

When you set up archiving of Canzlog data, consider the following items:
- "Canzlog Data Set Characteristics"
- "Canzlog Data Access"
- "Canzlog Archive Storage Requirements" on page 106

Canzlog Data Set Characteristics

Consider the following data set characteristics when setting certain archive data set parameters in the NetView program or the Storage Management System (SMS), particularly parameters that are related to space and block size.

- Message data sets in a Canzlog archive have a logical record length of 1024 bytes, and contain 8192 records.
- Index data sets have a logical record length of 80 bytes and, except for the primary index data set, are limited to 4096 records.
- The number of records in the primary index data set is not limited. Records in this data set accumulate slowly (approximately one record every 4 weeks at a sustained rate of 50 messages per second).

Also, consider the characteristics of the devices on which the data sets are to be stored.

See the descriptions of the following statements in the *IBM Tivoli NetView for z/OS Administration Reference*:
- ARCHIVE.INDEX.SPACE
- ARCHIVE.INDEX.BLOCKSIZE
- ARCHIVE.MESSAGE.SPACE
- ARCHIVE.MESSAGE.BLOCKSIZE

If you use SMS to define data set characteristics for the archive data sets, see *z/OS DFSMSdfp Storage Administration*.

The NetView program supplies default space and block size values that are suitable for an IBM 3390 direct access storage device. If you use a different type of device, review the device specifications, including organization of data and device capacity; then, choose space allocations and block sizes to ensure that complete data sets can be stored in the most efficient manner on the devices.

You can also use z/OS components such as DFSMDdfp and SMS in selecting suitable block sizes for the data sets.

Canzlog Data Access

If many operators (50 or more) are expected to simultaneously browse or search a large amount of archived Canzlog data, consider the following actions:

- Allocating at least the message data sets on DASD with a faster access time, especially if these operators search the data.
- Increasing the value specified for the ARCHIVE.BROWSE.DATASPACES statement in the CNMSTUSR or C*xx*STGEN member. For more information

about this statement, see the *IBM Tivoli NetView for z/OS Administration Reference*. For information about changing CNMSTYLE statements, see *IBM Tivoli NetView for z/OS Installation: Getting Started*.

Canzlog Archive Storage Requirements

The amount of disk space that is required to archive Canzlog data depends on a number of factors, including the following factors:

- The rate at which messages are produced on the system
- Storage device capacity and data organization
- The length of the time that archived data is to be available for NetView operators to browse
- The length of the time that archived data, other than the data for NetView operators to browse, is to be kept

To estimate the required disk space, determine the rate at which messages are produced on the system. Because message production varies during operation, examine the message production for several time periods throughout the day or week to determine the average message production rate to use in the formulas that follow. Increase or decrease that estimate based on expected future message production, such as for increased workloads.

To illustrate the calculations for expected storage usage for an archive, consider a z/OS system on which messages are produced at a sustained rate of 50 per second by the operating system and any jobs running there. Also, suppose that each message line requires an average of 256 bytes of space in the Canzlog log.

The average amount of space that is required for each message can vary due to things such as the location of multiline messages in the log or the saving of data that occurs when a NetView program instance that archives Canzlog data stops. However, the average should be useful for a lengthy, continuous period of system operation with the NetView program running.

Each message data set holds an 8-megabyte (8,388,608 bytes) segment of Canzlog data, which is stored as 8192 1024-byte records; that is, each 8-megabyte segment contains approximately 32768 messages, calculated by using the following formula:

8,388,608 bytes per segment ÷ 256 bytes per message

At a sustained rate of 50 messages per second, each 8-megabyte segment holds messages that cover a time period of approximately 655 seconds, or about 10.9 minutes, calculated by using the following formula:

32,768 messages per segment ÷ 50 messages per second

At this message rate, after the NetView program begins archiving Canzlog data, an older 8-megabyte segment of Canzlog data becomes eligible for archiving each time the latest 8-megabyte segment becomes full, approximately every 10.9 minutes. When the latest 8-megabyte segment is full, a new message data set is created, the data from the older 8-megabyte segment is written to the new message data set, and a record for the new message data set is written to the current index data set. If a new message data set is created approximately every 10.9 minutes, approximately 132 message data sets are created per day, calculated by using the following formula:

1440 minutes per day ÷ 10.9 minutes per message data set

If you use the default space allocation and block size values that are provided by the NetView program (11 cylinders and 27648 bytes, respectively) and if you use a 3390 device, approximately 1452 cylinders per day are required for archiving the message data, calculated by using the following formula:

132 message data sets per day × 11 cylinders per message data set

For each message data set that is created, the NetView program adds one 80-byte record to an index data set. An index data set, not including the primary index data set, contains a maximum of 4096 records. At the message rate that was described previously, an index data set fills, and a new one is created, approximately every 31 days, calculated by using the following formula:

4096 message data set records per index data set ÷ 132 message data sets per day

If you use the default space allocation and block size values that are provided by the NetView program (6 tracks and 27,920 bytes, respectively) and if you use a 3390 device, approximately 6 tracks of space per 31 days (a month) are required for a new index data set.

Each time a new index data set is created, the NetView program adds one 80-byte record for that index data set to the primary index data set. If you use the default values for space allocation (6 tracks) and block size (27,920 bytes) and if you use a 3390 device, two 27,920-byte blocks fit on a track. Therefore, a 6-track extent of the primary index data set holds 4188 records, calculated by using the following formula:

6 tracks × (2 blocks per track × (27,920 ÷ 80) records per block)

If a new index data set is created approximately every 31 days, then that 6-track extent of a primary index data set requires approximately 129,828 days (over 355 years) to fill completely, calculated by using the following formula:

4188 records per 6-track extent × 31 days per record for an index data set

If your storage devices for archive data sets have different capacities and data organizations than those of 3390 devices, replace the applicable numbers in the formulas (such as blocks per track and block size) with values that are appropriate for your storage devices. If you do not use SMS to provide the data set characteristics for data set allocation, you might have to change one or more of the following values so that the NetView program can allocate data sets that are more appropriate for your devices:

- ARCHIVE.INDEX.SPACE
- ARCHIVE.INDEX.BLOCKSIZE
- ARCHIVE.INDEX.UNIT
- ARCHIVE.MESSAGE.SPACE
- ARCHIVE.MESSAGE.BLOCKSIZE
- ARCHIVE.MESSAGE.UNIT

After you determine the disk space requirements for the primary index data set, the index data sets, and the message data sets, which are based on the message production rate on your system, determine how long the data must be kept and how much of it is to remain available for NetView operators to browse.

When archived Canzlog data is no longer required, you can delete the message data sets that contain data that is no longer needed. Do not delete index data sets. As a result, the calculation of the disk space requirement must include an estimate

of the total number of index data sets that might be created over an estimated useful life of the system and the NetView product.

For this example, to complete the calculations, consider an estimated useful life of approximately 20 years (7305 days). If you use 3390 devices for archived Canzlog data, and if the sustained message production rate on this system is 50 messages per second, and if you keep 2 months of message data (deleting message data monthly after 2 months of data are collected, which means that nearly 3 months of message data is available just before a deletion occurs), the following storage is required:

- For the index components: 95 cylinders, calculated by using the following formula:

  (6 tracks for a primary index data set + 1416 tracks for all other index data sets) ÷ 15 tracks per cylinder

  The tracks that are needed for the index data sets are as follows:
  - 1 primary index data set: 6 tracks is sufficient
  - 236 index data sets: 1416 tracks

    236 index data sets is calculated by using the following formula:

    7305 days of useful life ÷ 31 days per index data set

    1416 tracks is calculated by using the following formula:

    236 index data sets × 6 tracks per data set
- For the message components (message data sets): 135,036 cylinders, calculated by using the following formula:

  1452 cylinders per day × 31 days per month × 3 months
- For the whole archive: 135,131 cylinders, calculated by using the following formula:

  95 cylinders for index components + 135,036 cylinders for message components

Note that many of the numbers in this section are estimates. You might want to increase some of the percentages.

Command Security

This section discusses certain considerations for achieving maximum performance of NetView when security checks are run against commands. There are two different methods of command security in NetView: the NetView command authorization table and a system authorization facility (SAF) product, such as RACF®. See the *IBM Tivoli NetView for z/OS Security Reference* for more information about command security.

Considerations:

- Regardless of which command security you use, you can code SEC=BY on a CMDDEF statement in the CNMCMDU initialization member for commands that do not require a security check (HELP, for example). This improves performance by eliminating security check processing time on commands that are safe to use in your environment.
- For all three methods of security, you can code AUTOSEC=BYPASS on the DEFAULTS command to bypass security checks on all commands originating from the automation table, assuming your automation table member update process is secure. This can eliminate unnecessary checking of commands not entered at an operator console.

- When using RACF, auditing **all** resources can degrade system performance. Setting RACF auditing to NONE for resources in the NETCMDS class can improve performance. Using RACF AUDIT provides you with an audit trail of attempts to issue unauthorized commands or command lists.
- When using a backup command authorization table with SAF as your primary command security method, you should make sure generic command identifiers are specified to prevent unnecessary searches of the backup command authorization table. For example, in RACF:

  ```
  RDEFINE NETCMDS *.*.* UACC(READ)
  ```
- When migrating to the SAF NETCMDS class or the NetView command authorization table with the SECMIGR command, excess statements might be generated which can be deleted to (slightly) improve performance. When the SECMIGR tool generates statements equivalent to scope KEYCLASS statements, and a VALCLASS statement is not specified for the keyword, a statement is generated to cover any specified values. For keywords that cannot have values, this statement can be safely deleted. For example, because the AUTOTBL OFF keyword has no value, statements generated for a command identifier of netid.luname.AUTOTBL.OFF.* can be safely deleted.
- Processing generic command identifiers is the most performance intensive part of searching the command authorization table. If you are using generic command identifiers (wildcards) in the command authorization table, you can code specific command identifiers on EXEMPT statements for commands that do not need protection. Using specific (not generic) PROTECT statements for frequently used commands should also be helpful.

Data Services Request Blocks (DSRBs)

The following types of data services request blocks (DSRBs) are used to store information about a transaction request being processed by a data services task (DST):

- Unsolicited (DSRBUs)
- Solicited (DSRBOs)

DSRBUs are used to process unsolicited problem determination request units (RUs). DSRBOs are used to process solicited RUs and VSAM requests. If more requests are received than there are DSRBs available, the requests are queued.

The number of DSRBOs and DSRBUs allocated for a DST are defined as parameters on DSTINIT statements in the DSIPARM initialization member for the DST. If you do not specify the parameters, the default allocations are 3 DSRBOs and 5 DSRBUs. See the *IBM Tivoli NetView for z/OS Administration Reference* for the syntax of DSTINIT statements.

The DSRBS command displays statistics on the data services request block use for the NetView program and user-written DSTs. The DSRBS output is a snapshot of the current DSRB use, and can be used to determine if the DSRB allocations are sufficient.

Figure 21 on page 110 shows a sample of output from the DSRBS command.

```
DSRBS  Data Services Request Block Usage for BNJDSERV  13:35:07

Unsolicited DSRBs:     5    Used:     0                       Free:  5
  Solicited DSRBs:     5    Used:     5  VSAM Redrive:    0   Free:  0
      TOTAL DSRBs:    10    Used:     5  VSAM Redrive:    0   Free:  5

Current DSRB Usage
     1      2       3       4      5       6       7        8
No.  DSRB  STATUS  Taskname  Type  Request  Redrive  Serial No. Step No.
001  Unsl  Inact
002  Unsl  Inact
003  Unsl  Inact
004  Unsl  Inact
005  Unsl  Inact
006  Soli  Active  NCF01PPT  VSAM    Erase       No       5104      5
007  Soli  Active  NCF01PPT  VSAM      Get       No       5100     14
008  Soli  Active  NCF01PPT  VSAM      Put      Yes       5105      8
009  Soli  Active  PCF01PPT  VSAM      Get       No       5102     13
010  Soil  Active  PCF01PPT  VSAM      Put       No       5103     12
```

Figure 21. Sample Output from the DSRBS Command

The statistics displayed include:

DSRB Type
Statistics

Unsolicited DSRBs (DSRBU)
Number allocated, in use, and available

Solicited DSRBs (DSRBO)
Number allocated, in use, being redriven because of VSAM contention, and available

Total DSRBs (DSRBO + DSRBU)
Number allocated, in use, being redriven because of VSAM contention, and available

For each DSRB currently in use, the following information is displayed:

1 Type of DSRB (unsolicited or solicited)

2 Status (active or inactive)

3 Task that initiated the request

4 Type of request (VSAM or CNM)

5 Type of VSAM request (ENDREQ, ERASE, GET, POINT, PUT)

6 Whether the VSAM request is being redriven because of contention (YES or NO)

7 Request serial number

8 Step sequence number

The DSRBS command is useful in determining DSTs that are waiting for requests to complete. DSRBS is also useful in determining the optimum number of DSRBs to allocate. Too few DSRBs can result in DST requests being queued. Too many DSRBs can result in an excessive numbers of VSAM requests being redriven, which causes extra CPU overhead.

Consider the following items for tuning the DSRB allocations for a DST.

- If DSRBOs are frequently in VSAM redrive status, consider lowering the number of DSRBOs allocated for the DST.
- If a majority of the DSRBs are frequently in use, consider increasing the number of DSRBs allocated for the DST.
- Monitor the DSRB usage for the DSIGDS, AAUTSKLP, and AAUTCNMI tasks closely, because they benefit from additional DSRBs in many environments.
- Performance of the BNJDSERV task (hardware monitor) can degrade if additional DSRBs are added, because its VSAM requests might go into redrive status.

Installation Exits

This topic provides performance considerations for using exits.

- For most OST-type exits (DSIEXxx), a LOAD FAILED message is issued if the exit is not found. Using dummy exits would prevent this message, but degrade system performance by causing the NetView program to process instructions to set up a call to the dummy exit every time the exit is driven, therefore unnecessarily using CPU.
- Coding exits for frequently called exits also degrades performance on systems with heavy message loads, especially if the exits are coded in C or PL/I. C has a greater initialization overhead than PL/I. If you code very frequently called exits, consider using Assembler.
- If you use the BLOG command list, be aware that DSIEX18 is run under the browse task to match the search arguments specified in the BLOG input. If you have a large log and the search string matches only a small number of records, the forward or backward function key causes the log to be searched until enough records matching the string are found to fill the screen. This could mean that thousands of records will be searched before enough matches are found to fill the screen, while resulting in a large amount of processing time being used.

LOGTSTAT Command

The LOGTSTAT command can be used to write task utilization data to the System Management Facility (SMF) log. You can use the LOGTSTAT command to create a record for one specified task, or for all tasks that were running at the time when the LOGTSTAT command was issued. If LOGTSTAT is used to generate records for all tasks, an SMF record is written for each task that is active.

LOGTSTAT data can be useful in determining task start and end times. It also provides some Resource Limits data similar to that produced using TASKMON. Specific system storage usage for a task from startup to termination or for a known time interval can be determined from the LOGTSTAT data as well. For more information, see the *IBM Tivoli NetView for z/OS Command Reference Volume 1 (A-N)* or the NetView online help.

LU 6.2 Transport

The NetView LU 6.2 transport is a programming interface that implements architected protocols to enable applications in network nodes to communicate using conversations over LU 6.2 sessions.

The NetView LU 6.2 transport consists of two similar application program interfaces: the management services (MS) transport and the high performance transport. For applications that run in the NetView program, each transport

provides a high-level programming interface to mask the LU 6.2 complexities. An application registered with the appropriate transport can send data in architected envelopes to a partner application and receive data in return.

Although both transports provide the same functions and mask the LU 6.2 complexities, each transport offers its own advantages.

The high performance transport uses different LU 6.2 protocols that are faster than the protocols used by the MS transport. Because of these protocols, the high performance transport provides general error notification rather than specific error notification about data. In addition to the advantage of speed, the high performance transport enables programmers to define session parameters such as RU size.

The MS transport uses LU 6.2 conversation protocols that generate more network traffic than the high performance transport protocols to transport each piece of data. The advantage of the MS transport is that it guarantees delivery of data or specific error notification about the data.

See the *IBM Tivoli NetView for z/OS Application Programmer's Guide* for information about LU 6.2 transports.

The following tuning considerations apply to the LU 6.2 transport.

- When designing applications to use the LU 6.2 transport, use the high performance API instead of the management services API when possible.
- Send requests with a reply expected require more processing than send requests without reply expected, because of the extra overhead of timeout checking and processing the reply. When designing applications to use the LU 6.2 transport, use send requests without reply expected where possible.
- To use send requests with reply expected, create a CMDDEF statement for the reply processor in the CNMCMDU NetView initialization member. If the reply processor is a command list, use the following statement:

  ```
  CMDDEF.clistnameL.MOD=DSICCP
  ```

  The presence of the CMDDEF statement eliminates I/O to the command list data set (DSICLD) to verify the existence of the reply processor before the request is sent.
- The NetView constants module (DSICTMOD) contains an entry for the LU 6.2 transport support. This entry specifies the number of LUs with which you expect to have sessions. This value is used to optimize control block access. The default value is 2000. If you expect to have more partner LUs than the default, change this value in DSICTMOD. The number you specify does not need to be exact, but too small a number hinders access to control blocks. A value in excess of the expected number of partner LUs can result in unused virtual storage, but can improve access to control blocks. In general, it is better to overestimate than underestimate. See the *IBM Tivoli NetView for z/OS Installation: Getting Started* for information about changing and relinking DSICTMOD.
- The high performance transport enables applications to specify their logmode when they register. Sample logmode definitions are contained in member CNMS0001. Logmodes have an RUSIZES parameter that you can use to specify the maximum size of data in bytes that the LUs can send. The default RUSIZES parameter for LU 6.2 applications is 8585. The first two numbers are for the primary LU, and the second two numbers are for the secondary LU. Each pair of numbers represents a mantissa and an exponent, as follows:

  $M \times 2^N$

The default 8585 means that both the primary and secondary LU can send a maximum of 8 x 2^5, or 256 bytes. Adjust the RUSIZES parameter appropriately for your LU 6.2 applications. The RMTCMD command uses the PARALLEL logmode (in CNMS0001), which uses RUSIZES=8787 (or 1024 bytes). Consider increasing the RUSIZES parameter for the PARALLEL logmode to higher values, so that the RMTCMD can send larger data buffers.

- To forward messages or management service units (MSUs) to the generic automation receiver (NVAUTO) for automation table processing, modify the command definition for DSINVGRP to make the generic automation receiver command processor resident. To do this, add the following to the CNMCMDU initialization member:

  ```
  CMDDEF.DSINVGRP.RES=Y
  ```

  Making this command processor resident avoids the I/O needed to load the command processor every time the generic automation receiver processes a message or MSU.

MAXSESS Keyword

You can use the MAXSESS keyword on the CNMAUTH statement in DSILUCTD to restrict the number of cross-domain sessions the NetView program can set up to an adjacent domain. The value for MAXSESS, if specified, can be in the range 1-65535. The value in the samples is 10.

If you do not specify the MAXSESS keyword, the NetView program allocates as many sessions as it needs for alert forwarding and remote database retrieval for the hardware monitor and session monitor. Do not specify a value for MAXSESS unless you need to restrict the number of cross-domain sessions the NetView program can set up.

If you use nonpersistent sessions, do not specify a value for MAXSESS, because any idle sessions are brought down.

If you must specify a value for MAXSESS, use the following formula to calculate a value:

```
MAXSESS value =    2  (Number of session monitor sessions)

               +  1  (Alert forwarding, if NPDA.ALERTFWD=NV-UNIQ in CNMSTYLE
                      %INCLUDE member CNMSTUSR)

               + xx  (Number of concurrent NetView operators doing
                      hardware monitor remote data retrieval)
```

If the MAXSESS value is exceeded, an SDOMAIN (set domain) command from the session monitor and hardware monitor can fail and alerts might not be forwarded.

If an SDOMAIN command fails, message DSI784 is issued.

NCCF TRACE Options

To help reduce processor consumption, especially for autotasks, consider running without the STOR option on the NCCF TRACE command. If the OPTION keyword is not specified on the TRACE ON keyword, the default options of QUE, PSS, DISP, STOR, and UEXIT are used. These are required for debugging by IBM Software Support. However, if your environment is heavily automated with autotasks, consider specifying the TASK= option on the TRACE command and

specifying all task types except OST. Tracing is then inactive for all OSTs and AOSTs (autotasks). The processor usage is reduced because of the STOR option and associated processor consumption for autotasks. However, pertinent problem determination and analysis data can be lost. Users might be requested by IBM Software Support to temporarily reactivate tracing for OSTs and recreate with TRACE active for all task types. For additional information regarding the NCCF TRACE command, see the *IBM Tivoli NetView for z/OS Command Reference Volume 1 (A-N)* or the NetView online help.

MultiSystem Manager Performance Considerations

- Plan to contain as much of the virtual storage demand as possible in central (real) and expanded storage.

  This keeps data movement to auxiliary storage (disk) to a minimum. This method is especially important for the GETTOPO scenario where many objects are created in RODM.
- If the networks that are being managed by MultiSystem Manager are large (more than 50,000 resources), consider staging the issuance of GETTOPO requests.

  This can be done at the managing agent level (IBM Tivoli Network Manager or Open), then at the subgroup level (service points for the various managing agents). Over time, this spreads the large CPU and storage demand that is required for the GETTOPO command.

  Note: Do not attempt the GETTOPO command for MultiSystem Manager and MONITOR requests for SNATM at the same time.
- Reducing the number of resources to be monitored or designated as critical can make a major difference in the number of RODM objects, which affects the initial topology processing and RODM storage.

  For example, consider reducing the number of unmanaged resources by the IBM Tivoli Network Manager agent (UNMANAGED=NO for the GETTOPO ITNMRES command).
- When exception views are used, the number of exception view table entries in the exception view file (specified using the MSM `COMMON.FLC_EXCEPTION_VIEW_FILE` statement in the CNMSTYLE member) affects the amount of CPU used during the GETTOPO processing.

  You might want to specify only entries that will be needed for the agents collecting topology.
- Performance of MultiSystem Manager can be improved by choosing to run several autotasks in support of multiple concurrent RUNCMDs.

  Choosing the correct number of autotasks is dependent on the number of managing agents (IP, Open) you are supporting and the multiprogramming capability of your processor.

NetView Access from the Web Browser

This function provides the capability for NetView users to convert host data to HTML and then make it available to web browsers by way of the IBM Internet Connection Server. Users can log on to the internet from a workstation, go to a URL for their NetView system, and request/receive command-line data responses.

There is a 1000 line limit for allowable data display when using the web browser function. If more than 1000 lines of data are requested, users see a message stating how many lines were truncated. Users should not knowingly attempt to browse

> members or data sets that far exceed this limit. The entire file must be read in,
> causing an increase in response time and CPU usage, both at the host NetView
> program and at the workstation. Performance testing showed no significant
difference in response time to commands with regard to both platform and specific web browser used.

NetView Constants Module (DSICTMOD)

DSICTMOD is the NetView constants module. The sample is CNMS0055. This sample assembles and link-edits the module. Changes in the module require an assembly and link-edit.

All of the values are described in *IBM Tivoli NetView for z/OS Installation: Getting Started*. The following constants are described in this book:

- The expected number of task global variables is described in "Global Variables" on page 38.
- The expected number of common global variables is described in "Global Variables" on page 38.
- Sense code filtering is described in "DASD Filtering" on page 69.
- LU 6.2 transport values are described in "LU 6.2 Transport" on page 111.
- Nonpersistent session timeout values are described in "Persistent and Nonpersistent LUC Sessions" on page 118.
- The management of below-the-line storage is described in "Minimizing Storage Usage" on page 157.

NetView-NetView Communication

You can use the RMTCMD command to send commands to another NetView program and receive responses, and to query details about RMTCMD associations. The RMTCMD command offers the following advantages over NetView-NetView (NNT) sessions and the ROUTE command.

- The RMTCMD command consolidates the LU-LU communications from multiple operators by sending commands to a remote NetView program using a pair of LU 6.2 sessions. This saves storage and processing time for setting up sessions, and for maintaining session awareness in VTAM and the session monitor. A separate session is not needed for each operator.
- The RMTCMD command uses large buffers and RU sizes, improving performance for operators receiving large multiline messages.

NetView Program-to-Program Interface

The NetView program-to-program interface enables application programs to send network management vector transport (NMVT) or control point management services unit (CP-MSU) requests to the NetView program and enables application programs to send data buffers to, or receive data buffers from, other application programs. An application program can be a sender program, a receiver program, or both. Application programs can send data buffers to, or receive data buffers from, other applications running in the same host as the NetView program, or in a different host.

Each receiver program has a buffer queue for temporary storage of incoming data buffers. These buffer queues reside in the program-to-program interface. A sender program sends a data buffer to a receiver buffer queue, and the receiver program retrieves the data buffer from the buffer queue.

When you define a program as a receiver, you also define the buffer queue limit, the maximum number of outstanding buffers that can be stored in the receiver buffer queue. When the receiver buffer queue is full, and other buffers are sent, the sender programs receive a return code of 35.

You can use the DISPPI command to display information about PPI buffer queues, including buffer limits, buffer queue lengths, total buffers sent, and buffer storage usage. This command displays information for the current receiver or receivers defined to the program-to-program interface. Figure 22 contains sample output from the DISPPI command.

```
DWO948I RECEIVER  RECEIVER  BUFFER      QUEUED      TOTAL       STORAGE
DWO949I IDENTITY  STATUS    LIMIT       BUFFERS     BUFFERS     ALLOCATED
DWO950I --------  --------  ----------  ----------  ----------  ----------
DWO951I NETVALRT  ACTIVE          1000           0          18           0
DWO951I DUIFSSCO  ACTIVE           100           0       10049           0
DWO951I PPICMDID  ACTIVE           100           0           0           0
DWO951I DUIATMGR  ACTIVE          1000           0        3287           0
DWO951I FNMRCVQ   ACTIVE            99           0       20111           0
DWO951I NPM60AP   ACTIVE            99           0       20111           0
DWO951I DUIFI000  ACTIVE          1000           0       15027           0
DWO968I END OF DISPLAY
```

Figure 22. Sample DISPPI Command Output

Another command, DISBQL, displays buffer queue limits and the number of buffers currently available on the buffer queue. You can use the SETBQL command to reset the buffer queue limit of a receiver.

The program-to-program interface trace facility enables you to set up a trace in the program-to-program interface for either an individual receiver or all current and future receivers. The program-to-program interface trace facility writes a trace record each time a user defines, deactivates, or deletes a receiver to the program-to-program interface and each time a buffer is sent or received. You control the program-to-program interface trace facility with the TRACEPPI command. You can use the TRACEPPI command to start, stop, modify, or end the program-to-program interface trace facility. See the *IBM Tivoli NetView for z/OS Command Reference Volume 1 (A-N)* or the NetView online help for more information about the TRACEPPI command.

See the *IBM Tivoli NetView for z/OS Application Programmer's Guide* for detailed information about the NetView program-to-program interface.

Network Asset Management Facility

The network asset management facility enables you to collect vital product data (VPD) from the network. See the *IBM Tivoli NetView for z/OS Command Reference Volume 1 (A-N)* or the NetView online help for information about these commands: VPDALL, VPDPU, VPDDCE, VPDCMD, and VPDLOG. The nature of those commands and the functions they perform extend their elapsed time for execution.

A request for VPD is sent serially to the physical units (PUs) and data circuit-terminating equipment (DCE) in the network. The PUs and DCEs must receive the request and send a response. The elapsed time for this collection varies depending on the configuration of the network and the traffic rate.

Consider dividing your network into logical sections and scheduling the collection of VPD from a section at a time during off-peak hours. See the *IBM Tivoli NetView for z/OS Application Programmer's Guide* for interpretation of messages returned from the VPDCMD command.

Partitioned Data Set (PDS) Allocation

The following are the non-VSAM data sets used by the NetView program.

BNJPNL1
NetView hardware monitor panel data sets

BNJPNL2
NetView hardware monitor panel data sets

CNMPNL1
NetView panel data sets

DSICLD
NetView command list data sets

DSILIST
NetView listing data sets

DSIMSG
NetView messages data sets

DSIPARM
NetView definitions, automation table, and CMDDEF statements

DSIPRF
NetView operator profile definitions

DSIVTAM
VTAMLST data sets

The command list data set (DSICLD) is the most critical data set from a performance standpoint. Each time a command list is selected for execution, it is located and read from that data set (unless it is preloaded by LOADCL). A normal BLDL search of the partitioned data set directory is done to find the command list, enabling you to make command list changes dynamically. Usually, DSICLD is a concatenation of several data sets that can be on different direct access storage device (DASD) volumes.

Define the command list data sets with one extent and ensure that the extent will not fill up over the time the NetView program is running. If a data set expands to multiple extents after the NetView program is up and running, attempts to access members newly placed in the additional extents can cause I/O errors.

Retrieval time for command lists is an important consideration in command list performance. You can avoid physical I/O either by preloading command lists using the LOADCL command or by using a virtual I/O data set for DSICLD. If you cannot use either of those options, you can minimize physical I/O response time by placing DSICLD on a cached DASD device. If some of your command lists are on cached DASD and you have multiple volumes, put the cached volumes first in the DD definition list for DSICLD.

You can create temporary VIO data sets by placing an IEBCOPY statement in the NetView startup procedure, which copies the command lists to a VIO data set and

passes that data set on to the NetView program. When you use these temporary data sets, you cannot dynamically change the command lists. You must restart the NetView program to include the changes.

If you use panels extensively, you can reduce I/O delays by placing the panel data sets in a VIO data set. However, you cannot change such panels dynamically.

Persistent and Nonpersistent LUC Sessions

If you have a multiple-domain environment with copies of the NetView program on different hosts communicating with one another, you need to decide whether to use persistent or nonpersistent sessions for the NetView-NetView communication used by the session monitor, the hardware monitor.

Persistent sessions are most commonly used with leased lines, while nonpersistent sessions are most commonly used with dialed (switched) lines. Using nonpersistent sessions involves the additional overhead of establishing the dialed connection. Therefore, use nonpersistent sessions only when you expect very low traffic over the session. In deciding between persistent and nonpersistent sessions, examine the trade-off between leased line cost, the host processor cost of establishing the dialed connection, and the nonpersistent session.

Using Nonpersistent Sessions over Dialed Lines

If you decide to use nonpersistent sessions over dialed lines, you should understand the relationship between the timers maintained by the NetView program and NCP.

- For every nonpersistent session that it maintains, the NetView program has an activity timer, which it resets every time traffic is sent over the session. The value for this timer is defined by a constant in DSICTMOD. See *IBM Tivoli NetView for z/OS Installation: Getting Started* for more information. If there is no activity over the session within the timer interval, the NetView program ends the nonpersistent session.
- For dialed connections involving an NCP (VTAM-NCP or NCP-NCP), NCP has an activity timer, which it resets every time traffic is sent over the dialed line. This NCP timer is controlled by setting BRKCON=CONNECTO on a line or PU statement in the NCP definition. The value for this timer is set by the ACTIVTO parameter on the GROUP statement. Refer to the appropriate NCP, SSP, and EP publication for more information about activity timers. If no traffic occurs over the dialed line within the timer interval, NCP ends the dialed connection.
- For VTAM-VTAM dialed connections, if VTAM detects that a dialed connection is active but no sessions are occurring over it, VTAM ends the dialed connection.

For a nonpersistent session over a VTAM-VTAM dialed connection, the session times out according to the NetView timer. The amount of time before the line drops is therefore determined by the NetView timer.

If NCPs are involved in the dialed connection, the nonpersistent session times out as follows:

- If the NCP timer value is less than the NetView timer value, the NCP ends the dialed connection, causing the nonpersistent session to end. In this case, the line drop time is based on the NCP timer.
- If the NetView timer value is less than the NCP timer value, the NetView program brings down the nonpersistent session. Because the session termination causes traffic over the dialed connection, NCP resets its activity timer. If no other

activity occurs within the NCP timer interval, NCP ends the dialed connection. In this case, the line drop time is based on the NetView timer plus the NCP timer.

RESOURCE Command

The RESOURCE command displays statistics about NetView system resource use. This information is helpful in determining the amount of system resources used by the NetView program. Figure 23 contains sample output from the RESOURCE command.

```
DSI386I NETVIEW RESOURCE UTILIZATION 09:58:07
    1  TOTAL CPU %                =      6.65
    2  E530EENV CPU %             =      0.81
    3  E530EENV CPU TIME USED     =     14.06 SEC.
    4  REAL STORAGE IN USE        =     7664K
    5  PRIVATE ALLOCATED < 16M    =      612K
    6  PRIVATE ALLOCATED > 16M    =    17596K
    7  PRIVATE REGION    < 16M    =     4160K
    8  PRIVATE REGION    > 16M    =    32768K
END OF DISPLAY
```

Figure 23. Sample Output from the RESOURCE Command

The following information is displayed in the command output (see Figure 23).

1 Total CPU Utilization

Total complex CPU utilization based on a maximum of 100%. This utilization is calculated over the most recent 1 second interval.

2 NetView CPU Utilization

NetView CPU utilization based on a maximum of 100%. This utilization is calculated over the most recent 1 second interval.

3 NetView CPU Time Used

The combination of task control block (TCB) and service request block (SRB) CPU time used. This field is cumulative from when the NetView program was first started.

4 Real Storage In Use

The number of real storage frames that are in use (shown in kilobytes).

This value includes the number of real storage frames that are in use for both the storage that is allocated in the NetView address space and the data spaces that are owned by the NetView program.

5 Private Allocated Below 16 M

The amount of virtual storage allocated below the 16 MB line.

6 Private Allocated Above 16 M

The amount of virtual storage allocated above the 16 MB line.

7 Private Region Below 16 M

The total amount of virtual storage below the 16 MB.

8 Private Region Above 16 M

The total amount of virtual storage above the 16 MB.

The CPU use of the NetView program depends on message and network traffic levels, which can appear in bursts. Therefore, the CPU utilization can appear to spike over the small 1 second interval that the RESOURCE command uses. The cumulative CPU time, monitored over time, is a better indicator of the level of CPU use.

The real (processor) storage use of the NetView program includes central plus expanded storage frames allocated to the NetView program. On systems with little or no storage contention, a real storage use can be inflated and might not represent the true working set size.

Resource Limits

Use the NetView resource limits function to monitor and limit resource usage for various NetView tasks. You can obtain information that you can use to plan for and tune the NetView program. You can then adjust keywords according to the amount of storage consumed, CPU used, and other factors.

Keywords for Resource Limits

The following keywords can be adjusted to limit resource usage:

MAXSTG (Maximum Storage for a task)
Specifies the maximum amount of storage in Kilobytes that a task can use. When MAXSTG is reached and further storage requests are made, the DSIGET macro returns an *out of storage* return code.

SLWSTG (When to start limiting a task from getting storage)
Specifies the maximum amount of storage in kilobytes that a task can use before slowdown measures are used. When a task exceeds SLWSTG, all storage requests (using DSIGET) have a time delay.

AVLMAX
Specifies a percentage that determines, for any task, at which value the DSIGET macro returns an *out of storage* return code. In addition, queuing a message to a task that is over its AVLMAX limit results in the *task not active* condition, and the message is not transferred.

The percentage is specified as a decimal number in the range of 0–99. The NetView program computes the ratio of the amount of storage a task is using compared to the sum of that amount and the amount of storage left in the NetView address space. If the task usage is above the specified limit, the DSIGET rejects the request.

Note: The specified limit enables users to have the tasks that are under the most storage stress to fail instead of letting the entire region deplete storage, which can result in the failing of all tasks. For example, when the default of AVLMAX=90 is used, a task using 45 MB of storage has a storage failure if the amount of free space falls below 5 MB. Specifying a lower value for AVLMAX leaves more of the free address space for tasks that do not overuse storage. Specifying a higher or no limit value for AVLMAX increases the risk for storage failures on all tasks, regardless of whether they are in storage stress.

When the NetView program is started, the AVLMAX default is set to 90. This setting can be modified by using the DEFAULTS command.

AVLSLOW
Specifies a percentage that determines, for any task, at which point

slowdown measures are used. In addition, queueing a message to a task that is over its AVLSLOW limit results in that task having the same slowdown measures applied based on how much over the limit the receiving task gets.

When the NetView program is started, the AVLSLOW default is set to 85. This setting can be modified by using the DEFAULTS command.

Slowdown measures are used when a task exceeds AVLSLOW. All storage requests (using DSIGET) and message queuing to the affected task have a time delay. The time delay is one microsecond for each byte of storage requested over the SLOWSTG limit value, and quadrupled for each 1% the task is beyond the AVLSLOW value thereafter. As the task's use of storage grows, this produces a slowdown effect that is proportional to the size of the request.

The initial slowdown rate is calculated to allow storage to grow at a rate of 1 megabyte per second, in the range 0–1% beyond the limit value. When the AVLSLOW value is lowered, the point at which slowdown occurs is lowered. For example, SLOWSTG=85 triggers if the task is using 42.5 MB of storage and only 7.5 MB of good memory is left in the region. SLOWSTG=80 triggers if the task is using 40 MB of storage and only 10 MB are left in the region.

MAXCPU (Maximum CPU for a task)
Specifies the maximum CPU utilization allowed for a task. When a task exceeds the limit, automatic task slowdown measures are used to bring the task back into the specified range. The task is suspended until enough time passes for the CPU to be below the specified limit.

MAXIO (Maximum input/output transactions for a task)
Specifies the maximum number of logical VSAM I/O requests per minute allowed for a task. When a task exceeds the limit, automatic task slowdown measures are used to bring the task back into the specified range.

MAXMQIN (Maximum number of messages received by a task)
Specifies the number of message KB per minute that is allowed to be sent to the task from other tasks. When a task exceeds the limit, automatic task slowdown measures are used to bring the task back into the specified range. The intent is to add enough of a delay to each request so that the measured rate over a one minute or longer period of time falls to near or below the specified value.

MAXMQOUT (Maximum number of messages a task can send to a task)
Specifies the number of message Kilobytes per minute allowed for a task to send to another task. When a task exceeds the limit, automatic task slowdown measures are used to bring the task back into the specified range. If the task attempts to queue a message to another task, it is slowed down until the rate is under the limit. The intent is to add enough of a delay to each request so that the measured rate over a minute or longer period falls to near or below the specified value.

Changes can be made dynamically to all resource limits settings. Old values are cancelled within one second of the OVERRIDE command being processed. The tasks continue with the new limit in force. Coding a value of 0 turns off a specified resource limit setting. See the *IBM Tivoli NetView for z/OS Command Reference Volume 1 (A-N)* or the NetView online help for more information.

LOGTSTAT (Whether to log the data to SMF)
Specifies whether resource utilization data is logged to the external log (SMF).

Using Resource Limits

Be careful when you restrict a task with resource limits. Gather performance data using the V6R2PERF command list sample in Figure 1 on page 4 and then analyzed. Gather data over time for peak, standard, and off-shift workload to ensure that a complete analysis can be made.

There are certain areas within the NetView program that use a large amount of storage, high CPU during certain operations or at initialization. Do no limit these tasks beyond the default settings. For example, the Session Monitor main task, AAUTSKLP, can use high CPU during purge processing and can use a large amount of storage during a network outage. The SNA Topology Manager task FLBTOPO will use a large amount of the CPU, especially during TOPOSNA MONITOR requests. Do not limit resource utilization for tasks, such as these, at peak workload.

The resource limit function can prevent an operator task or autotask from looping and saturating a processor. When the task CPU limit is exceeded, BNH161I is issued and the CPU usage, for the OST, will be throttled. User intervention can terminate the application. The same result is true for a user-written application that is issuing DSIGET macros to obtain storage, but never using DSIFRE to release the storage. Resource limits provide the ability to put a cap on the task storage usage and will abend the task if the storage limit exceeds the maximum allowed (MAXSTG).

SNA Topology Manager

The amount of virtual storage and host processor usage by SNA topology manager on your system depends on the size of your network and the number of RODM objects that SNA topology manager creates. This topic describes how to use SNA topology manager efficiently.

Because of virtual storage and processor demands to collect and store the status and topology data, consider establishing most of your TOPOSNA MONITOR requests during off-peak periods for your system, for example, after network activation.

You can display statistics, traffic levels, storage usage, and other information with the TOPOSNA LISTRODM and TOPOSNA LISTSTOR commands. See the *IBM Tivoli NetView for z/OS Command Reference Volume 1 (A-N)* or the NetView online help for examples on using these commands.

Some TOPOSNA commands result in references to large numbers of objects in RODM and should be avoided during peak periods of activity for your system.

- The TOPOSNA STOP command stops the monitoring of the specified topology (network, local, or LU collection) associated with a specific node. As part of command processing, SNA topology manager marks each affected RODM object with *unknown* status. If there are a large number of affected objects, and storage is constrained on the system, this command can result in a large number of page faults. Therefore, if you have a large number of SNA topology manager objects in RODM, consider activating your TOPOSNA MONITOR requests throughout the peak periods of activity.

- The TOPOSNA STOPMGR command stops the topology manager in an orderly fashion. As part of this command processing, SNA topology manager marks all objects it has created in RODM with *unknown* status. If there are a large number of SNA topology manager objects in RODM, and storage is constrained on the system, this command can result in a large number of page faults. Therefore, if you have a large number of SNA topology manager objects in RODM, consider activating SNA topology manager throughout peak periods of activity.
- The TOPOSNA REFRESH command requests a refresh of values for the status resolution table, the OSI-display status table, and the Exception View table. When the Exception View table is refreshed with either `TOPOSNA REFRESH EXVIEW,CLASS=xxxx` or `TOPOSNA REFRESH ALLTABLS,CLASS=xxxx`, SNA topology manager refers to all objects in the classes listed in the `CLASS=xxxx` parameter to query their values and change them appropriately. If there are a large number of SNA topology manager objects in RODM, and storage is constrained on the system, refreshing the Exception View table can result in a large number of page faults. For this reason, if you have a large number of SNA topology manager objects in RODM, avoid refreshing the Exception View table during peak periods of activity.
- The TOPOSNA PURGE command deletes expired unreachable objects from the RODM data cache. As part of this command processing, SNA topology manager references all objects it has created in RODM to determine if they need to be purged. If there is a large number of SNA topology manager objects in RODM, and storage is constrained on the system, this command can result in a large number of page faults. For this reason, if you have a large number of SNA topology manager objects in RODM, you should avoid using the TOPOSNA PURGE command during peak periods of activity.

Warm Starts, Cold Starts, and Checkpointing

Performance is an important consideration in determining whether to warm start or cold start SNA topology manager and how often to checkpoint RODM.

There is no performance advantage in starting SNA topology manager with SNA topology data already residing in RODM; in fact, there is a small penalty in doing so. For performance, it is best to initialize SNA topology manager with no SNA topology manager objects in RODM, and then establish monitor requests for your network. Also, there is no performance advantage from checkpointing RODM with SNA topology manager objects residing in RODM.

Status Monitor STATOPT Filtering

The status monitor component of the NetView program collects and summarizes information on the status of resources defined in a VTAM domain. The status monitor can handle a maximum of 999999 resources. The status monitor preprocessor uses the resource definitions in the VTAMLST data sets to create a DSIPARM member named DSINDEF. DSINDEF contains the network resource information that the status monitor reads during initialization. See *IBM Tivoli NetView for z/OS Installation: Configuring Additional Components* for information on the preprocessor operation.

The status monitor requires approximately 120 bytes of storage for each resource that it monitors. By default, the status monitor keeps status for every resource in the network. If you would like to reduce the storage requirement for the status monitor, you can use the OMIT operand of the STATOPT statement. By specifying OMIT in the VTAMLST data sets, you can omit a node, plus all of the dependent lower nodes that follow, from the status monitor's view of the network definition.

See the *IBM Tivoli NetView for z/OS Administration Reference* for more information about coding the STATOPT statement.

STEPLIB DD Statements

Do not use a STEPLIB DD statement in your production NetView job control language (JCL). The presence of the STEPLIB DD statement causes its directory to be searched for each LOAD, LINK, or XCTL system macro executed during normal operation. That directory search degrades the performance of command procedures.

Place the NetView load libraries on the system's LINKLST. See *IBM Tivoli NetView for z/OS Installation: Getting Started*. For considerations on placing the HLL runtime libraries, see "Command Processors" on page 35.

TASKMON Command

The TASKMON command is a REXX procedure that provides color-coded monitoring of all NetView tasks. The output under each group is sorted by the severity index. The *Severity Index* represents a percentage of the maximum value allowed. Usage of TASKMON is similar to TASKUTIL usage. You can use the data shown in the TASKMON output to view current and historical data on Resource Limits.

Color codes used by the TASKMON command:

White SLOWSTG limit exceeded

Yellow
70% of limit for this line exceeded

Pink 80% of limit for this line exceeded

Red 90% of limit for this line exceeded

TASKMON provides statistics based on CPU percentage used on a single processor. TASKUTIL provides statistics based on CPU percentage for the sum of all defined processors, for example, a sysplex with six CPUs dedicated to the NetView program.

To issue a TASKMON command, enter:

```
TASKMON * *
```

A response that is similar to the following response is displayed:

```
TASKMON ---- START OF REPORT ----
  Severity Index   OPID        Current    Session    Maximum      Limit
  ------CPU------  --------  ---------  ---------  ---------  ---------
          152.00%  OPER3        1.52 %     0.19 %    33.85 %     1.00 %
           23.34%  AUTO2       11.67 %     1.53 %    67.24 %    50.00 %
            0.03%  NTV98PPT     0.03 %     0.04 %     4.16 %    99.99 %
            0.02%  DSIMONIT     0.02 %     0.01 %     0.04 %    99.99 %

  Severity Index   OPID        Current    Session              Seconds
  -Penalty Time--  --------  ---------  ---------  ---------  ---------
          81.89%   OPER3       81.89 %     2.97 %               81.66 S

Memory=  46.26%   24-Bit=  16.63%   31-Bit=  50.02%     Left= 19844 K

Severity Index   OPID        Current    Maximum      Limit   Slowdown
----Storage----  --------  ---------  ---------  ---------  ---------
          7.15%  AAUTSKLP     1528 K     1544 K   999999 K   999999 K
          5.86%  AUTO2        1172 K     3605 K    20000 K     4000 K
          4.93%  MAINTASK     1028 K     1028 K    26214 K    23592 K
          1.96%  CNMTAMEL      397 K      401 K   999999 K   999999 K
          1.21%  AAUTCNMI      244 K      295 K   999999 K   999999 K
          0.82%  NTV98PPT      164 K      265 K   999999 K   999999 K
          0.81%  AUTO1         162 K      251 K   999999 K   999999 K
          0.81%  DSISVRT       162 K      213 K   999999 K   999999 K
          0.47%  DSIAL2WS       93 K      121 K   999999 K   999999 K
          0.42%  BNJDSERV       84 K       85 K   999999 K   999999 K
          0.31%  NTV98VMT       62 K       81 K   999999 K   999999 K
          0.30%  DSILCOPR       59 K      114 K   999999 K   999999 K
          0.29%  OPER3          57 K       60 K   999999 K   999999 K
          0.28%  ALIASAPL       55 K      102 K   999999 K   999999 K
          0.27%  DSI6DST        54 K      112 K   999999 K   999999 K
          0.23%  DSIGDS         45 K       89 K   999999 K   999999 K
          0.22%  VPDTASK        44 K       75 K   999999 K   999999 K
          0.21%  NTV98LUC       42 K       93 K   999999 K   999999 K
          0.21%  DSIHPDST       42 K       93 K   999999 K   999999 K
          0.20%  DSIQTSK        39 K       94 K   999999 K   999999 K
          0.18%  BNJDSE36       35 K       89 K   999999 K   999999 K
          0.18%  DSIQRV4A       36 K       36 K   999999 K   999999 K
          0.18%  DSIQRV4B       36 K       36 K   999999 K   999999 K
          0.18%  DSIQRV4C       36 K       36 K   999999 K   999999 K
          0.17%  DSIUDST        34 K       85 K   999999 K   999999 K
          0.17%  DSICRTR        33 K       85 K   999999 K   999999 K
          0.15%  DSIAMLUT       30 K       73 K   999999 K   999999 K
          0.14%  BNJMNPDA       28 K       28 K   999999 K   999999 K
          0.13%  DSILOG         26 K       73 K   999999 K   999999 K
          0.13%  DSIKREM        25 K       73 K   999999 K   999999 K
          0.12%  DSIROVS        24 K       77 K   999999 K   999999 K
          0.11%  DSIELTSK       22 K       73 K   999999 K   999999 K
          0.11%  OPER1          22 K       73 K   999999 K   999999 K
          0.10%  OPER2          20 K       20 K   999999 K   999999 K
          0.09%  DSITRACE       18 K       73 K   999999 K   999999 K
          0.04%  DUIFSSCO        8 K        8 K   999999 K   999999 K
          0.04%  NTV98BRW        8 K        8 K   999999 K   999999 K
          0.03%  NTV98           6 K        6 K   999999 K   999999 K
```

Figure 24. Sample TASKMON Output (Part 1 of 2)

```
          0.02%  DSIMONIT        4 K        4 K   999999 K   999999 K
          0.02%  DSIDCBMT        3 K        4 K   999999 K   999999 K
          0.02%  DSILOGMT        4 K        4 K   999999 K   999999 K
          0.02%  DSIHLLMT        3 K        4 K   999999 K   999999 K
          0.02%  CNM01QSD        4 K       59 K   999999 K   999999 K
          0.02%  DSIQSD4A        4 K       59 K   999999 K   999999 K
          0.02%  DSIQSD4B        4 K       59 K   999999 K   999999 K
          0.02%  DSIQSD4C        4 K       59 K   999999 K   999999 K
          0.02%  DSISTMMT        4 K        4 K   999999 K   999999 K
          0.02%  SYSOP           3 K        4 K   999999 K   999999 K
          0.02%  CNMCALRT        4 K        4 K   999999 K   999999 K
          0.02%  GOPHER          3 K       58 K   999999 K   999999 K
          0.02%  CAPTAIN         3 K       58 K   999999 K   999999 K
          0.02%  DSIRQJOB        4 K        4 K   999999 K   999999 K
          0.02%  DSITIMMT        3 K        4 K   999999 K   999999 K
 Severity Index   OPID        Current    Session  Cur 24bit Sess 24bit
----DSIGET-----  --------  ---------  ---------  ---------  ---------
        100.00%  AUTO2     20120 K/m    521 K/m   8971 K/m     99 K/m
          0.02%  NTV98VMT      4 K/m      8 K/m      0 K/m      4 K/m
Severity Index   OPID        Current    Session  Cur 24bit Sess 24bit
----DSIFRE-----  --------  ---------  ---------  ---------  ---------
        100.00%  AUTO2     17779 K/m    479 K/m   8977 K/m     99 K/m
          0.04%  NTV98PPT      7 K/m     27 K/m      0 K/m      6 K/m
Severity Index   OPID        Current    Session    Maximum      Limit
----MQS In-----  --------  ---------  ---------  ---------  ---------
          0.91%  AUTO2         1 K/m      1 K/m    153 K/m    110 K/m
          0.00%  NTV98PPT      7 K/m      4 K/m     41 K/m 999999 K/m
          0.00%  DSILOG        1 K/m      1 K/m     71 K/m 999999 K/m
Severity Index   OPID        Current    Session    Maximum      Limit
----MQS Out----  --------  ---------  ---------  ---------  ---------
          4.35%  AUTO2         5 K/m      0 K/m     69 K/m    115 K/m
          0.00%  NTV98PPT      1 K/m      1 K/m     28 K/m 999999 K/m
          0.00%  NTV98VMT      1 K/m      2 K/m     54 K/m 999999 K/m
Severity Index   OPID        Current    Session    Maximum      Limit
------I/O------  --------  ---------  ---------  ---------  ---------
         32.45%  AUTO2       6490 /m    144 /m   26036 /m   20000 /m
          0.00%  DSILOG        11 /m     10 /m     395 /m  999999 /m
TASKMON ----- END OF REPORT -----
```

Figure 25. Sample TASKMON Output (Part 2 of 2)

Note: The output under each group is sorted by the ***severity index***. The *Severity Index* represents percentage of the maximum value allowed, or if no limit, the maximum value measured for any task.

The command `WINDOW TASKMON * * (TAKE 4` produces a panel that displays the highest four tasks in each of the measured categories. The WINDOW refresh function key can be used to see updated values. TASKMON output is color coded based on severity.

For more information on using the TASKMON command and its operands, see the *IBM Tivoli NetView for z/OS Command Reference Volume 1 (A-N)* or the NetView online help.

TASKUTIL Command

The TASKUTIL command displays task performance information, including central processing unit (CPU) utilization, queue lengths, storage use, and active command lists. This command is for NetView diagnosis and tuning purposes only.

The TASKUTIL command has three parameters:

TYPE
Specifies the type of NetView task:

ALL All active NetView tasks. ALL is the default.

AUTO
NetView automation operator station tasks started with the AUTOTASK command. This does not include operator station tasks (OSTs) or distributed automation tasks (DISTs).

DIST NetView distributed automation tasks started with the RMTCMD command. This does not include OSTs or autotasks.

DST NetView data services tasks (DSTs). This does not include optional tasks (OPTs).

HCT NetView hard copy log tasks.

MNT NetView main task.

NNT NetView-NetView tasks.

OPT NetView optional tasks. This does not include DSTs.

OST NetView operator station tasks. This does not include autotasks or DSTs.

PPT NetView primary program operator interface task (PPT).

VOST Virtual Operator Station Tasks (VOSTs). A VOST is created during the ATTACH phase of each full screen automation request.

TYPE can also specify an individual task name.

DURATION
Specifies the length of the measurement, in seconds, over which utilizations are to be calculated. Valid values are from 1–60 seconds. The default is 2 seconds.

SORT
Specifies how the output should be sorted. For example, by NAME, TYPE, or CPU percentage (CPUP). CPUP is the default value.

See the *IBM Tivoli NetView for z/OS Command Reference Volume 1 (A-N)* or the NetView online help for a complete description of the TASKUTIL command and its parameters.

TASKUTIL Command Output

To display CPU utilization and storage used for NetView DSTs, enter the following command:

```
TASKUTIL TYPE=DST
```

You receive a response similar to the output in Figure 26 on page 128.

```
DWO022I
TASKNAME TYPE DPR     CPU-TIME N-CPU% S-CPU% MESSAGEQ STORAGE-K  CMDLIST
-------- ---- --- ------------ ------ ------ -------- --------- --------
AAUTSKLP DST  249     22019.13  49.02   9.37        0     87521      N/A
BNJDSERV DST  250      4466.25   7.35   1.41        0       357      N/A
DSIELTSK DST  253      4731.99   7.24   1.38        0        31      N/A
DSICRTR  DST  251      1362.16   1.97   0.38        0        32      N/A
DSILOG   DST  254       624.64   1.40   0.27        0        23      N/A
DSIAMLUT DST  248      1145.74   1.34   0.26        0        26      N/A
AAUTCNMI DST  249        94.44   0.33   0.06        0       463      N/A
BNJDSE36 DST  249         0.04   0.00   0.00        0        25      N/A
CNMTAMEL DST  249         0.36   0.00   0.00        0        49      N/A
CNM01LUC DST  251       306.54   0.00   0.00        0        43      N/A
DSIGDS   DST  254         1.89   0.00   0.00        0        46      N/A
DSIHPDST DST  252         2.15   0.00   0.00        0        39      N/A
DSIKREM  DST  250         2.15   0.00   0.00        0       549      N/A
DSIROVS  DST  251         0.03   0.00   0.00        0        13      N/A
DSISVRT  DST  253         0.93   0.00   0.00        0       105      N/A
DSIUDST  DST  250         2.59   0.00   0.00        0        14      N/A
DSI6DST  DST  251        28.98   0.00   0.00        0        41      N/A
NETVIEW  OTHR N/A          N/A   0.00   0.00      N/A       N/A      N/A
NETVIEW  SRB  N/A       4026.90   5.93   1.13      N/A       N/A      N/A
NETVIEW  TOTL 157      54766.96 100.00  19.11      253    157477      N/A
SYSTEM   TOTL N/A          N/A    N/A  63.70      N/A       N/A      N/A
```

Figure 26. TASKUTIL Command Output

This output was created using the SORT parameter default CPUP and the DURATION default of 2 seconds. See the *IBM Tivoli NetView for z/OS Command Reference Volume 1 (A-N)* for a full explanation of the output fields.

The following events occur when the TASKUTIL command is invoked:

1. CPU time readings are taken for each NetView task. These are the cumulative CPU time values shown under the heading `CPU-TIME`.
2. The task processing the TASKUTIL command waits for the amount of time equal to the value of the DURATION parameter. The task is unable to process commands or messages during this time.
3. When the wait is over, a second set of CPU time readings is taken for each NetView task.

The two fields most important to tuning and diagnosis are N-CPU% (NetView program CPU utilization) and S-CPU% (system CPU utilization).

The N-CPU% and S-CPU% results reflect utilization over the measurement interval specified by the DURATION parameter of the TASKUTIL command. For short intervals, such as the default of 2 seconds, these utilizations are only snapshots, and can be subject to wide variation as the workload of the NetView program fluctuates. If you use a longer measurement duration, you will get more meaningful utilization results. The DURATION parameter has a limit of 60 seconds, because suspending a task for a longer period could cause problems if the task is receiving messages.

It is helpful to understand the N-CPU% and S-CPU% fields and how their values are calculated. The CPU utilization percentage values are calculated from the two sets of CPU time readings.

Task NetView CPU Utilization

N-CPU% is the task's relative contribution to the CPU utilization of the NetView program, based on a maximum of 100%. The formula is:

```
                (Task 2nd reading - Task 1st reading)
N-CPU%=------------------------------------------------------ × 100%
       (NetView total 2nd reading - NetView total 1st reading)
```

The numerator represents the task control block (TCB) time used by the task during the measurement. The denominator represents the total CPU time (TCB time + system request block (SRB) time) used by the NetView program during the measurement. Multiplying the result by 100% expresses the utilization as a percentage.

Task System CPU Utilization

S-CPU% is the task's contribution to the total system CPU utilization, based on a maximum of 100%. The formula is:

```
                (Task 2nd reading - Task 1st reading)
S-CPU%=-----------------------------------------------------------x100%
       (Measurement duration × Number of online host processors)
```

The numerator represents the TCB time used by the task during the measurement. The denominator represents the total CPU time that was available during the measurement (the total capacity of the host processors). The measurement duration must be expressed in seconds. Multiplying the result by 100% expresses the utilization as a percentage.

Other CPU Utilization

The NETVIEW OTHR category represents TCB utilization that cannot be attributed to active tasks. The following formula is used to calculate the value in the NETVIEW OTHR CPU-TIME field is:

```
OTHR CPU TIME=TOTAL CPU TIME - SRB CPU TIME - (Sum of CPU TIME for each active task)
```

When the NETVIEW OTHR CPU-TIME value is calculated, it is used in the numerators of the N-CPU% and S-CPU% formulas to calculate the NETVIEW OTHR N-CPU% and S-CPU% utilization values.

SRB Utilization

To calculate the NetView SRB N-CPU% and S-CPU% utilization values, two readings of the NetView address space cumulative SRB time are used in the numerators of the N-CPU% and S-CPU% formulas.

NetView Program Total CPU Utilization

For the NETVIEW TOTL utilization results, two readings of the NetView address space cumulative CPU time (TCB + SRB) are used in the numerator of the N-CPU% and S-CPU% formulas. For the N-CPU% field, the result is always 100%. The S-CPU% field for NETVIEW TOTL is the same result as the NetView CPU % field reported by the RESOURCE command, except that the RESOURCE command uses a 1 second measurement duration. See “RESOURCE Command” on page 119 for more information.

System Total CPU Utilization

The SYSTEM TOTL utilization is the average processor utilization percentage for all processors currently online. This result is calculated using the wait time for each of the host processors as follows:

```
       Sum of wait time for all processors during measurement
(1 - ------------------------------------------------------) × 100%
     (Measurement duration × Number of online host processors)
```

The SYSTEM TOTL CPU utilization is the same result as the TOTAL CPU % field reported by the RESOURCE command, except that the RESOURCE command uses a 1 second measurement duration. See "RESOURCE Command" on page 119 for more information.

Calculating Task Utilizations with Two Observations of TASKUTIL

You can calculate task utilization values over longer measurement intervals using two observations of the TASKUTIL command. You can use the same N-CPU% and S-CPU% formulas to calculate task utilization over an hour, an 8 hour shift, a day, or a week.

The output in Figure 27 is from a TASKUTIL command invocation taken from the same system as in Figure 26 on page 128, two hours later.

```
DWO022I
TASKNAME TYPE DPR     CPU-TIME N-CPU% S-CPU% MESSAGEQ STORAGE-K  CMDLIST
-------- ---- --- ------------ ------ ------ -------- --------- --------
AAUTSKLP DST  249     23907.17  64.62   9.51        0     88844      N/A
DSIELTSK DST  253      5053.53   8.97   1.32        0        31      N/A
DSIAMLUT DST  248      1210.42   2.32   0.34        0        26      N/A
BNJDSERV DST  250      4747.71   1.90   0.28        0       364      N/A
DSICRTR  DST  251      1456.56   1.83   0.27        0        32      N/A
DSILOG   DST  254       668.85   0.43   0.06        0        23      N/A
AAUTCNMI DST  249       100.61   0.00   0.00        0       463      N/A
BNJDSE36 DST  249         0.04   0.00   0.00        0        25      N/A
CNMTAMEL DST  249         0.36   0.00   0.00        0        49      N/A
CNM01LUC DST  251       329.23   0.00   0.00        0        43      N/A
DSIGDS   DST  254         2.06   0.00   0.00        0        46      N/A
DSIHPDST DST  252         2.23   0.00   0.00        0        39      N/A
DSIKREM  DST  250         2.15   0.00   0.00        0       549      N/A
DSIROVS  DST  251         0.03   0.00   0.00        0        13      N/A
DSISVRT  DST  253         0.93   0.00   0.00        0       105      N/A
DSIUDST  DST  250         2.59   0.00   0.00        0        14      N/A
DSI6DST  DST  251        31.10   0.00   0.00        0        41      N/A
NETVIEW  OTHR N/A          N/A   0.00   0.00      N/A       N/A      N/A
NETVIEW  SRB  N/A      4279.93   6.26   0.92      N/A       N/A      N/A
NETVIEW  TOTL 157     59017.88 100.00  14.72      275    151527      N/A
SYSTEM   TOTL N/A          N/A    N/A  60.51      N/A       N/A      N/A
```

Figure 27. Output from TASKUTIL Command, 2 Hours Later

It is evident that AAUTSKLP, the session monitor data services task, is the biggest contributor to NetView CPU use. Over the 2 hour period, AAUTSKLP used 1888.04 CPU seconds (23907.17 - 22019.13), while the NetView program as a whole used 4250.92 CPU seconds (59017.88 - 54766.96). For the 2 hour period, AAUTSKLP's relative contribution to the total CPU utilization according to the N-CPU% formula is:

$$\frac{(23907.17 - 22019.13)}{(59017.88 - 54766.96)} \times 100\% = 44.41\%$$

Assume that there are six online host processors. AAUTSKLP's contribution to the total system CPU utilization according to the S-CPU% formula is:

$$\frac{(23907.17 - 22019.13)}{(2 \times 60 \times 60) \times 6} \times 100\% = 4.37\%$$

Remember that you need to convert the measurement duration to seconds for these utilization formulas (2 hours × 60 minutes per hour × 60 seconds per minute

= 7200 seconds). This technique makes the assumption that the task did not stop and restart during the measurement interval.

According to the S-CPU% formula, the contribution to the total system CPU utilization for the 2 hour period is:

$$\frac{(59017.88 - 54766.96)}{(2 \times 60 \times 60) \times 6} \times 100\% = 9.84\%$$

Suggestions for Using TASKUTIL

Suggestions for using TASKUTIL are:

- Although an individual invocation of TASKUTIL provides a valuable picture of the level of activity in the NetView program, remember that it is only a snapshot. Use multiple invocations of TASKUTIL to spot trends in task CPU usage and storage growth.
- Consider setting an EVERY timer under an autotask to invoke TASKUTIL every 15 minutes or every hour. By default, output from the TASKUTIL command (DWO022I) goes to the network log. The TASKUTIL output can be used as important historical data in diagnosing performance or storage problems. You can use the BLOG command to browse only messages in the network log generated by the autotask invoking TASKUTIL.
- You can write applications to invoke TASKUTIL and trap the output for analysis:
  - A command list can warn of threshold boundaries for task CPU or storage usage being reached.
  - A command list/View panel pair can invoke TASKUTIL and display the data dynamically.
  - A REXX command list can reformat the CPU and storage data into a history file using EXECIO.
  - A command processor can build SMF records from the TASKUTIL output and write the records to the external log task (DSIELTSK).
- TASKUTIL output can aid in tuning the NetView program, for example:
  - If a command or component is showing constantly high CPU usage, the command or component should receive focus for tuning or performance improvements.
  - If a subset of the autotasks show heavy CPU usage while others have light CPU usage, you could probably improve performance by redistributing work among the autotasks.
  - If the NetView program contributes more to the total system CPU utilization than you would like, TASKUTIL output could be used to justify component tuning activity or possibly hardware upgrades.
- TASKUTIL output can aid in diagnosis of problems. For example:
  - If the task's storage allocation of a task continues to rise, it could indicate that the task is getting storage, but not freeing it properly.
  - If an operator task, autotask, distributed autotask, or NNT shows continually high CPU usage, this could indicate an endless loop condition in a command list or command. TASKUTIL displays the active command list for these task types.
  - If an operator task, autotask, distributed autotask, or NNT shows the same command list active, a message queue build up, and low CPU usage, this could indicate that the command list is stuck in a WAIT.

– If the message queues for tasks continue to grow during a steady state period when the workload activity of the NetView program should be fairly uniform, and if the total system CPU utilization is near 100%, then this could indicate that the NetView program is not getting dispatched frequently enough to do its work. Continued message queue growth results in continued NetView storage growth, which can lead to storage abends. If you detect such a condition, consider ending low-priority CPU-intensive applications to relieve the system CPU constraint. If the NetView program regularly experiences message queue growth, consider making the MVS dispatching priority for the NetView address space more favorable.

Tivoli NetView for z/OS Enterprise Management Agent

Use the IBM Tivoli NetView for z/OS Enterprise Management Agent to manage your network from the Tivoli Enterprise Portal. Both sampled and real-time NetView data is available in the Tivoli Enterprise Portal with this agent. With the NetView for z/OS Enterprise Management Agent and the OMEGAMON® XE performance agents, you can manage and view availability and performance data for your network from a single interface.

Data collection for the NetView for z/OS Enterprise Management Agent is done in the NetView address space. When reviewing the NetView for z/OS Enterprise Management Agent statements in the CNMSTYLE member, choose the sampling interval values carefully. Here are things to consider:

- If the volume of data that you are collecting for a particular subtower is high, you might want a higher interval value than for a subtower for which you have less data.
- If you are using OMEGAMON XE for Mainframe Networks and using the NetView cross-product links, you might want to set your CONNACT and CONINACT subtower interval values to be the same value as the OMEGAMON XE for Mainframe Networks TCPC collector value.
- DVIPA data collection can involve walking MIBs. This is usually slower than other methods of data collection.
- Each time a data collection occurs for each subtower, you might see NetView CPU and storage utilization increase. Use the TASKMON and TASKUTIL commands to monitor CPU and storage for the autotasks (AUTODC*x* and AUTOCT*x* by default) assigned to each subtower.
- If data collection for a subtower does not seem to occur on the designated interval, use the NACTL LISTINFO or the COLLCTL LISTINFO command (depending on the subtower) to determine how long the data collection is taking.

See *IBM Tivoli NetView for z/OS Installation: Configuring the NetView Enterprise Management Agent* and the *IBM Tivoli NetView for z/OS Administration Reference* for more information about CNMSTYLE statements for the NetView for z/OS Enterprise Management Agent.

You can also make tuning changes when you configure the NetView for z/OS Enterprise Management Agent. See the section about tuning considerations in *IBM Tivoli NetView for z/OS Installation: Configuring the NetView Enterprise Management Agent*.

Chapter 11. Storage Considerations

This section provides techniques for accomplishing the following tasks:
- Estimating storage that is required for the NetView program, RODM, and GMFHS at the host
- Minimizing storage requirements
- Setting REGION sizes

Estimating Storage Usage

A spreadsheet is provided and contains formulas for estimating minimum virtual storage requirements for the NetView, NetView subsystem, GMFHS, RODM, and Event/Automation Service address spaces, the RODM data space, and minimum DASD requirements for important NetView, GMFHS, and RODM data sets.

The spreadsheet, along with a readme file, is contained in the nvstorage_estimator_v6r2.ods file in the storage_estimator directory on the NetView DVD. The spreadsheet can be used with spreadsheet programs that support the Lotus® Symphony® ODS format, for example, Lotus Symphony.

If you do not have access to a spreadsheet program, use the formulas in the following tables to estimate the storage requirements for the NetView for z/OS program.

If you have access to a spreadsheet program, the following tables can be useful for reference because they contain additional information not contained in the spreadsheets on how to pick appropriate values for the input parameters.

Table 3. Base NetView Formulas. All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
INITSTART	3	19124	20456	Initial Storage use of the base NetView program is 19124 KB.
Autotasks	25	_____ * 268	_____	The number of autotasks you expect to have active on your system. Use the TASKUTIL command to display the active NetView tasks on your system. Add the number of tasks with TYPE=AUTO and TYPE=DIST (distributed autotasks used by the RMTCMD command) shown in the TASKUTIL display.
NNTs	5	_____ * 150	_____	The number of NetView-NetView tasks (NNTs) you expect to have active on your system. NetView-NetView tasks are started when an operator from another NetView domain starts a session to this NetView domain. For the number of NNTs, use the TASKUTIL command to display the active NNTs on your system. Add the number of tasks with TYPE=NNT shown in the TASKUTIL display.
BrowseLines	10000	_____ / 50 * 4	_____	Number of lines (or records) in the largest data set you will browse. Member browse reads the entire member into storage.

Table 3. Base NetView Formulas (continued). All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
ExtTrace	0	_____ * 44	_____	Will you be using the external trace function? Enter 1 if yes or 0 if no. If yes, this adds in the extra storage required. To determine if the external trace function is used, use either the LIST STATUS=TASKS or TASKUTIL command and see whether task DSITRACE is active. The default is 1 for yes.
IntTracePgs	0	_____ * 4	_____	How many pages will you be using for NetView internal trace? The default is 0. If you start NetView internal trace and do not specify the SIZE parameter, a default of 250 pages is used. The LIST TRACE command can be used to determine this value.
SaveRestore	1	_____ * 232	_____	Will you be using the save/restore function? Enter 1 for yes or 0 for no. If yes, this adds in the extra storage required. To determine if the save/restore function is used, use either the LIST STATUS=TASKS or TASKUTIL command and see if task DSISVRT is active. The default is 1 for yes.
StatMon	1	_____ * 145	_____	Will you be using the status monitor? Enter 1 for yes or 0 for no. If yes, this adds in the extra storage required. To determine if the status monitor is used, use either the LIST STATUS=TASKS or TASKUTIL command and see if a task is active whose name consists of the five letter NetView domain identifier followed by the letters 'VMT' (for example, CNM01VMT). The default is 1 for yes.
VTAMnodes	4200	(_____ * 130) / 1024	_____	How many VTAM nodes (major and minor) will you be monitoring with the status monitor? A minor node is a uniquely-defined resource within a major node. A major node is a set of resources that can be activated and deactivated as a group. Include all PUs and LUs defined in the VTAMLST. The status monitor main panel (domain status summary) displays this total.
Alias	0	_____ * 92	_____	Will you be using the alias name translation function? Enter 1 for yes or 0 for no. If yes, this adds in the extra storage required. To determine if this function is used, use either the LIST STATUS=TASKS or TASKUTIL command and see if task ALIASAPL is active. The default is 0 for no.
NtwkProduct	1	_____ * 63	_____	Will you be using the network product support facility? Enter 1 for yes or 0 for no. If yes, this adds in the extra storage required. To determine if this function is used, use either the LIST STATUS=TASKS or TASKUTIL command and see if task DSIGDS is active. The default is 1 for yes.

Table 3. Base NetView Formulas (continued). All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
GdsDSRBs	6	_____ * 1	_____	Specify the number of DSRBs used by task DSIGDS. This number is the sum of the DSRBO and DSRBU parameters in DSIPARM member DSICPINT. The DSRBS DSIGDS command also displays this number. The default is 6. This is applicable only if the network product support facility is used.
CSCF	0	_____ * 38	_____	Will you be using the central site control facility (CSCF)? CSCF enables you to run remote online diagnostic tests on 3172 and 3174 devices that support this function. Enter 1 for yes or 0 for no. If yes, this adds in the extra storage required. To determine if this function is used, use either the LIST STATUS=TASKS or TASKUTIL command and see if task DSIKREM is active. The default is 0 for no.
ExternalLog	0	_____ * 56	_____	Will you be using the external logging support facility? Enter 1 for yes or 0 for no. If yes, this adds in the extra storage required. To determine if this function is used, use either the LIST STATUS=TASKS or TASKUTIL command and see if task DSIELTSK is active. The default is 0 for no.
InfoMgmt	0	_____ * 1960	_____	Will you be using the Information/ Management Link? Problems can be logged in the information/management database from the NetView program. Enter 1 for yes or 0 for no. If yes, the required extra storage is added. The default is 0 for no.
MSTransport	1	_____ * 93	_____	Will you be using the management services (MS) transport? The MS transport is a programming interface that enables applications in network nodes to communicate using conversations over LU 6.2 sessions. MS transport is used for focal point support, remote bridge support, and user-written applications. Enter 1 for yes or 0 for no. If yes, this adds in the extra storage required. To determine if this function is used, use either the LIST STATUS=TASKS or TASKUTIL command and see whether task DSI6DST is active. The default is 1 for yes.
MSPartners	20	(_____ * 124) / 1024	_____	Using MS transport, how many partner LUs will communicate with the NetView program? Specify the total number of LUs communicating with applications using MS transport services. This is applicable only if you are using the MS transport.

Table 3. Base NetView Formulas (continued). All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
HPTransport	1	_____ * 53	_____	Will you be using the NetView high performance transport? The high performance transport offers higher performance over the MS transport for applications that require a high transfer rate, or do not require send confirmations. Enter 1 for yes or 0 for no. If yes, this adds in the extra storage required. To determine if this function is used, use either the LIST STATUS=TASKS or TASKUTIL command and see if task DSIHPDST is active. The default is 1 for yes.
HPPartners	20	(_____ * 124) / 1024	_____	Using HP transport, how many partner LUs will communicate with the NetView program? Specify the total number of LUs communicating with applications using high performance transport services. This is applicable only if you are using the HP transport.
RMTCMD	1	_____ * 80	_____	Will you be using the RMTCMD command? RMTCMD allows you to send system, subsystem, and network commands for execution under other NetView domains. You can send only single or multiline messages, or commands that do not produce full-screen output. RMTCMD uses high performance transport services (DSIHPDST). Enter 1 for yes or 0 for no. If yes, this adds in the extra storage required. To determine if this function is used, use either the LIST STATUS=TASKS or TASKUTIL command and see if task DSIUDST is active. The default is 1 for yes.
AutoTblSize	1000	(_____ * 200) / 1024	_____	How many IF-THEN and ALWAYS statements will be in the automation table? The AUTOCNT TYPE=BOTH STATS=DETAIL command has the IF-THEN and ALWAYS statements numbered sequentially for the MSG and MSU statements. Select the highest statement number from the MSG and MSU sections of the detailed report.
GlobalVars	50	used in next formula		What is the total number of global variables (task and common) you will be using? Command list global variables are stored in dictionaries; one task level dictionary per operator and one common global dictionary for all operators logged onto the NetView program. Enter the total number of task and common global variables to be stored in all dictionaries. Use the QRYGLOBL command to determine the number of global variables in use.

Table 3. Base NetView Formulas (continued). All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
AvgVarSize	40	(GlobalVars_____ * (AvgVarSize_____ + 45)) / 1024	_____	What is the average length (in bytes) of your variables? The length of numeric variables is 4 bytes, while the length of a text variable is simply the length of the text string in bytes. Enter the average length for your common and task global variables. The QRYGLOBL command can help in determining this value.
UserTasks	0	_____ * 50	_____	How many user-written tasks will you have? Enter the number of user-written data services tasks (DSTs) and optional subtasks (OPTs) for your installation.
PreloadClists	0	used in next formula		How many command lists will you preload with the LOADCL command? Use the MAPCL command to obtain this information.
AvgClistSize	2000	(PreloadClists_____ * AvgClistSize_____) / 1024	_____	What is the average size (in bytes) of your preloaded command lists? Use the MAPCL command to obtain this information.
ResCmdProcs	0	used in next formula		How many resident user-written command procedures will you have? Command procedures are made resident if the RES=N parameter on the CMDDEF statement for the command procedure in member CNMCMD is omitted.
AvgResSize	2000	(ResCmdProcs_____ * AvgResSize_____) / 1024	_____	What is the average size (in bytes) of your resident user-written command procedures?
ATFs	0	used in next formula		How many user-written automation table functions (ATFs) will you have? ATFs allow function calls from the automation table to a user-written or to a module supplied by IBM, which can then pass and return information. When the automation table is loaded, all ATFs invoked from the table are also loaded.
AvgATFSize	2000	(ATFs_____ * AvgATFSize_____) / 1024	_____	What is the average size (in bytes) of your user-written ATFs?
Exits	0	used in next formula		How many installation exits will you have? Include both DST (XIT*xx*) and OST (DSIEX*xx*) exits.
AvgExitSize	2000	(Exits_____ * AvgExitSize_____) / 1024	_____	What is the average size (in bytes) of your installation exits?

Table 4. Hardware Monitor Formulas. All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
HardMon	0	_____ * 433	_____	Will you be using the hardware monitor? Enter 1 for yes or 0 for no. If yes, this adds in the extra storage required. To determine if this function is used, use either the LIST STATUS=TASKS or TASKUTIL command and see if task BNJDSERV is active. The default is 0 for no. The remainder of the parameters in this table are applicable only if hardware monitor is used.
ALCACHE	10	(_____ * 500) / 1024	_____	Specify the ALCACHE value from the CNMSTYLE member. If the ALCACHE value is set to NONE, use a value of 0. If the ALCACHE value is set to WRAPCNT, use a value equal to the alert recording wrap count, which defaults to 100. The default value is 10.
TotResources	5000	Used in DASD storage formula		Specify the number of resources in your network that could send alerts to hardware monitor.
AvgRecords	10	Used in DASD storage formula		Specify the average number of records you expect to have in the hardware monitor database, per resource. To get a conservative (high) estimate, you can specify the average wrap count used for events and statistics recording. Wrap counts are specified with the NPDA SWRAP command. The default wrap count for events and statistics recording is 25.

Summary	Formula	Result
Hardware Monitor Virtual Storage	Sum of table values in Results column	_____
Hardware Monitor DASD Storage in kilobytes (Kb)	(500000 + TotResources_____ * (500 + AvgRecords_____ * 700)) / 1024	_____

Table 5. Session Monitor Formulas. All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
SessMon	0	_____ * 2327	_____	Will you be using the session monitor? Enter 1 for yes or 0 for no. If yes, this adds in the extra storage required. To determine if this function is used, use either the LIST STATUS=TASKS or TASKUTIL command and see if task AAUTSKLP is active. The default is 0 for no. The remainder of the parameters in this table are applicable only if session monitor is used.
TsklpDSRBs	10	(6 + roundup(.5 * _____) + roundup(.75 * _____)) * 16	_____	Specify the number of DSRBOs used by task AAUTSKLP. This number is specified with the DSRBO parameter in the initialization member for AAUTSKLP (default AAUPRMLP). You can also use the DSRBS AAUTSKLP command to display this number. The default is 10.

Table 5. Session Monitor Formulas (continued). All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
TcnmiDSRBs	11	(_____ + 1) * 16	_____	Specify the total number of DSRBs used by task AAUTCNMI. This number is the sum of the DSRBO and DSRBU parameters in the initialization member for AAUTCNMI (default AAUCNMTD). You can also use the DSRBS AAUTCNMI command to display this number. The default is 11.
RTM	0	Used in session storage formulas	_____	Is RTM (response time monitor) active? Enter 1 for yes or 0 for no. RTM is a NetView feature available with the 3x74 control unit to measure response times. To determine if RTM is used, check the initialization member for AAUTSKLP (default AAUPRMLP) to see if RTM=YES is specified. The default is 0 for no.
KEEPRTM	10	Used in session storage formulas		Specify the KEEPRTM value in the initialization member for AAUTSKLP (default AAUPRMLP), which specifies the number of collection periods retained for sessions which have RTM data collected. If you do not issue the NLDM COLLECT RTM command, RTM data is only received from the 3x74 when the session ends, and you should specify a KEEPRTM value of 1. This value is applicable only if RTM is active. The default is 10.
KEEPSESS	0	Used in DASD storage formulas		Specify the KEEPSESS value in the initialization member for AAUTSKLP (default AAUPRMLP), which is used to control DASD session recording and reduce purging session data from the database. The default is 0.
SSCP-SSCP	0	(_____ * 370) / 1024	_____	Specify the number of active SSCP-SSCP sessions. SSCPs (system services control points) activate, control, and deactivate network resources. To determine this value, use the SESSMDIS command.
SSCP-PU	0	(_____ * 370) / 1024	_____	Specify the number of active SSCP-PU sessions. To determine this value, use the SESSMDIS command.
SSCP-LU	0	(_____ * 370) / 1024	_____	Specify the number of active SSCP-LU sessions. To determine this value, use the SESSMDIS command.
LU-LU	0	(_____ * 260) / 1024	_____	Specify the number of active LU-LU sessions. To determine this value, use the SESSMDIS command.
CP-CP	0	(_____ * 370) / 1024	_____	Specify the number of active CP-CP sessions. To determine this value, use the SESSMDIS command.

Table 5. Session Monitor Formulas (continued). All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
Accounting	0	Accounting_____ * 48 * (SSCP-SSCP_____ + SSCP-PU_____ + SSCP-LU_____ + LU-LU_____ + CP-CP_____) / 1024	_____	Is Accounting active? Enter 1 for yes or 0 for no. Session accounting data consists of session start and end times, and traffic counters for the session. If SESSTATS=YES is specified in the initialization member for AAUTSKLP (default AAUPRMLP), session accounting data is collected for all sessions processed by the session monitor. The default is 0 for no.
Availability	0	Availability_____ * 16 * (SSCP-SSCP_____ + SSCP-PU_____ + SSCP-LU_____ + LU-LU_____ + CP-CP_____) / 1024	_____	Is Availability active? Enter 1 for yes or 0 for no. Session availability data consists of session start and end times for the session. (Availability data is a subset of the data that would be collected if Accounting was active.) If SESSTATS=AVAIL is specified in the initialization member for AAUTSKLP (default AAUPRMLP), session availability data is collected for all sessions processed by the session monitor. The default is 0 for no. This is applicable only if Accounting is not active.
PctCrossDmn	80	(PctCrossDmn_____ / 100) * LU-LU_____ * 50 / 1024	_____	Specify the percentage (between 0 and 100 inclusive) of LU-LU sessions that will be cross-domain. A cross-domain LU-LU session connects logical units in different domains. When the two LUs reside in different domains, each is owned by a different SSCP.
PctCrossNet	10	(PctCrossNet_____ / 100) * LU-LU_____ * 150 / 1024	_____	Specify the percentage (between 0 and 100 inclusive) of LU-LU sessions that will be cross-network. A cross-network LU-LU session connects LUs in different networks.
PctRTM	50	(PctRTM_____ / 100) * LU-LU_____ * (80 + KEEPRTM_____ * 20) / 1024	_____	Specify the percentage (between 0 and 100 inclusive) of LU-LU sessions which have response time data collected. An LU-LU session will have response time data if the terminal is attached to a control unit that supports RTM and the terminal is owned by the VTAM host in which the NetView program is installed. This function is not applicable if RTM is not active (see the RTM parameter).
PctThruAPPN	50	(PctThruAPPN_____ / 100) * LU-LU_____ * 100 / 1024	_____	Specify the percentage (between 0 and 100 inclusive) of LU-LU sessions which have APPN nodes in the session path. Route Selection Control Vector data is kept for those LU-LU sessions using a session path containing APPN nodes.
PctTraced	5	Used in KEEPPIU formula	_____	Specify the percentage (between 0 and 100 inclusive) of the total number of sessions which have PIU trace storage kept.

Table 5. Session Monitor Formulas (continued). All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
AvgKEEPPIU	7	(PctTraced_____ / 100) * (96 + KEEPPIU_____ * 48) * (SSCP-SSCP_____ + SSCP-PU_____ + SSCP-LU_____ + LU-LU_____ + CP-CP_____) / 1024	_____	Specify the average KEEPPIU value for sessions that have PIU trace data kept. A global KEEPPIU value is specified in AAUPRMLP, and KEEPPIU values can be specified for individual keep classes on the KCLASS statements in the keep member (default AAUKEEP1).
SessRecorded	25000	Used in DASD storage formulas		Specify the total number of sessions that are recorded to the session monitor VSAM database during a typical 24-hour day. To determine this value, you can monitor the "Sessions Recorded" counter displayed by the SESSMDIS command over a 24-hour period. The total number of sessions recorded will be influenced by the amount of DASD filtering that you set up.
DaysKept	3	Used in DASD storage formulas		Specify the number of days of activity that are retained in the database when a purge operation is performed with either the DBAUTO or NLDM PURGE command. If you use RESETDB to clear the database, specify a value of 0.
DaysBetween	7	Used in DASD storage formulas		Specify the maximum number of days that will pass before a database purge operation is performed or the database is redefined.

Summary	Formula	Result
Session Monitor Virtual Storage	Sum of table values in Results column	_____
Session Monitor DASD Storage in kilobytes (Kb)	maximum of either (1100 * SessRecorded_____ * (DaysKept_____ + DaysBetween_____) * 2.1) / 1024 or (1100 * KEEPSESS_____ * (SSCP-SSCP_____ + SSCP-PU_____ + SSCP-LU_____ + LU-LU_____ + CP-CP_____)) / 1024	_____

Table 6. TCP Connection Management Monitor Formulas. All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
TCPConn	0	_____ * 83	_____	Will you be using the TCP Connection Management function? (1=Yes, 0=No)
ActiveConnSess	10000	_____ * 0.0625	_____	How many active TCP connections will be monitored?

Table 7. SOA/Web Services. All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
SOA	0	_____ * 42440	_____	Will you be using the SOA/Web Services Gateway function? (1=yes, 0=no)
Connections	10	_____ * 38	_____	Number of SOA/Web Services connections.

Table 7. SOA/Web Services (continued). All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
AvgDataSize	1	Connections_____ * AvgDataSize_____ * 26	_____	Average data size for each connection (1K - 32K).

Table 8. VSAM LSR Buffer Storage. Modify the buffer sizes and number of buffers for each size to match the values you have in CNMSJM01 (DSIZVLSR). All numbers in the results column are in kilobytes (KB).

Buffer Size and Number	Default Values	Formula	Result	Description
Data Buffers:				
CINV, BUFNO	7168, 4	CINV_____ * BUFNO_____	_____	For each buffer size in the output of the VSAMPOOL command, specify the buffer size (CINV) and number of buffers (BUFNO). For more information on buffer size and the number of buffers in specific VSAM LSR buffer storage configurations, see "Definitions for LSR and DFR" on page 94.
CINV, BUFNO	8192, 20	CINV_____ * BUFNO_____	_____	
CINV, BUFNO	16384, 4	CINV_____ * BUFNO_____	_____	
CINV, BUFNO	18432, 20	CINV_____ * BUFNO_____	_____	
CINV, BUFNO	20480, 20	CINV_____ * BUFNO_____	_____	
CINV, BUFNO	22528, 20	CINV_____ * BUFNO_____	_____	
CINV, BUFNO	24576, 20	CINV_____ * BUFNO_____	_____	
Index Buffers:				
CINV, BUFNO	512, 3	CINV_____ * BUFNO_____	_____	
CINV, BUFNO	1536, 30	CINV_____ * BUFNO_____	_____	
CINV, BUFNO	2048, 30	CINV_____ * BUFNO_____	_____	
CINV, BUFNO	2560, 30	CINV_____ * BUFNO_____	_____	
CINV, BUFNO	3072, 10	CINV_____ * BUFNO_____	_____	
CINV, BUFNO	3584, 30	CINV_____ * BUFNO_____	_____	
CINV, BUFNO	4096, 30	CINV_____ * BUFNO_____	_____	
CINV, BUFNO	4608, 30	CINV_____ * BUFNO_____	_____	

Summary	Formula	Result
VSAM LSR Buffer Virtual Storage	Sum of table values in Results column/1024	_____

Table 9. NetView Subsystem Storage. All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
buffer		*z**60 where *z* is the larger of the two numbers *n* and *m*		Because of reentrancy requirements, there must be enough storage for 2 tables to be loaded at the same time.

Table 9. NetView Subsystem Storage (continued). All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
CRT		*m**60 where *m* is the number of lines in the CRT		Specify the number of lines in the Command Revision Table.
MRT		*n**60 where *n* is the number of lines in the MRT		Specify the number of lines in the Message Revision Table.
PPIreceivers	1	Used in CSA storage formula		Specify the number of program-to-program interface (PPI) receivers that you will have. PPI receivers are programs that are related to the NetView program and user-written application programs to route data such as generic alerts to the NetView program for processing by the hardware monitor, automation facilities, or installation exits. To determine this value, use the DISPPI command to display the list of PPI receivers. The storage for PPI receivers is allocated in the Common Storage Area (CSA) in 24-bit storage (below the 16 MB line).
RVAR		(256 + 45**n*), where *n* is the number of variables.		Specify the number of revision variables associated with the Message or Command Revision table.
TotalLimits	1000	(_____ * 880) / 1024	_____	Specify the total of the buffer limits defined for each PPI receiver. To determine this value, use the DISPPI command to display the list of PPI receivers and their buffer limits.
TracePPIpgs	0	_____ * 4	_____	Specify the number of pages of storage that you will use for PPI internal trace data. The storage required for the PPI internal trace is based on the user-specified size of the trace table (SIZE parameter on TRACEPPI command). The default is 10 pages.

Summary	Formula	Result
NetView Subsystem Virtual Storage	Sum of table values in Results column	_____
NetView Subsystem Storage in CSA below the line	(3868 + 280 * PPIreceivers_____) / 1024	_____

Table 10. Additional NetView Storage. All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
AON	0	_____ * 9692	_____	Will you be using the Automated Operations Network (AON) feature? Enter 1 for yes or 0 for no. If yes, this adds in the extra storage required. To determine if this function is used, use either the LIST STATUS = TASKS or TASKUTIL command and see if there are some AUTxxxx or EZLxxxx tasks active. The default is 0 for no.

Table 10. Additional NetView Storage (continued). All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
Controllers	5	Used in DASD storage formula		Specify the number of 3600/4700 system controllers that will be defined in your network.
Counters	10	Used in DASD storage formula		Specify the average number of extended statistical counters per loop. The first counter listed for each date/time is loop basic counter 2. All subsequent entries represent the extended statistical counters you define.
LOOPERR	24	Used in DASD storage formula		Specify the loop error wrap count coded with the TARAWRP LOOPERR statement from the initialization member for BNJDSE36 (default BNJ36DST). Base the size for error wrap count on the anticipated solicitation interval of the data.
Loops	20	Used in DASD storage formula		Specify the average number of communication loops that will be attached to each 3600/4700 controller.
LOOPSTAT	20	Used in DASD storage formula		Specify the loop status wrap count coded with the TARAWRP LOOPSTAT statement from the initialization member for BNJDSE36 (default BNJ36DST). A wrap count defines the number of records kept for a certain record type. All wrap counts must be within the range of 1–9999.
MSM	0	_____ * 7824	_____	Will you be using MultiSystem Manager? Enter 1 for yes or 0 for no. If yes, this adds in the extra storage required. To determine if this function is used, use either the LIST STATUS = TASKS or TASKUTIL command and see if task AUTOMSM or AUTOMSMD is active. The default is 0 for no.
NETVONLY	0	200 or 400	_____	If your command revision table has any NETVONLY statements, specify the 200 value. If you expect heavy traffic in such commands, specify the 400 value.
OSTs	5	_____ * (340 + 50 (if session monitor active) + 58 (if hardware monitor active) + 58 (if 4700 support facility active) + 8 (if status monitor active) + 14 (if TAF used))	_____	How many operators will be concurrently logged on to your NetView system? An operator station task (OST) is the subtask that establishes and maintains an online session with the network operator. Use the TASKUTIL command to display the active NetView operators on your system. Add the number of tasks with TYPE=OST shown in the TASKUTIL display.
Packet Trace	0	3320 + (_____ / 1.2048)Minimum value = 11620	_____	Will you be using the packet trace VSAM database to save packet trace data? If yes, how many packet trace records will be saved in the VSAM database?

Table 10. Additional NetView Storage (continued). All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
RESPTIME	24	Used in DASD storage formula		Specify the response time wrap count coded with the TARAWRP RESPTIME statement from the initialization member for BNJDSE36 (default BNJ36DST). Base the size for response time wrap count on the anticipated solicitation interval of the data.
StatFocalPt	0	_____ * 852	_____	Will this host be a status focal point for the NetView management console? Enter 1 for yes or 0 for no. If yes, additional storage is added. Check the initialization member for CNMTAMEL task specified in member DSISTASK. If an AMELINIT statement is enabled, this host is a status focal point. The default is 0 for no.
SNATM	0	_____ * 572	_____	Will you be using the SNA Topology Manager (SNATM)? SNATM obtains the status and topology information of SNA resources from the VTAM topology agent for graphical display using NetView management console. Enter 1 for yes or 0 for no. If yes, this adds in the extra storage required. To determine if this function is used, use either the LIST STATUS=TASKS or TASKUTIL command and see if task FLBTOPO is active. The default is 0 for no.
SnatmObjects	4000	_____ * 1.3	_____	Specify the number of objects managed by SNATM in your network. To determine this value, use the TOPOSNA LISTRODM command to determine the total number of objects that SNATM is managing in RODM. This is not applicable if you are not using SNATM. Storage for SNATM objects in the RODM data space is included in Table 15 on page 149 **Note:** If you do not have SNATM active for using the TOPOSNA LISTRODM command, see "SNA Topology Manager" on page 122 for more information.
TAF	1	Used in OST formula		Will your operators be using the terminal access facility (TAF)? TAF is a facility that allows a network operator to control several subsystems from one NetView terminal. Enter 1 for yes or 0 for no. If yes, additional storage is added for each OST. The default is 1 for yes.
TARA	0	_____ * 84	_____	Will you be using the 4700 support facility (TARA)? Enter 1 for yes or 0 for no. If yes, this adds in the extra storage required. To determine if this function is used, use either the LIST STATUS=TASKS or TASKUTIL command and see if task BNJDSE36 is active. The default is 0 for no. The remainder of the parameters in this table are applicable only if the 4700 support facility is used.

Table 10. Additional NetView Storage (continued). All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
TEMA	0	_____ * 42440	_____	Will you be using the Tivoli NetView for z/OS Enterprise Management Agent? (1=yes, 0=no)
VOSTs	0	_____ * 200 Also used in NetView below the 16MB line private storage calculation	_____	How many Virtual OSTs will be concurrently logged on to your NetView system? A virtual operator station task (VOST) is created as the result of the ATTCH phase during the full screen automation process. Use the TASKUTIL command to display the active virtual OSTs on your system. Add the number of tasks with TYPE=VOST shown in the TASKUTIL display.
Workstat	20	Used in DASD storage formula		Specify the average number of workstations that will be physically attached to each financial system controller.

Summary	Formula	Result
Additional NetView Virtual Storage	Sum of table values in Results column	_____
4700 Support Facility DASD Storage in kilobytes (Kb)	Controllers_____ * (Loops_____ * (LOOPSTAT_____ * 72 + 224 + LOOPERR_____ * (Counters_____ * 23 + 76) + Workstat_____ * (RESPTIME_____ * 91 + 127) + 54)) / 1024	_____

Table 11. GMFHS Address Space. GMFHS requires that RODM be active. All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
GMFHS	0	_____ * 6780	_____	Will you be using the Graphic Monitor Facility host subsystem (GMFHS)? Enter 1 for yes or 0 for no. GMFHS is an advanced network management system which employs task-oriented dialogs in an intelligent workstation providing a graphics base for IBM systems and network management products. The default is 0 for no. If you will not be using GMFHS, the remainder of the parameters in this table are not applicable.
GmfhsObjects	1000	Used in RODM data space virtual storage formula. See Table 15 on page 149.		Specify the number of GMFHS-managed objects that you expect to have in RODM.
GmfhsTrcPgs	0	_____ * 4	_____	Specify the number of pages of storage used for GMFHS internal trace. Trace pages are used to record GMFHS data for test and debug purposes. The TRACEPAGES parameter is specified in the DUIGINIT member and works in conjunction with TRACE=ON.

Summary	Formula	Result

GMFHS Address Space Virtual Storage above the 16 MB Line	Sum of table values in Results column	_____

Table 12. Event/Automation Service Address Space. All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
Ev/Aut	0	_____ * 5852	_____	Will you be using the Event/Automation Service (IHSAEVNT)? Enter 1 for yes or 0 for no. The Event/Automation Service serves as a gateway for event data between the NetView for z/OS management environment, the Tivoli management regions managers and agents that handle Event Integration Facility (EIF) events, and SNMP managers and agents. You can use this gateway function to manage all network events from the management platform of your choice. The default is 0 for no.

Summary	Formula	Result
Event/Automation Service Address Space Virtual Storage	Sum of table values in Results column	_____

Table 13. Tivoli NetView for z/OS Enterprise Management Agent. All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
TEMA	0	Used in RTE and Agent formula	_____	Will you be using the Tivoli NetView for z/OS Enterprise Management Agent? (1=yes, 0=no)
InstallLibrary	0	Install Library storage requirements will be calculated based on information in the EMA Program Directory	_____	Install Library (DASD). See Tivoli NetView for z/OS Enterprise Management Agent Program Directory for specific Install Library DASD requirements.
RTE		TEMA_____ * 897024	_____	RTE (DASD). Run Time Environment (Full) - using defaults, with Persistent Data Store configured.
Agent		TEMA_____ * 42800	_____	Tivoli NetView for z/OS Enterprise Management Agent address space (Virtual storage).

Table 14. RODM Address Space Storage. All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
RODM	0	_____ * 49055	_____	Will you be using the Resource Object Data Manager (RODM)? Enter 1 for yes or 0 for no. RODM is an object-oriented data store which supports on-line, real-time collection and access of data, mainly network and system management data. RODM is required in order to use the Graphic Monitor Facility host subsystem and the SNA Topology Manager. The default is 0 for no. If you will not be using RODM, the remainder of the parameters in this table are not applicable.
ConcurUsers	10	Used in formulas		Specify the number of RODM users connected concurrently. To determine this value, check member EKGCUST for the CONCURRENT_USERS value. Allow room for growth, but do not waste storage unnecessarily.
AsyncTasks	5	Used in formulas		Specify the number of asynchronous RODM tasks. To determine this value, check member EKGCUST for the ASYNC_TASKS value. Allow room for growth but do not waste storage unnecessarily.
PLI_ISA	40	PLI_ISA_____ * (ConcurUsers_____ + AsyncTasks_____)	_____	Specify the amount of stack storage in KB that will be allocated for each RODM user. To determine this value, check member EKGCUST for the PLI_ISA value. This is storage below the 16 MB line set aside for PL/I intermodule communication. Use 40 K for faster run time with minimum wasted space.
PrimaryHeap	64	PrimaryHeap_____ * (ConcurUsers_____ + AsyncTasks_____)	_____	Specify the amount of primary PL/I heap storage in KB that will be allocated for each RODM user. To determine this value, check member EKGCUST for the PRIMARY_HEAP_SIZE value. This is temporary storage allocated by RODM modules for work area. Use 64 K for faster run time with minimum wasted space.
LogRecords	30000	Used in the following DASD storage formula.		Specify the number of records you want to keep in each log (primary and secondary).

Summary	Formula	Result
RODM Address Space Virtual Storage	Sum of table values in Results column	_____
RODM Storage in CSA below the line	64 * (ConcurUsers_____ + AsyncTasks_____) / 1024	_____
RODM Log DASD Storage in kilobytes (Kb)	LogRecords_____ / 2	_____

Table 15. RODM Object Storage. All numbers in the results column are in kilobytes (KB).

Name	Default Value	Formula	Result	Description
UserObjects	0	Used in formula		Specify the number of RODM objects created by user-written RODM applications. To determine this value, use the RODMUNLD facility provided with the NetView for z/OS program with the REPORTONLY=YES option to get a detailed report of objects residing in RODM. For prior NetView releases, use the Create Object API counters in the STATAPI record. Create a STATAPI record prior to loading the user objects, and a second STATAPI record after loading the user objects. The differences in the Create Object counters between the two readings can be used to estimate the total number of user objects created. See "RODM API Statistics" on page 85 for more detail on the STATAPI record.
UserObjSize	3072	(UserObjects_____ * UserObjSize____) / 1024	_____	Specify the average size (in bytes) for the RODM objects created by user-written RODM applications. To determine this value, use cell pool usage information in the STATCELL record. Create a STATCELL record prior to loading the user objects, and a second STATCELL record after loading the user objects. The differences in cell pool usage between the two readings can be used to calculate the total storage used by the user objects.

Summary	Formula	Result
RODM Address Space Virtual Storage	13005 + (SnatmObjects_____ (see Table 10 on page 143) * 0.3) + MultiSystem Manager-managed address space storage (see Table 16 on page 150)	_____
RODM Data Space Virtual Storage	UserObject storage (see previous formula) + 3686 + (GmfhsObjects_____ * 3) + (SnatmObjects_____ (Table 10 on page 143 NetView table) * 3.4) + MultiSystem Manager-managed data space storage (see Table 16 on page 150)	_____
RODM Checkpoint Data Set DASD Storage in kilobytes (KB)	RODM Data Space Virtual Storage for objects + 16384	_____
RODM Translation Data Set DASD Storage in kilobytes (KB)	RODM Address Space Virtual Storage for objects + 16384	_____

Table 16. RODM Object Storage for MultiSystem Manager-managed Resources. All numbers in the Results column are in kilobytes (KB).

Name	Default Value	Formula	Data Space Result	Addr Space Result	Description
IBM Tivoli Network Manager agents	0	((_____ * 16076) + 27356)/1024	_____		Specify the number of IBM Tivoli Network Manager agents to calculate the data space.
	0	((_____ * 596) + 1950020)/1024		_____	Specify the number of IBM Tivoli Network Manager agents to calculate the address space.
IBM Tivoli Network Manager resources	0	((_____ * 4139) + 426164)/1024	_____		Specify the number of resources that are managed by IBM Tivoli Network Manager to calculate the data space. Resources include bridges, routers, hubs, hosts, IP links, and IP addresses.
	0	((_____ * 196) + 2260344)/1024		_____	Specify the number of resources that are managed by IBM Tivoli Network Manager to calculate the address space.
Summary		**Formula**	**Data Space Result**	**Addr Space Result**	
RODM storage for MultiSystem Manager-managed resources		Sum of table values in Results column	_____	_____	

Table 17. Minimum Virtual Storage Requirements Summary. All numbers in the Results column are in kilobytes (KB). To convert values to megabytes (MB), divide by 1024.

Storage Type	Table Location/Formula/Amount	Result
NetView Address Space above the 16 MB Line	See Table 3 on page 133, Table 4 on page 138, Table 5 on page 138, Table 8 on page 142, and Table 10 on page 143.	_____
NetView Address Space below the 16 MB Line	((#Autotasks + #NNTs + #UserTasks + #OSTs + #VOSTs) * 2) + 538	_____
NetView Subsystem Address Space above the 16 MB Line	See Table 9 on page 142.	_____
NetView Subsystem Address Space below the 16 MB Line	8	_____
RODM Address Space above the 16 MB Line	Sum of results in Table 14 on page 148 + Address Space object storage (see Table 15 on page 149).	_____
RODM Address Space below the 16 MB Line	Environment Dependent	_____
RODM Data Space above the 16 MB Line	Data Space object storage (see Table 15 on page 149).	_____
RODM Data Space below the 16 MB Line	N/A	_____
GMFHS Address Space above the 16 MB Line	692 plus the value for GmfshTrcPgs that was calculated in Table 11 on page 146.	_____

Table 17. Minimum Virtual Storage Requirements Summary (continued). All numbers in the Results column are in kilobytes (KB). To convert values to megabytes (MB), divide by 1024.

Storage Type	Table Location/Formula/Amount	Result
GMFHS Address Space below the 16 MB Line	7084	_____
Event/Automation Service above the 16 MB Line	4800	_____
Event/Automation Service below the 16 MB Line	2400	_____
CSA Storage below the 16 MB Line	See Table 14 on page 148 and Table 9 on page 142.	_____

Table 18. DASD Storage Conversion Table. Use to convert kilobytes of storage into Cylinders or Blocks.

DASD Type	Kilobytes per unit	Unit Type
3390	720	Cylinders
3375	384	Cylinders
3330	228	Cylinders
9335	0.5	Blocks
9332	0.5	Blocks
3370	0.5	Blocks
3310	0.5	Blocks

Table 19. Minimum DASD Storage Requirements Summary. Use the DASD conversion table to convert storage in KB into blocks or cylinders.

Storage Type	Table Location	Device Type	Formula	Result
Session Monitor primary	See Table 5 on page 138.	_____	Round up (StorageInKb_____ / KbPerUnit_____) and use minimum of 3	_____
Session Monitor secondary		_____	Round up (0.2 * Session Monitor primary result _____)	_____
Hardware Monitor primary	See Table 4 on page 138.	_____	Round up (StorageInKb_____ / KbPerUnit_____) and use minimum of 3	_____
Hardware Monitor secondary		_____	Round up (0.2 * Hardware Monitor primary result _____)	_____
TCPCONN Primary	See Table 6 on page 141.	_____	Round up ((StorageInKb_____ * 92.16) / KbPerUnit_____) and use minimum of 50 when the TCP Connection Management function was selected	_____
TCPCONN Secondary		_____	Round up (0.125 * TCPCONN Primary result _____) and use minimum of 10 when the TCP Connection Management function was selected	_____
4700 Support Facility primary	See Table 10 on page 143.	_____	Round up (StorageInKb_____ / KbPerUnit_____) and use minimum of 3	_____

Table 19. Minimum DASD Storage Requirements Summary (continued). Use the DASD conversion table to convert storage in KB into blocks or cylinders.

Storage Type	Table Location	Device Type	Formula	Result
4700 Support Facility secondary		_____	Round up (0.2 * 4700 Support Facility primary result _____)	_____
Save/Restore	See Table 3 on page 133.	_____	Round up (StorageInKb_____ / KbPerUnit_____) and use minimum of 2	_____
RODM Log primary	See Table 14 on page 148.	_____	Round up (StorageInKb_____ / KbPerUnit_____) and use minimum of 1	_____
RODM Log secondary		_____	Same as RODM Log primary	_____
RODM Translation Data Set	See Table 15 on page 149.	_____	Round up (Address Space StorageInKb_____ /1024/16) * 16 * 1024/KbPerUnit_____	_____
RODM Checkpoint Data Set 1	See Table 15 on page 149.	_____	Round up (round up (Data Space StorageInKb_____ / 1024 / 16) / 2) * 16 * 1024 / KbPerUnit_____	_____
RODM Checkpoint Data Set 2		_____	Same as RODM Checkpoint Data Set 1	_____
Canzlog Archiving		_____	See "Canzlog Archive Storage Requirements" on page 106.	_____

Region Size

The REGION parameter on the EXEC statement in the startup procedure for a program specifies how much virtual storage the program is enabled to allocate. Specifying various values for the region size has the following results (unless your installation changes the default limits in MVS that are supplied by IBM):

- A value equal to 0 MB allows the program to allocate all of the storage it requires below and above the 16 MB line.
- A value greater than 0 MB and less than or equal to 16 MB establishes the size of the private area below 16 MB. The extended region size (above the 16 MB line) is the default value of 32 MB.
- A value greater than 16 MB and less than or equal to 32 MB gives the program all the storage available below 16 MB. The extended region size is the default value of 32 MB.
- A value greater than 32 MB gives the program all the storage available below 16 MB. The extended region size is the specified value.

The default REGION size in the NetView startup procedure is 96 MB. Consider changing the REGION size to 0 MB, which enables the NetView program to allocate the storage it needs and minimizes the risk of out-of-storage failures. If you do not want to use a value of 0 MB, use no less than 96 MB so that you do not restrict the use of NetView storage usage below the 16 MB line. Restricting storage below the 16 MB line does not help other jobs in the system, and could cause out-of-storage failures unnecessarily.

If you want information about...	Refer to...
Estimating the amount of virtual storage the NetView program requires for your environment	"Estimating Storage Usage" on page 133
The REGION parameter	The appropriate MVS JCL publication
Region size	*IBM Tivoli NetView for z/OS Administration Reference*

Estimating the Number of RODM Objects Created by SNA Topology Manager

You can estimate the number of RODM objects that are created by SNA topology manager for your environment. The estimate is not exact, but it can be useful to help you plan the additional storage requirements that SNA topology manager introduces.

Two sections follow, one to estimate objects created by local and network topology monitor requests, and one to estimate LU objects created by critical LU and LU collection monitor requests. Sum the number of objects that you calculate from these two sections.

The two sections that follow assume that the requests are issued to a VTAM agent. If you are issuing local topology requests to a non-VTAM agent such as the APPN Topology and Accounting Agent (APPNTAA), you should, in general, use 10 to 15 objects per locally monitored node.

Objects Created by Local and Network Topology Monitor Requests

The following formula is based on the these assumptions:

- J-lines are suppressed and only CDRSCs that represent adjacent CPs are reported (consistent with the default VTAM options ILUCRDCS and NOLLINES).
- There is a single TG to PU 2.1 nodes (appnENs and lenNodes).
- All nodes are connected through NCPs.
- There are 2 subarea TGs between subarea nodes.
- There are 2 APPN TG circuits between network nodes.

Specify values for the following variables in the formula:

TotalNNs

The value of network nodes to be monitored. Estimate this using the following command:

```
D NET,STATS,TYPE=VTAM ID 109, NETWORK NODES IN THE NETWORK
```

Note: If you receive message IST1315I indicating that the output has been truncated, use the NUM parameter to specify more lines of output for the DISPLAY STATS command. For a description of the DISPLAY STATS command, refer to the appropriate VTAM publication.

Subareas

The number of value type 4 and 5 nodes in the network. Estimate this using the following command:

```
D NET,STATS,TYPE=VTAM ID 22, DESTINATION SUBAREAS
```

If local and network topology monitor requests will be sent to multiple VTAMs in the network, combine the DESTINATION SUBAREAS values for each VTAM. However, because multiply-owned T4s are represented by a single object in RODM, do not count multiply-owned T4s more than once.

TotalLines
The number of lines in the network. Estimate this using the following command:

```
D NET,STATS,TYPE=VTAM ID 65, NUMBER OF LINES DEFINED
```

If local and network topology monitor requests will be sent to multiple VTAMs in the network, combine the NUMBER OF LINES DEFINED values for each VTAM. However, because multiply-owned lines are represented by a single object in RODM, do not count multiply-owned lines more than once. See the *IBM Tivoli NetView for z/OS SNA Topology Manager Implementation Guide* for more information on multiply-owned lines.

NTRILines
The number of NTRI lines (J-lines) in the network. You should be able to get a count of these lines using the following command:

```
D NET,RSCLIST,ID=J*,IDTYPE=LINES
```

This command produces a separate message for each line, so if you think you have a large number, do not issue this command during a peak period of activity on your system.

TotalPUs
The number of PUs in the network. Estimate this using the following command:

```
D NET,STATS,TYPE=VTAM ID 48, DEFINED PU TOTAL
```

If local and network topology monitor requests will be sent to multiple VTAMs in the network, the DEFINED PU TOTAL values for each VTAM should be combined. However, because multiply-owned PUs are represented by a single object in RODM, be sure not to count multiply-owned PUs more than once. See the *IBM Tivoli NetView for z/OS SNA Topology Manager Implementation Guide* for more information on multiply owned PUs.

NTRILogicalPUs
The number of NTRI logical links PUs in the network. Because there is a one logical PU per NTRI line, this value should be equal to the value for NTRILines.

PctPU2.1
The percentage of the total PUs (not including NTRI logical PUs) that are type 2.1. Estimate this value, because it is not reported. The following command can provide information to help you with an estimate:

```
D NET,RSCLIST
```

Using values for the variables, estimate the number of RODM objects created by local and network topology requests to VTAM agents as follows:

```
(TotalNNs * 7.25) + (Subareas * 3) + (TotalLines - NTRILines) +
(TotalPUs - NTRILogicalPUs) * (1 + PctPU2.1 * 4)
```

LU Objects Created By Critical LU and LU Collection Monitor Requests

The following variables are used to estimate the number of objects created by LU collection requests.

If you plan to issue LU collection requests to VTAM hosts, specify values for the next three variables; otherwise, use values of zero for these variables.

LocalNonSNA

The number of local non-SNA terminals defined on VTAMs targeted for LU collection requests. Estimate this value using the following command:

```
D NET,STATS,TYPE=VTAM ID 16, LOCAL NON-SNA TERMINALS
```

If LU collection requests will be sent to multiple VTAMs in the network, and VTAM is the target of an LU collection request, the `LOCAL NON-SNA TERMINALS` values for each VTAM should be summed together.

IndLUs

The number of independent LUs in the network for which VTAM provides boundary function services, and where VTAM is the target of an LU collection request. Estimate this using the following command:

```
D NET,STATS,TYPE=VTAM ID 46, INDEPENDENT LU TOTAL
```

If you want to send LU collection requests to multiple VTAMs in the network, the `INDEPENDENT LU TOTAL` values for each VTAM should be summed together.

APPLs

The number of application programs defined on the VTAMs specified for LU collection requests. To get this value, use the following command:

```
D NET,APPLS
```

The last message in the `D NET,APPLS` display (IST1454I) contains the number of resources displayed. If you want to send LU collection requests to multiple VTAMs in the network, and VTAM is the target of an LU collection request, add the number of applications for each VTAM.

If you plan to issue LU collection requests to logical links (PUs) in the network, supply a value for the next variable; otherwise, use a zero value.

LogLinkLUs

The expected number of LUs that will be in concurrent LU collection requests issued to logical links (PUs) in the network. In most environments, this value represents a small percentage of LUs in the network.

If you plan to issue TOPOSNA CRITICAL requests for specific LUs in the network, supply a value for the CriticalLUs variable; otherwise, use a zero value.

CriticalLUs

The expected number of LUs in the network that will be the target of concurrent TOPOSNA CRITICAL monitor requests. In most environments, this value represents a small percentage of LUs in the network.

Estimate the number of LU objects created in RODM using the following formula:

```
LocalNonSNA + IndLUs + APPLs + LogLinkLUs + CriticalLUs
```

Add the estimates for the number of LU objects and the number of objects created by local and network topology requests to determine the number of SNA topology manager objects in RODM.

Keeping Track of Virtual Storage and Other System Resource Usage

To collect statistics that help you tune your systems' performance and avoid costly system shutdowns, periodically check the amount of virtual storage, CPU, and other resources your tasks are using. For an accurate picture of the resource usage, you probably need to track usage for an entire business processing cycle. For example, you might want to track usage for a full month to see the usage peaks for applications and tasks that are not run daily.

To collect statistics on virtual storage, CPU usage, message queuing, and input/output activity for a system, issue the following timed LOGTSTAT command from a NetView command line:

```
EVERY 00:30:00,PPT,LOGTSTAT
```

The example command writes the results to the system monitoring facility (SMF) log. When you have collected data for the number of days you want, turn off the EVERY command by issuing a PURGE TIMER command with the timer ID of the original EVERY command. (If you do not know the timer ID, you can find it by issuing a LIST TIMER command.)

After the statistics are collected in the SMF log, use that data to determine the peak resource usage for various tasks. Use the NetView function that enables you to issue the DEFAULTS and OVERRIDE commands to set limits on resource usage for each critical task. When limits are set, the NetView program sends a warning message when one of the limits is reached or exceeded by a task. You will have time to react before the task can use enough virtual storage or CPU time to slow down or halt your system. You can even automate your responses to the warning messages.

To do a quick check of resource usage (for example, for a day or two), use the following command instead of setting an EVERY timer:

```
WINDOW TASKMON * *
```

This command sends the TASKMON output to a window at the operator's console where the command is issued. It monitors virtual storage, CPU, message queuing, and I/O activity for every task for which you have set a limit. The results are color-coded, with tasks that are at 90% of their limits shown in red.

To monitor only the virtual storage your tasks are using, issue the following TASKUTIL command each morning:

```
EVERY 30, TASKUTIL
```

This command checks the virtual storage usage every 30 minutes for all tasks. You can vary the number of minutes.

The TASKMON and TASKUTIL outputs provide a baseline from which to compare future data when you suspect a task might be using an unusual amount of virtual storage. For example, suppose a normal amount of virtual storage usage for one of your NetView operator tasks is about 2 MB. If the operator ROLLs from one NetView window to another, the operator task could quickly take up to 20 MB of storage. Also, the IBM NCP NTuneMon product can use a large amount of virtual

storage. If an operator is checking out two or three NCPs at the same time, it could use in the range of 12–15 MB of virtual storage.

When you have collected data for the specified number of days, turn off the EVERY command by issuing a PURGE TIMER command with the timer ID of the original EVERY command. (If you do not know the timer ID, you can find it by issuing a LIST TIMER command.)

Hint: If your TASKUTIL output at 8 a.m. says 70 MB and your REGION size is 75 MB, attempt to determine immediately what is using the most storage. The amount of virtual storage being used will surely increase when operators start logging on for the day.

Messages warn you when the NetView region is running out of space. You can automate responses to the following messages:

```
BNH162I  THE domainid BELOW 16M STORAGE IS nn% USED, mmmK IS LEFT
BNH163I  THE domainid ABOVE 16M STORAGE IS nn% USED, mmmK IS LEFT
```

Minimizing Storage Usage

If you need to save storage, you have several alternatives. When you optimize for storage, you almost always have a trade-off between storage and host processor utilization.

The constants module (DSICTMOD) enables you to choose whether the first allocation of below-the-line storage for an individual subpool and size is freed when it is no longer in use. You can use the RESOURCE command to display the amount of storage in use below-the-line. If the amount of below-the-line storage used by the NetView program is a problem, set DSICTMOD to free unused storage, although performance for subsequent uses will be slowed.

If you have fewer than 300 users logged on at any one time, or if you have a large amount of user-written code that runs in below-the-line storage, choose the option that keeps the first allocation of below-the-line storage (the default).

Coding RES=N on Command Definition Statements

If you are operating a storage-constrained system, you can save small amounts of storage by coding RES=N on specific CMDDEF statements in the CNMCMDU initialization member. When a module has RES=N specified in the CNMCMD initialization member, the module must be dynamically loaded each time it is used. If you use the module infrequently, the trade-off between saved storage and added processor time is minimal. For frequently used modules, do not code RES=N because it can result in excessive system use and I/O activity.

This section lists the command definition (CMDDEF) statements that you can code as RES=N to save storage.

Alert Network Operations Support

```
CMDDEF.DSIREGGR.RES=N
CMDDEF.DSILOGGR.RES=N
```

Coding RES=N on the CMDDEF statements for alert network operations support saves 2 KB.

ALLOCATE, FREE, and LISTA

```
CMDDEF.ALLOCATER.RES=N
CMDDEF.FREE.RES=N
CMDDEF.LISTA.RES=N
```

Coding RES=N on the CMDDEF statements for these functions saves 19 KB.

Automated Operations

```
CMDDEF.AUTOTASK.RES=N
CMDDEF.GENALERT.RES=N
CMDDEF.DEFAULTS.RES=N
CMDDEF.OVERRIDE.RES=N
CMDDEF.GETMSIZE.RES=N
CMDDEF.GETMTYPE.RES=N
CMDDEF.GETMLINE.RES=N
CMDDEF.PARSEL2R.RES=N
CMDDEF.EXCMD.RES=N
```

Coding RES=N on the CMDDEF statements for automated operations saves 24 KB.

Automated Operations

```
CMDDEF.MVS.RES=N
CMDDEF.WTO.RES=N
CMDDEF.WTOR.RES=N
CMDDEF.DOM.RES=N
CMDDEF.RELCONID.RES=N
CMDDEF.DISCONID.RES=N
```

Coding RES=N on the CMDDEF statements for automated operations (MVS) saves 18 KB.

Automation Table Listing

```
CMDDEF.DSIDTEND.RES=N
```

Coding RES=N on the CMDDEF statements for this function saves 0.7 KB.

CNM Router

```
CMDDEF.DSICRUSP.RES=N
CMDDEF.CHNGFP.RES=N
CMDDEF.FPDLCMD.RES=N
```

Coding RES=N on the CMDDEF statements for the CNM router saves 5 KB.

Commands

```
CMDDEF.LIST.RES=N
CMDDEF.MSG.RES=N
CMDDEF.HOLD.RES=N
CMDDEF.INPUT.RES=N
CMDDEF.PURGE.RES=N
CMDDEF.ROUTE.RES=N
```

Coding RES=N on these CMDDEF statements saves 12 KB.

Cross-Domain CNM Data Transfer

```
CMDDEF.DSILUITF.RES=N
CMDDEF.DSILCRTR.RES=N
CMDDEF.DSILCSTP.RES=N
CMDDEF.DSILCSF7.RES=N
CMDDEF.DSILCTCU.RES=N
CMDDEF.DSILCNTM.RES=N
```

Coding RES=N on the CMDDEF statements for data transfer saves 11 KB.

Cross-Domain Logon Facilities

```
CMDDEF.DSI809A.RES=N
```

Coding RES=N on the CMDDEF statements for cross-domain logon saves 4 KB.

DCNM Router Function

```
CMDDEF.DSIFSOLP.RES=N
CMDDEF.DSIFACP.RES=N
CMDDEF.DSIFSCP.RES=N
CMDDEF.DSIFDCP.RES=N
CMDDEF.DSIFRCP.RES=N
CMDDEF.DSIFRMP.RES=N
CMDDEF.DSIFRDP.RES=N
CMDDEF.DSIFRDCP.RES=N
CMDDEF.DSIFDACP.RES=N
```

Coding RES=N on the CMDDEF statements for the DCNM router saves 13 KB.

External Logging

```
CMDDEF.DSIELDAT.RES=N
```

Coding RES=N on the CMDDEF statements for external logging saves 1 KB.

Focal Point Support Over LU 6.2

```
CMDDEF.DSIFPRCV.RES=N
CMDDEF.DSIFPSND.RES=N
```

Coding RES=N on the CMDDEF statements for focal point support saves 2 KB.

GLOBALV and Save/Restore Focal Point

```
CMDDEF.DSIGVRES.RES=N
CMDDEF.AAUDRRES.RES=N
CMDDEF.GLOBALV.RES=N
```

Coding RES=N on the CMDDEF statements for GLOBALV and save/restore saves 6.5 KB.

HLL and REXX

```
CMDDEF.WAIT.RES=N
CMDDEF.TRAP.RES=N
```

Coding RES=N on the CMDDEF statements for HLL and REXX saves 7 KB.

HLL Only

```
CMDDEF.TIMEP.RES=N
CMDDEF.QUEUE.RES=N
CMDDEF.RID.RES=N
```

Coding RES=N on the CMDDEF statements for HLL saves 6 KB.

LU 6.2 Transport and Operations Management Support

```
CMDDEF.DSI6DSCP.RES=N
CMDDEF.DSI6LOGM.RES=N
CMDDEF.DSIOSRCP.RES=N
CMDDEF.DSIOARCP.RES=N
CMDDEF.DSIOURCP.RES=N
CMDDEF.DSIOLGFP.RES=N
```

Coding RES=N on the CMDDEF statements for LU 6.2 saves 63 KB.

Message Forwarding, Uppercase Translation

```
CMDDEF.SET.RES=N
CMDDEF.SWITCH.RES=N
CMDDEF.TRACE.RES=N
CMDDEF.UPPER.RES=N
```

Coding RES=N on the CMDDEF statements for message forwarding saves 10 KB.

NetView Bridge

```
CMDDEF.RTRQUEUE.RES=N
CMDDEF.TRANRCV.RES=N
CMDDEF.TRANSND.RES=N
CMDDEF.DSINBRSM.RES=N
CMDDEF.DSINBTRM.RES=N
```

Coding RES=N on the CMDDEF statements for NetView Bridge saves 23 KB.

NetView Bridge Remote Access

```
CMDDEF.DSINBR62.RES=N
CMDDEF.DSINBRLG.RES=N
```

Coding RES=N on the CMDDEF statements for NetView Bridge remote access saves 2 KB.

NetView Command List Language and REXX

```
CMDDEF.DROPCL.RES=N
CMDDEF.LOADCL.RES=N
CMDDEF.MAPCL.RES=N
```

Coding RES=N on the CMDDEF statements for NetView command list language and REXX saves 9 KB.

NetView management console

```
CMDDEF.DUIATERM.RES=N
```

Coding RES=N on the DUIATERM statement for the NetView management console saves 3.5 KB.

Network Product Support (NPS)

```
CMDDEF.DISPCMD.RES=N
CMDDEF.CANCMD.RES=N
```

LPDA-2 Modem Support

```
CMDDEF.MDMCNTL.RES=N
CMDDEF.MDMCNFG.RES=N
```

Service Point

```
CMDDEF.RUNCMD.RES=N
CMDDEF.LINKPD.RES=N
CMDDEF.LINKTEST.RES=N
CMDDEF.LINKDATA.RES=N
```

3710, 3708, and 386X Modem Support

```
CMDDEF.LINESTAT.RES=N
CMDDEF.DISPCNFG.RES=N
CMDDEF.RUNDIAG.RES=N
CMDDEF.LPDA.RES=N
CMDDEF.THRESH.RES=N
CMDDEF.CCPLOADI.RES=N
CMDDEF.CCPLOADT.RES=N
CMDDEF.CCPLOADF.RES=N
CMDDEF.CCPDR.RES=N
```

Coding RES=N on the CMDDEF statements for NPS saves 43 KB.

Other Commands and Command Lists

```
CMDDEF.AFTER.RES=N
CMDDEF.AT.RES=N
CMDDEF.UNIQUE.RES=N
CMDDEF.EVERY.RES=N
```

Coding RES=N on the CMDDEF statements for commands and command lists saves 4 KB.

Remote Operations Over the LU 6.2 Transport

```
CMDDEF.DSIUSNDM.RES=N
CMDDEF.ENDTASK.RES=N
```

Coding RES=N on the CMDDEF statements for remote operations saves 8 KB.

Save/Restore

```
CMDDEF.DSITIRTR.RES=N
CMDDEF.RESTORE.RES=N
CMDDEF.AAUDRSRT.RES=N
```

Coding RES=N on the CMDDEF statements for save/restore saves 15 KB.

Sequential Log

```
CMDDEF.DSIBSWCP.RES=N
CMDDEF.DSIZBSQW.RES=N
```

Coding RES=N on the CMDDEF statements for the sequential log saves 5 KB.

Service and Tuning Command Processors

```
CMDDEF.IDCAMS.RES=N
CMDDEF.SUBMIT.RES=N
CMDDEF.SESSMDIS.RES=N
CMDDEF.DSRBS.RES=N
CMDDEF.LISTCAT.RES=N
CMDDEF.DISPMOD.RES=N
CMDDEF.MSGROUTE.RES=N
CMDDEF.RESOURCE.RES=N
CMDDEF.RESETDB.RES=N
CMDDEF.TASKUTIL.RES=N
```

Coding RES=N on the CMDDEF statements for service and tuning saves 63 KB.

Session Monitor

```
CMDDEF.AAUSLGEX.RES=N
CMDDEF.AAUSRTEA.RES=N
```

Coding RES=N on the CMDDEF statements for the session monitor saves 3 KB.

Status Monitor

```
CMDDEF.MONIT.RES=N
CMDDEF.STATMON.RES=N
CMDDEF.CLRSTATS.RES=N
CMDDEF.PARSE.RES=N
```

Coding RES=N on the CMDDEF statements for the status monitor saves 15 KB.

Terminal Access Facility (TAF)

```
CMDDEF.LISTSESS.RES=N
CMDDEF.ENDSESS.RES=N
CMDDEF.SENDSESS.RES=N
CMDDEF.DSILMEXP.RES=N
```

Coding RES=N on the CMDDEF statements for TAF saves 8 KB.

4700 Support Facility

```
CMDDEF.SOLICIT.RES=N
CMDDEF.SYSMON.RES=N
```

Coding RES=N on the CMDDEF statements for the 4700 Support Facility saves 4 KB.

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Index

Special characters

Numerics

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X

Y

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