Resource Measurement Facility (RMF) Version 3 General Information Manual

GC28-1115-7

Program Product

Seventh Edition (September 1989)

This is a major revision of, and obsoletes, GC28-1115-6. See the Summary of Changes following the Contents for a summary of the changes made to this manual. Technical changes and additions to the text and illustrations are indicated by a vertical line to the left of the changes.

This edition applies to Version 3.5.1 of the Resource Measurement Facility (RMF) Licensed Program, Program Number 5665-274, and to all subsequent releases until otherwise indicated in new editions or Technical Newsletters. Changes are made periodically to the information herein; before using this publication in connection with the operation of IBM systems, consult the latest *IBM System/370 Bibliography*, GC20-0001, for the editions that are applicable and current.

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Preface

Resource Measurement Facility (RMF) measures and reports the performance and availability of an MVS/Extended Architecture system. This book is intended for installation managers and system programmers who are responsible for problem resolution, system tuning, and capacity planning for an MVS/Extended Architecture system. Readers should have a background in MVS.

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- PR/SM™
- ES/3090™
- Enterprise Systems/3090™

Organization of this Book

This book contains five chapters:

"Chapter 1. What is RMF?" describes the basic functions of RMF.

"Chapter 2. RMF Monitor III" describes RMF Monitor III.

"Chapter 3. RMF Monitors I and II" describes RMF Monitors I and II.

"Chapter 4. RMF System Availability Management" describes RMF System Availability Management (SAM).

"Chapter 5. Planning Information" describes the machine and programming requirements for RMF Version 3 and the compatibility information for RMF Version 3 Release 5.

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RMF Library

The RMF library consists of this book (the *General Information Manual*), nine other books, and two reference cards. The name and order number of each RMF publication follows. The library is shown on the opposite page.

Resource Measurement Facility (RMF) Monitor I and Monitor II Reference and User's Guide, LC28-1556

Resource Measurement Facility (RMF) Monitor III Reference and User's Guide, LC28-1557

Resource Measurement Facility (RMF) System Availability Management User's Guide, SC28-1558

Resource Measurement Facility (RMF) Monitor I and Monitor II Operating Procedures Reference Summary, SX22-0009

Resource Measurement Facility (RMF) Monitor III Operating Procedures Reference Summary, SX22-0010

Resource Measurement Facility (RMF) Messages and Codes, GC28-1382

Resource Measurement Facility (RMF) System Availability Management Diagnosis Guide, LC28-1559

Resource Measurement Facility (RMF) Program Logic Manual, Volume I (Parts 1 and 2), LY28-1170 and LY28-1171, and Volume II (Parts 1 and 2), LY28-1365 and LY28-1366

Associated Publications

Other books that contain information related to using RMF are:

MVS/Extended Architecture System Management Facilities (SMF), GC28-1153

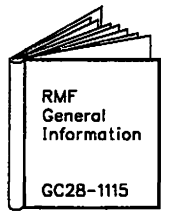
Interactive System Productivity Facility (ISPF) General Information Manual, GC34-4041

MVS/ESA General Information for System Product Version 3, GC28-1359

MVS/ESA DFP Version 3: General Information, GC28-4507

The RMF Library

Evaluation



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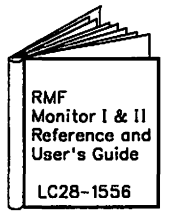

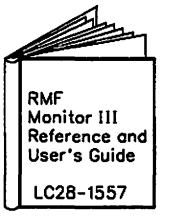

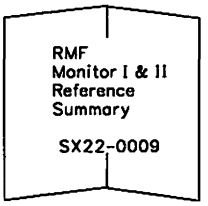

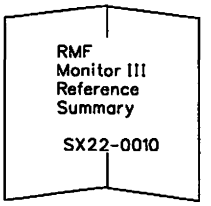

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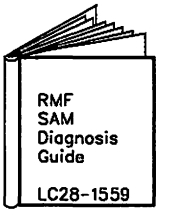

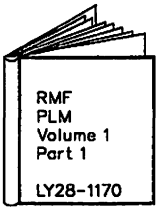

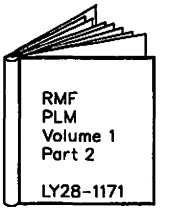

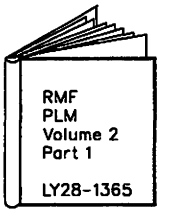

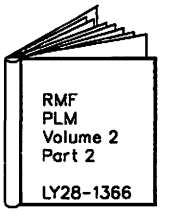

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Summary of Changes

Summary of Changes
for GC28-1115-7
as Updated September 1989
for RMF Version 3 Release 5.1

This major revision consists of changes in support of RMF Version 3 Release 5.1. RMF 3.5.1 provides support for MVS/System Product Version 2 Release 2.3 (MVS/SP 2.2.3) and the system managed storage function of MVS/Data Facility Product Version 3 Release 1 (MVS/DFP 3.1) by allowing the user to obtain storage group information from I/O Device Activity reports. Monitor I and II Device reports and the associated SMF records measure and report device activity by storage groups, if requested by the user.

In addition, RMF Version 3 Release 5.1 includes function that collects and reports:

- Instrumentation counts relating to the movement of Hiperspace™ (High Performace Data Space) pages. RMF reports information about Hiperspaces via the Monitor I Paging Activity report.
- Page movement rates and frame counts relating to virtual input output (VIO). RMF reports information about VIO via the Monitor I Paging Activity report, the Monitor II System Paging Data report, and the ASID Resource Data report.
- Logical partition activity for a 3090 processor complex using Processor Resource/Systems Manager™ (PR/SM™). RMF reports information about PR/SM via the partition data report sections of the CPU Activity report.

Summary of Changes
for GC28-1115-6
as Updated June 1987
for RMF Version 3 Release 5

This edition describes the changes in the RMF Version 3 Release 5.

RMF Version 3 Release 5:

- Replaces the Monitor III reporter session with an ISPF dialog
- Provides color graphics reports for Monitor III
- Includes new fields in several Monitor I and Monitor II reports
- Provides improved vector facility performance reporting in Monitors I and III

Because this manual has been restructured and substantially rewritten for RMF Version 3 Release 5, change bars do not appear.

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Summary of Changes
for GC28-1115-5
as Updated January 1986
for RMF Version 3 Release 4

This edition describes the changes in the RMF Version 3 Release 4. Version 3 Release 4 provides an enhancement for Monitor III and a new System Availability Management (SAM) function.

The enhancement for Monitor III allows the user to define VSAM RRDS data sets to store measurements collected by the Monitor III data gatherer. Monitor III has three new reports:

- The Resource Oriented Storage report, which provides information for analyzing storage or paging problems
- The System Information report, which provides an overview of the measured system, independent of whether the Display Session is on the same system
- The data set index screen, which provides information about active and defined VSAM RRDS data sets

Several existing Monitor III reports have been changed to include additional information.

The System Availability Management (SAM) function provides a means to detect, record, and report the availability of systems and applications.

Chapter 1. What is RMF?

Resource Measurement Facility (RMF) measures and reports on the performance and availability of your system. Many RMF reports are available online as well as in printed form.

RMF issues reports about performance problems as they occur, so that your installation can take action before the problems become critical. Your installation can also obtain long-term measurements of system performance that can be used for system tuning and capacity planning.

RMF reports provide information about the activity of individual jobs, specified groups of jobs, or all jobs in the system.

RMF also measures and reports on the activity and availability of system hardware and software resources, such as processors, channel paths, devices, real storage, address spaces, serially reusable resources, and JES.

Your installation can use RMF to:

- Determine that your system is running smoothly
- Identify system bottlenecks caused by contention for resources
- Identify system resources that consistently have exceptional use
- Identify periods when the use of particular system resources is exceptional
- Evaluate the service your installation provides to different groups of users
- Identify individual jobs that are delayed and the reason for the delay
- Monitor system failures, system stalls, and failures of selected applications

What Is an RMF Session?

To provide flexibility in the types of system activity your installation can measure and the type of output RMF can generate, your installation can run several types of sessions. Although the term "session" sometimes refers to an interactive use of computing facilities, an RMF session is, simply, an execution of an RMF monitor.

There are several types of RMF sessions, plus the RMF post processor. The type of session you run depends on what you need to know about your system and what form of output you require.

Because the end-user orientation of Monitor III allows the system tuner to distinguish between delays for important jobs and delays for jobs that are not as important to overall system performance, Monitor III is a good place to begin system tuning.

Monitor III provides short term data collection and online reports for continuous monitoring of system status and solving performance problems.

The Monitor III data gatherer session collects data about system delays and system resource utilization and records it in VSAM data sets for later use. The data is also available for immediate use from an in-storage buffer.

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A Monitor III reporter session runs under ISPF and issues online reports about system performance. Multiple Monitor III reporter sessions can be active at once. During a reporter session, a user can obtain reports with current data, reports with data collected earlier on the same system, or reports with data collected on another system.

Monitor I provides long term data collection and printed reports about system workload and resource utilization.

The Monitor I session runs as a background task. Conceptually, a Monitor I session is a continuous session of any duration that collects information about system resources and system workload. Measurements can be recorded in system management facilities (SMF) records and/or printed in reports. Only one Monitor I session can be active at a time.

Monitor II provides online measurements on demand for use in solving immediate problems.

A Monitor II session can be regarded as a snapshot session. Unlike the continuous Monitor I session that measures various areas of system activity over a long period of time, a Monitor II session generates a requested report from a single data sample.

A Monitor II session running independently of the Monitor I session can collect information about several areas of system activity, including address spaces, channels, system paging and enqueue contention. A Monitor II session running at the same time as the Monitor I session can produce reports that overlap some areas of Monitor I session measurements, including transactions, I/O devices, I/O queuing and page/swap data sets.

Measurement data collected during a Monitor II session can be seen in the form of reports sent to a display station for immediate inspection or in the form of SMF records and/or printed reports. To allow for this variety of output forms, a Monitor II session can be either a display session or a background session. Multiple Monitor II sessions can be active at a time.

The RMF **post processor** generates output based on the data gathered by Monitor I and Monitor II. The RMF post processor can execute as a background job or as a called program under TSO. It generates interval, duration, summary, exception, and plot reports from the data gathered during Monitor I sessions. It also generates interval reports based on data gathered during a Monitor II background session.

System Availability Management (SAM) provides long term data collection and printed reports with information about the availability of system hardware and key application programs.

The SAM collector session gathers data about the availability of system hardware and applications and records the information in the Information/Management data base.

The SAM report writer uses data in the Information/Management data base, combined with user-defined schedules and report definitions, to produce reports.

When Should RMF Run?

For most installations, running the following sessions at all times is recommended:

- Monitor III data gatherer session to collect data for short term problem solving (DASD space for at least two days worth of data is recommended.)
- Monitor III reporter session, with the workflow/exceptions report running in refresh (go) mode, at the system operator's workplace to monitor system workflow and identify exceptional system delays
- Monitor I session to collect data for capacity planning and after-the-fact system tuning
- SAM collector session to record system and application outage data

The post processor, additional Monitor III reporter sessions, Monitor II, and the SAM report writer can then be used whenever they are needed.

How Does RMF Gather Data?

Each class of system activity that RMF can measure has a set of data gathering routines. To understand the data in the reports and SMF records, it is helpful to separate the data items into two categories: those RMF obtains by counting and those RMF obtains by sampling.

Exact Count Technique

The system can accurately count certain system events, such as the number of start subchannel (SSCH) instructions to a device or the number of swap sequences that occur in a given time. RMF collects this data from system counters at the beginning and end of the reporting interval and calculates the difference in the counters for each event at the beginning and end of each interval.

Sampling Technique

For some kinds of data, counting would require too much system overhead to be practical. RMF acquires this data by sampling at each cycle within the report interval. A cycle is a unit of time within an interval, usually relatively small in comparison to the length of the interval. For example, the RMF program default for a Monitor I and Monitor III data gatherer sampling cycle is 1 second, while the default for the Monitor I reporting interval is 60 minutes, and the default for the Monitor III reporting interval is 100 seconds.

Information that is sampled includes amounts of virtual and real storage used by each job, and the amount of time an individual user spends delayed for each reason. RMF then uses statistical techniques to obtain the minimum, maximum, and average amount of storage held or the percentage of time that a user spent waiting for a device.

For example, if a job was found waiting for a device ten times during a 100 second interval where 100 samples were taken, the job is reported as delayed 10% of the time, or ten seconds, for that device.

Chapter 2. RMF Monitor III

RMF Monitor III issues online reports that present information about system performance in terms of delayed jobs (or users).

From the RMF Monitor III primary menu, shown below, the user can select a report, the data set index (an index of the data available for reporting), the option selection screen (a menu of options to control RMF Monitor III reporting), or the RMF Monitor III tutorial.

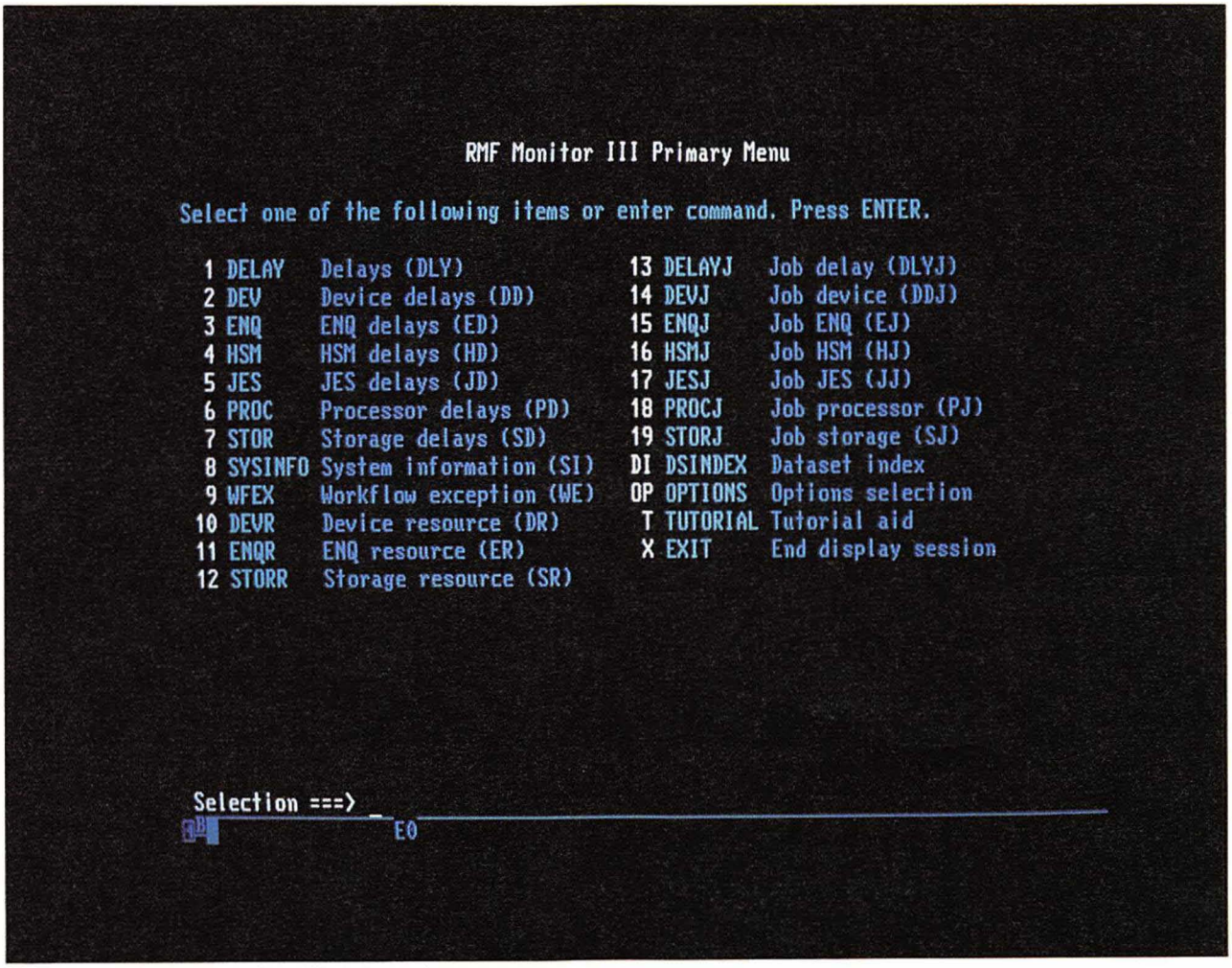

Figure 2-1. RMF Monitor III Primary Menu

The selections on the primary menu can also be accessed by entering a command on any RMF panel. The primary menu shows the commands and their abbreviations in upper case.

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Monitor III reports can provide delay information for any single job and for any of the following job groups:

- System
- TSO
- Batch
- Started tasks
- Domains
- Performance groups

For each job or group of jobs, Monitor III reports the delay experienced over the report interval and identifies the primary cause for the delay.

Reporting system performance in terms of delayed jobs allows your installation to determine whether delays are affecting important jobs in the system and to evaluate the service you are providing to various groups of end users.

The **go mode** feature of Monitor III provides continuous access to the latest available data. In **go mode**, online reports are refreshed with new data at regular intervals, so that your installation can make immediate adjustments to speed up the execution of a single job or to enhance overall system performance.

The Monitor III reporter runs under ISPF, and all of the features available under ISPF (such as the split screen facility, program function keys, and ISPF commands) are available to the Monitor III user.

Monitor III reports are available in both tabular and color graphic form. Tabular reports provide detailed information about jobs and resources. Graphic reports provide quick information about potential problem areas.

Monitor III Reports

RMF Monitor III measures delay associated with the following six categories:

- I/O devices (DEV)
- Serially reusable resources (ENQ)
- Hierarchical storage manager (HSM)
- Job entry subsystem (JES)
- Processors (PROC)
- Paging and swapping (STOR)

Three Monitor III reports (workflow/exceptions, system information, and the delay report) present overview information about the system delay associated with each of these categories.

For each category of delay, RMF provides two detail reports that show more information about the cause(s) of the delay. One report shows multiple jobs; the other shows a single job.

For three of the delay categories (DEV, ENQ, and STOR) RMF also provides a resource-oriented detail report with additional information about why that resource is causing a problem.

Overview Reports

Monitor III overview reports provide information about all areas of delay.

Workflow/Exceptions Report

The workflow/exceptions report provides a comprehensive overview of system activity. It has graphic workflow indicators that can be customized to present information about the jobs or groups of jobs that are most important at your installation. The exception capability displays a line to alert the systems programmer or operator whenever a user or group of users is not performing according to the criteria specified at your installation.

System Information Report

The system information report provides an overview of the system, its workload, and the total number of jobs using resources or delayed for resources. The system information report can report measurements for the entire system and for the following groups of jobs: TSO, batch, started tasks, domains, and performance groups.

Delay Report

The delay report (for all jobs) shows the activity of each job in the system and the hardware and software resources that are delaying each job. For most delay reasons, the tabular form of the report also lists the primary reason for the delay.

Job-Oriented Detail Delay Reports

Monitor III detail reports provide specific information about the hardware and software resources that are associated with job delays.

Device Delays

The device delays report presents jobs that were delayed by contention for device volumes, such as direct access devices, tapes, or a mass storage controller (MSC) volume. The tabular form of the report identifies up to four volumes that delayed each job.

Enqueue Delays

The enqueue delays report presents jobs that are waiting to use (enqueued on) serially reusable resources. The tabular display also lists the percentage of time that enqueue contention delayed the job over the report interval and the jobs that held the resource while the delayed job was waiting.

HSM Delays

The HSM delays report presents jobs waiting for services from HSM during the report interval. The tabular form of the report also lists explanations for the delay.

JES Delays

The JES delays report describes the jobs delayed waiting for services from JES2 or JES3. The tabular form of the report also lists explanations for the delay.

Processor Delays

The processor delays report presents all jobs delayed for or using a processor during the report interval. The tabular form of the report also identifies the three jobs that used processors the most while the delayed job was waiting for a processor.

Storage Delays

The storage delays report presents all jobs that used frames during the report interval. If a job was delayed because of paging or swapping activity, the report also identifies the reason for the delay.

Resource-Oriented Detail Delay Reports

Resource-oriented reports provide additional information about resources that are causing system delays.

Enqueue Resource Delays

The resource-oriented enqueue delays report presents serially reusable resources causing contention in the system. The tabular form of the report also lists the names of jobs that are delayed for (enqueued on) these resources, and the names of the jobs that are holding these resources.

Device Resource Delays

The resource-oriented device delays report presents information about the activity of I/O devices that are delaying jobs.

Storage Resource Delays

The resource-oriented storage delays report presents information about system storage usage and paging space delay by volume serial.

Controlling Monitor III Reporter Processing

Option selection screens allow a user to control a Monitor III reporter session from the terminal.

For example, the user can:

- Specify the time range over which RMF is to summarize and report data
- Select colors and patterns for RMF graphic reports
- Select job groups or individual jobs to be reported
- Set thresholds for exception reporting
- Create multiple sets of options and save them across sessions

Collecting Monitor III Data

The RMF Monitor III gatherer collects data for Monitor III. The operator or system programmer starts the data gatherer and can issue commands to control its processing. Data gathered by the Monitor III gatherer is available to all RMF Monitor III reporter sessions running on that system.

To enable an installation to gather additional data during an RMF Monitor III session, RMF provides a user exit so that your installation can use its own data gathering routine.

Saving Monitor III Data

Your installation can define VSAM data sets in which RMF can store data collected over time. This feature of RMF, known as data set support, allows your installation to analyze problems or system failures after they have happened without having to re-create the problem situation.

Data set support also allows for analysis of data collected on another system. The data set index screen (DSINDEX on the RMF primary menu) lists the dates and times of the data on each VSAM data set.

Getting Help for Monitor III

The RMF tutorial presents some important Monitor III concepts and commands and some typical RMF tasks. The tutorial provides information needed to start using Monitor III.

When using Monitor III, the user can access help information by pressing the HELP PF key on any report or panel. The help panels explain the meaning of measurements on the reports, including a description of possible causes for each delay reason, and how to use the various selection panels. Help information is also available for any user message that appears on a terminal.

Customizing Monitor III Reports

To help customize RMF reports or create new reports for your installation, RMF provides a report format definition utility. The utility consists of a series of ISPF panels to help modify the ISPF tables that RMF uses to produce reports.

Using Monitor III: An Illustration

The following pages illustrate how RMF reports might be used to obtain information about a single job and about device activity in the system.

Obtaining Information About a Single Job

The graphic version of the job delays (DELAYJ) report, shown below, presents information about how the job, IEAVEDS0, spent its time over a 100 second report interval.

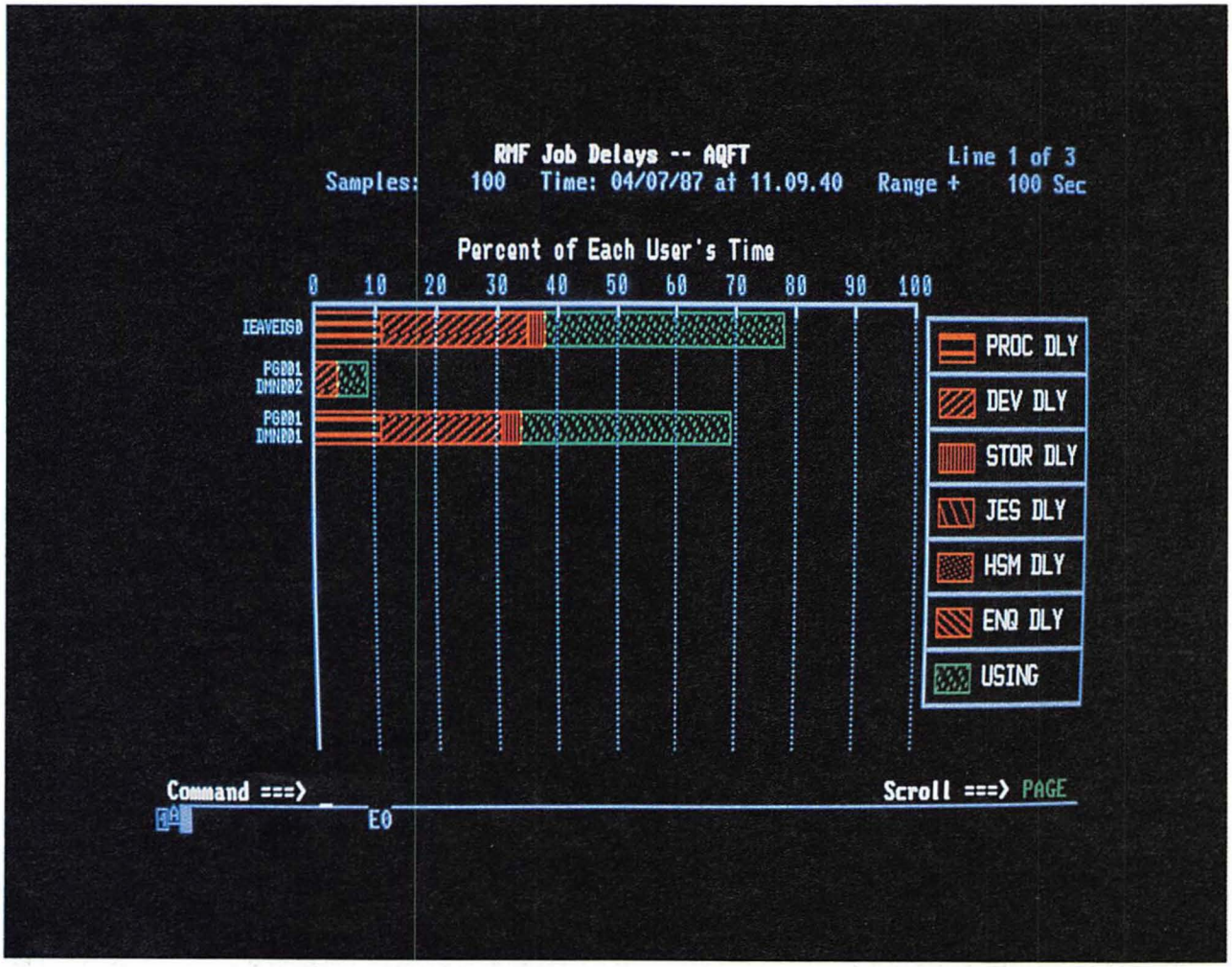


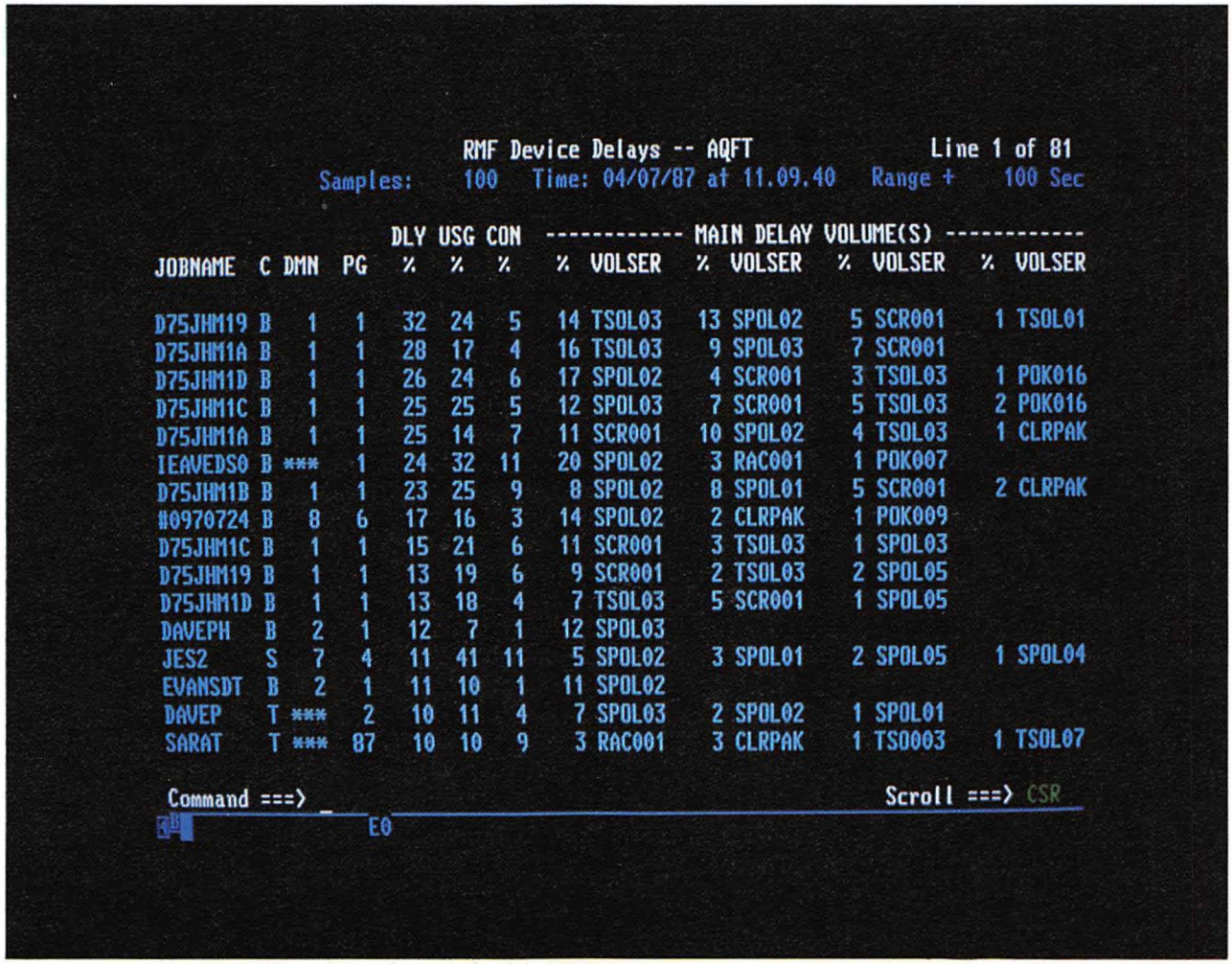
Figure 2-2. RMF Job Delays

The bar at the top shows the job's overall activity during the report interval. IEAVEDS0 spent 38 seconds delayed during the report interval, including 11 seconds waiting for a processor, 24 seconds waiting for a device, and 3 seconds delayed by paging or swapping activity (STOR). For 40 seconds of the report interval, IEAVEDS0 was using processors or devices. (For 22 seconds, IEAVEDS0 was engaged in one or more activities that RMF does not measure.)

Because the domain of the job changed during the report interval, three bars appear on the report. The middle bar shows the activity of the job while it was in DMN002. The bar at the bottom shows the job's activity while in DMN001.

Obtaining Device-Related Information

The device delay report (DEV) presents more information about the device-related activity of the job, IEAVEDS0. In the tabular version of the device delay report, below, IEAVEDS0 is the sixth job displayed. IEAVEDS0 spent 24 seconds during the report interval waiting for (DLY %) a device and 32 seconds during the report interval using (USG %) one or more devices. (CON % is a part of USG % and includes only the time that a device being used by the job was actually connected to a channel path. C, DMN, and PG represent the class, domain, and performance group, respectively, of the job.)



```
                    RMF Device Delays -- AQFT                 Line 1 of 81
          Samples:    100   Time: 04/07/87 at 11.09.40   Range +    100 Sec

                    DLY USG CON  ------------ MAIN DELAY VOLUME(S) ------------
JOBNAME  C DMN  PG   %   %   %    % VOLSER    % VOLSER    % VOLSER    % VOLSER

D75JHM19 B   1   1   32  24   5   14 TSOL03   13 SPOL02    5 SCR001    1 TSOL01
D75JHM1A B   1   1   28  17   4   16 TSOL03    9 SPOL03    7 SCR001
D75JHM1D B   1   1   26  24   6   17 SPOL02    4 SCR001    3 TSOL03    1 POK016
D75JHM1C B   1   1   25  25   5   12 SPOL03    7 SCR001    5 TSOL03    2 POK016
D75JHM1A B   1   1   25  14   7   11 SCR001   10 SPOL02    4 TSOL03    1 CLRPAK
IEAVEDS0 B ***   1   24  32  11   20 SPOL02    3 RAC001    1 POK007
D75JHM1B B   1   1   23  25   9    8 SPOL02    8 SPOL01    5 SCR001    2 CLRPAK
#0970724 B   8   6   17  16   3   14 SPOL02    2 CLRPAK    1 POK009
D75JHM1C B   1   1   15  21   6   11 SCR001    3 TSOL03    1 SPOL03
D75JHM19 B   1   1   13  19   6    9 SCR001    2 TSOL03    2 SPOL05
D75JHM1D B   1   1   13  18   4    7 TSOL03    5 SCR001    1 SPOL05
DAVEPH   B   2   1   12   7   1   12 SPOL03
JES2     S   7   4   11  41  11    5 SPOL02    3 SPOL01    2 SPOL05    1 SPOL04
EVANSDT  B   2   1   11  10   1   11 SPOL02
DAVEP    T ***   2   10  11   4    7 SPOL03    2 SPOL02    1 SPOL01
SARAT    T ***  87   10  10   9    3 RAC001    3 CLRPAK    1 TSO003    1 TSOL07

Command ===> _                                          Scroll ===> CSR
E0
```

Figure 2-3. RMF Device Delays

MAIN DELAY VOLUMES lists those volumes that contributed most to the delay of the job. Of the 24 seconds spent waiting for devices, IEAVEDS0 spent 20 seconds waiting for SPOL02, 3 seconds waiting for RAC001, and 1 second waiting for POK007.

For more information about these volumes, the resource-oriented device delays report can be examined.

Obtaining Information About Devices

The resource-oriented device delays report (DEVR) presents more detailed information about device volumes that are delaying jobs. The graphic version of the device resource delays report, shown below, shows how volume SPOL02, which was causing the greatest percentage of delay for IEAVEDS0, spent its time over the report interval.

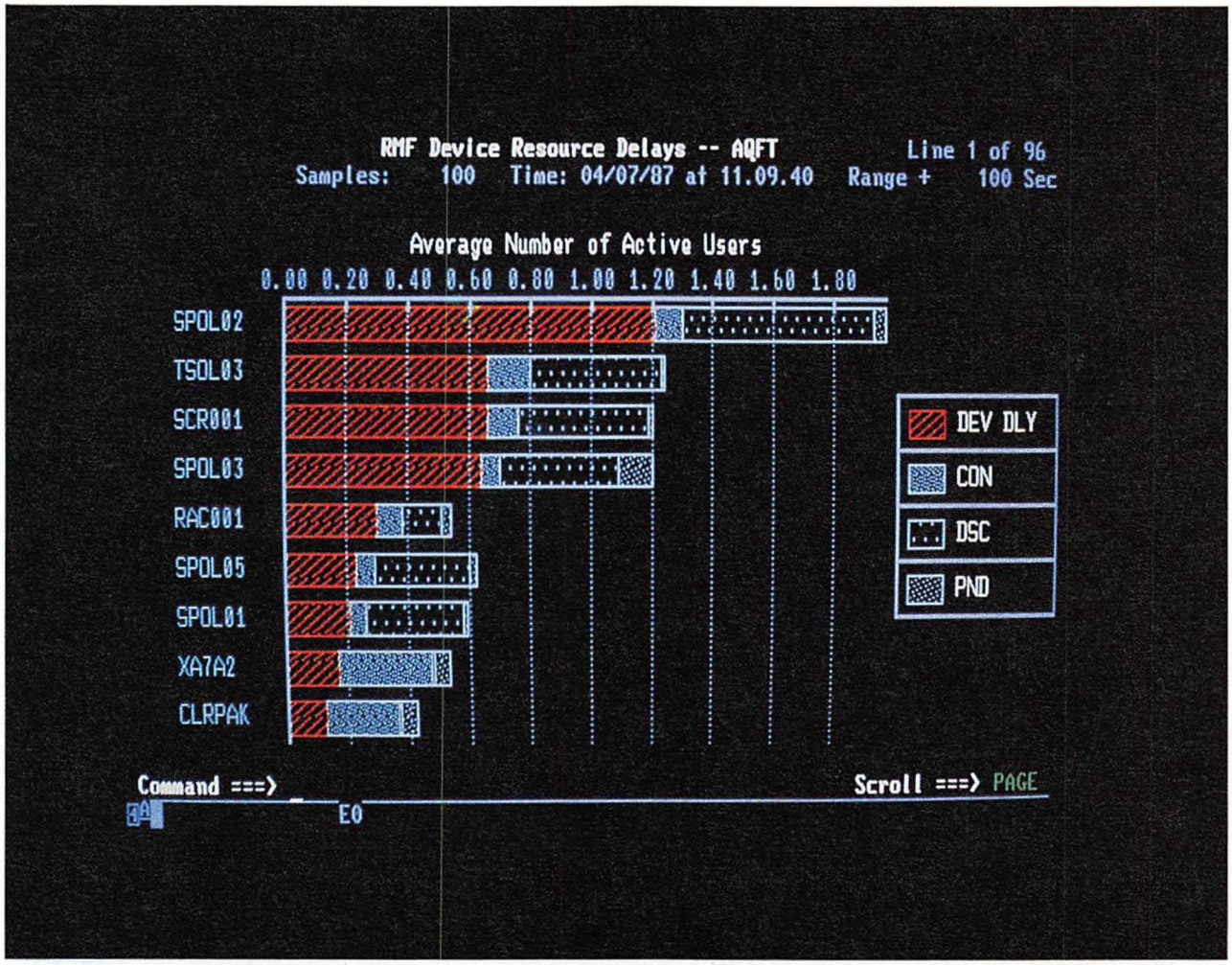


Figure 2-4. RMF Device Resource Delays

On the graphic report, device usage is expressed in terms of the number of *active* users of the device, averaged over the report interval. An active user is any user who is using or delayed for a device.

The sample graph shows that volume SPOL02 had an average of two active users during the report interval. 1.2 users were delayed for the volume and 0.8 users were using the volume.

When there is a long queue of requests for a device, the red (delay) portion of the bar lengthens, while the turquoise (using) portion of the bar becomes correspondingly shorter.

Using time for the device is broken into connect (CON), disconnect (DSC), and pending (PND) time. The report shows that for most of the interval, the device was disconnected from the channel. The online help information for the report explains possible causes for high disconnect time.

Chapter 3. RMF Monitors I and II

Monitor I and Monitor II collect system resource usage and contention data and store it in SMF records. The data can be used to produce reports immediately after each measurement interval or to generate reports at a later time.

Using the RMF post processor, RMF can generate five different kinds of printed reports from the data:

- **Interval reports** include the data gathered for a single system activity over a single time interval.
- **Duration reports** include the data gathered for a single system activity over multiple time intervals.
- **Summary reports** include an overview of system activity over a user-specified period of time.
- **Plot reports** provide graphic views of many areas of system activity (over a user-specified period of time) such as processor usage or paging.
- **Exception reports** are produced only when one or more key system measurements exceed user-selected thresholds.

Because Monitor I runs in the background and requires little overhead, it can run continuously to provide data for long term analyses.

Monitor II provides online snapshot reports with detailed information about the activity of address spaces (jobs) in the system and provides immediate online access to the latest data collected by Monitor I.

System Activities Measured

Monitor I and Monitor II both measure the following classes of system activity:

- Processor activity, including address space analysis
- Channel path activity
- I/O device activity
- I/O queuing activity
- Paging activity
- Workload activity (resource usage and response time by domain and performance group)
- Page/swap data set activity
- Enqueue activity

During a Monitor I session, RMF can measure:

- Virtual storage activity
- Tracing of selected system counters

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During a Monitor II session, RMF can measure:

- Address space activity for individual address spaces and groups of address spaces
- Real storage/processor/SRM activity
- Reserve activity
- Domain activity
- Transaction activity
- Device activity (including storage group reports)

The next several pages describe the information Monitor I and Monitor II provide for each system activity.

Processor Activity

The processor activity reports contain processor utilization information and an analysis of the number of address spaces that are swapped in, ready, or swapped out.

These reports can be used to analyze processor usage growth rate for capacity planning or to analyze in detail performance problems identified by Monitor III.

Channel Path Activity

Channel path activity reports indicate how long system channel paths are busy during the report interval.

The information about channel path activity, used with the information on I/O device activity and I/O queuing activity, can indicate performance problems associated with channel paths. If a channel path to a device shows excessive use, your installation can take steps to remedy the situation, such as defining additional paths to the device or introducing a different job mix to produce better performance.

I/O Device Activity

I/O device activity reports provide the following information about specified devices: activity rates, response time, delay time by reason, connect and disconnect time, and open data sets on the device.

When used with the channel path activity and I/O queuing activity reports, the detailed information in the I/O device activity reports can help your installation analyze its I/O configuration. For example, your installation can identify contention bottlenecks for a particular device and pinpoint the reason for the difficulty.

Because the logical control unit is the basis of I/O request queuing, scheduling, and measuring within the channels, devices included in the report are grouped by logical control units. This organization makes it easier to compare the data in the I/O device activity report with the data in the I/O queuing activity report. Along with individual device data lines, RMF provides a summary line with average or total values for the entire logical control unit.

With the use of system managed storage available with MVS/DFP 3.1, I/O device activity reports can be requested for specific storage groups. Measurements and exception checking can be restricted to specific storage groups.

I/O Queuing Activity

I/O queuing reports provide information about the queuing of I/O requests for each logical control unit. The reports provide the activity rates, busy percentages, and deferred percentages for each logical control unit and identify the control units that belong to each logical control unit.

The information in an I/O queuing report, used after the reports on channel path activity and I/O device activity have indicated that a problem exists, can help pinpoint the reason for contention delays associated with channel paths, control units, and devices.

If the report shows a large number of deferred requests for a logical control unit, your installation can take steps to reduce the contention, such as defining additional channel paths to the devices, reconfiguring control units or devices attached to control units, or adjusting the workload to provide a different job mix.

Paging Activity

The paging activity reports provide information about the demands made on system paging facilities. The reports contain information such as page-in, page-out, and reclaim rates by category, a summary of real storage frame usage and auxiliary storage slot usage, and movement of pages to and from expanded storage.

A swap placement activity section allows you to analyze the effectiveness of physical and logical swapping in your system. This section provides information such as rates of physical and logical swapping by reason, and percentage of successful logical swaps.

The Monitor II report also has some key system paging indicators, such as unreferenced interval count (UIC), paging rates by category, movement to and from expanded storage, and migration and swapping rates.

Workload Activity

The workload activity report provides information about resource usage by domain and performance group. Most of the data provided is in the terms needed for tuning the System Resources Manager (SRM) installation performance specification (IPS) and the SRM installation control specification (ICS) parameters. The measurements provided include SRM service units used by category, transaction count, transaction rate, response time, and real storage usage.

Your installation can isolate workload information for particular users or groups of users by assigning unique performance group numbers or domain numbers to each.

The report can be used to determine whether the TSO response time objectives at your installation are being met and whether your system is doing any unnecessary swapping.

Monitor II Session Transaction Activity

The Monitor II session transaction activity report is a snapshot of some of the data in the workload activity report. The report can be used to evaluate the effectiveness of the performance objectives in the IPS and the workload classification in the ICS.

Page/Swap Data Set Activity

The page/swap data set activity reports provide statistics on individual data set use for page data sets and for swap data sets.

The report identifies each data set and has information such as page transfer time or service time, number of pages transferred, and number of slots or swap sets used.

You can use the information in the page data set section of the report to determine, for example, whether you have allocated the optimum size for each data set.

Enqueue Activity

RMF measures enqueue activity during a Monitor I session or during a Monitor II session. In addition, RMF can measure reserve activity during a Monitor III session.

Monitor I Session Enqueue Activity

The Monitor I session interval report provides information about serially-reusable resources. A resource is included in the report only when there are one or more requestors waiting for the resource. The report is available at a summary level or a detail level.

The summary report provides information on all resources for which contention occurred, including the total contention time, number of contention events and queue length for each resource.

The detail report provides the total number of holding jobs and the total number of waiting jobs for each resource.

Monitor II Session Reserve Activity

The reserve activity report enables you to track RESERVE and DEQ macro instructions, which are issued to reserve a shared direct access device for use by a particular system. This snapshot report describes the reserve activity that is occurring at the time RMF processes the request for the report. Especially when requested during a display session, the report can help you to determine on a realtime basis whether any of the jobs and devices included in the report are contributing to any delays caused by contention for shared direct access devices.

You can request the report either for all devices that had a RESERVE request or for a particular volume that had a RESERVE request.

Virtual Storage Activity

The virtual storage reports produced by Monitor I provide information about virtual storage usage in major system areas and can lend insight into virtual storage fragmentation problems. Virtual storage reports are available for the common area and for the private area of specified jobs.

Common Area Reports

The common area reports provide information about common area storage.

The summary report for the common area contains a virtual storage map of the entire system with the size and address of all major system areas. The report also provides a summary of the number of pages actually used in each area, including minimum, maximum and average values.

The detail report for the common area provides a breakdown of CSA and SQA usage by subpool.

Private Area Reports

Private area reports contain information about private area storage.

The summary report for the private area provides a storage map that shows the size of the various areas used by a specified job, information about minimum and maximum page usage of each area and how many pages are free.

The detail report for the private area shows the minimum, maximum, and average number of pages below 16 megabytes in each private area subpool.

ASM/RSM/SRM Trace Activity

Auxiliary storage management/real storage management/system resources manager (ASM/RSM/SRM) tracing takes place during a Monitor I session. The interval report provides sampled values of key MVS control block fields over the interval for the fields you specify.

Address Space Activity

RMF measures address space activity during a Monitor II session.

An address space activity report can be requested for a single address space, for all address spaces, or for address spaces that meet specified criteria. An address space activity report for a single job displays multiple lines of data about the job on the screen at once, so that the operator or system programmer can monitor the job over time.

The address space activity reports available are:

- Address space state data
- Address space resource data
- Address space SRM data

The address space state data report provides an overview of the current state of the address space. The report can be used to determine which jobs are using large amounts of real storage or which jobs are being swapped excessively and why the swapping is occurring.

The address space resource data report provides an overview of the system resources (including processor time, paging, device connect time, and real storage) used by the address space. The report can help identify jobs that are contributing to system performance problems.

The address space SRM data report provides an overview of the SRM services (such as processor service, MSO service, and I/O service) used by the address space. The report can help identify which jobs are using which services and whether excessive use of system services by particular jobs is creating system performance problems.

Real Storage/Processor/SRM Activity

RMF measures real storage, processor, and SRM activity during a Monitor II session. The report provides a one-line summary of the current use of real storage, the processor, and SRM facilities, including common storage frame counts and queue lengths of swapped users. Repeated requests for the report build a table showing how the activity changes over a period of time.

Domain Activity

Domain activity is measured during a Monitor II session. The report contains the same information as the system response to the DISPLAY operator command with the DMN operand. Thus, the information enables you to verify the effectiveness of the current domain definitions.

The report identifies the name of the installation performance specification (IPS) member of SYS1.PARMLIB that is currently in effect as well as the current values for the CPU, IOC, MSO, and SRB service definition coefficients. For each domain defined in the IPS, the report shows key SRM measurements, such as target and current multiprogramming level, number of swapped out users, and contention index.

Post Processor Reports

The post processor can be used to generate any of the interval reports available with Monitor I or Monitor II. In addition, the post processor can produce duration reports, summary reports, exception reports, and plot reports from SMF records built during a Monitor I session.

A summary report report provides an overview of system activity. The following summary report shows some key indicators from various Monitor I reports.

```
                                R M F   S U M M A R Y   R E P O R T

OS/VS2                    SYSTEM ID AQFT           START 03/04/87-00.00.01  INTERVAL 00.27.42
SP2.2.0                   RPT VERSION 3.5.0        END   03/04/87-23.00.00  CYCLE 1.000 SECONDS

NUMBER OF INTERVALS 32           TOTAL LENGTH OF INTERVALS 14.46.46

DATE   TIME     INT   CPU-  DASD  DASD  TAPE JOB JOB TSO TSO STC STC SWAP DEMAND SERVICE  TRANS
MM/DD HH.MM.SS MM.SS  BUSY  RESP  RATE  RATE MAX AVE MAX AVE MAX AVE RATE PAGING  RATE    RATE

03/04 07.30.00 30.00  19.5    10 339.2   0.0   9   3 111   71  59  56 0.00   2.54   16410  3.301
03/04 08.00.00 29.59  27.5    11 483.4   0.0   8   3 228 170  59  57 0.00   1.92   25670  6.561
03/04 08.30.00 30.00  51.9    12 792.6   0.1  15   7 297 269  58  53 0.09   2.39   50974  9.917
03/04 09.00.00 29.59  48.1    12 700.4  14.2  13   6 344 325  57  54 0.21   2.04   51795 10.500

03/04 09.30.00 30.00  61.6    12 805.5  11.1  16   7 373 356  58  53 0.38   2.13   63817 12.000
03/04 10.00.00 30.00  67.5    12 679.8   3.1  16   8 386 379  57  53 0.41   2.48   72932 11.847
03/04 10.30.00 30.00  72.4    13 898.2   7.3  16  10 412 394  54  50 0.36   2.15  110840 12.701
03/04 11.00.00 29.59  70.3    13 959.6  35.0  22  11 412 404  55  49 0.37   2.31   84977 13.268

03/04 11.30.00 30.00  42.4    16 697.6   0.1  18   9 378 344  57  51 0.09   1.72   47652  8.552
03/04 12.00.00 29.59  34.5    14 575.1   0.0  17   8 332 327  58  53 0.05   1.72   41767  6.167
03/04 12.30.00 30.00  47.9    21 755.9   1.0  21  17 347 335  48  44 0.20   1.50   70310  7.334
03/04 13.00.00 29.59  63.9    20 842.9  16.3  21  17 399 370  48  44 0.45   2.04   83434 11.104

03/04 13.30.00 30.00  68.6    21 944.7   2.5  21  17 406 398  49  44 0.48   2.68   78169 13.336
03/04 14.00.00 30.00  79.8    20 992.9   5.0  22  14 410 403  55  48 0.90   3.53  419202 12.649
03/04 22.57.00 02.59   4.8    21  79.7   0.0   3   0   0   0  54  53 0.03   0.55    2894  0.033
03/04 23.00.00 29.59   1.7    32  16.9   0.0   2   0   0   0  55  55 0.00   0.02    1192  0.001

TOTAL/AVERAGE          48.9    18 696.8   9.4  22   7 412 256  59  53 0.24   2.20   84159  7.786
```

Figure 3-1. RMF Summary Report

Adding Your Own Functions to Monitors I and II

In addition to the data available through the standard RMF reports, installation exits allow your installation to gather and report on other data.

Chapter 4. RMF System Availability Management

The System Availability Management (SAM) function of RMF allows your installation to record, track, and report information about the availability of hardware and software on your system.

Specifically, SAM detects and records problem data for abnormal failures of selected applications, system stalls (a hang, wait, or loop condition), and system failures that require IPLs.

Availability management personnel can then define what information they want reported and how they want that information to appear in reports.

What SAM Does

SAM consists of a **collector** and a **report writer**.

The SAM Collector

The SAM collector gathers data about hardware and software problems and transfers the information to the Information/Management data base. Each time a problem record is created, the collector sends an alert message to a specified display console.

To run SAM, a multisystem installation needs to have Information/Management installed on only one MVS/XA processor. Problem records are transferred to the Information/Management processor through shared DASD or by means of a teleprocessing link or tape.

The SAM Report Writer

The SAM report writer uses information recorded in the Information/Management data base, combined with user defined schedules, report definitions, and report format definitions to produce reports.

User defined schedules are an installation's intended schedules for systems and applications that SAM is tracking. Both scheduled time and prime time hours can be defined for each system and application.

Report definitions control the content of the report, including the type and quantity of data. Report definitions allow your installation to specify:

- Systems, applications, and terms to be included in the report
- Dates and time of the data included in the report
- The length of time (day, week, or month) represented by each line of the report
- Exception conditions for creating exception reports
- Requests for subtotals and totals

Report format definitions control the format of the report. Format includes, for example, the content and placement of report headings and column headings.

The causes of software and/or hardware outages can be grouped together for reporting. Such a grouping is called a **term**.

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The SAM report writer includes Interactive System Productivity Facility (ISPF) panels that allow you to define schedules and report definitions. Using the ISPF panels ensures the correct syntax and format of input for the report writer.

Types of SAM Reports

SAM produces a detailed report and four kinds of summary reports.

Detailed Report: The detailed report provides the availability, outages, and incidents of a system or of multiple systems during a specified time period.

Cause Report: A cause is a reason for an outage. The cause report includes one line for each cause recorded in the problem records used for the report. The cause report is the only report that identifies causes not specified in the term definitions.

Term Report: The term report produces one line of output for each defined term that is responsible for an outage.

Termlist Report: The termlist report prints each defined term responsible for an outage, followed by a breakdown of the causes for the outage.

System/Application Summary Report: The system and application summary report produces a single line summary for a system, application, cause, or term.

Keeping Your System Available

You can compare the availability data produced by SAM to the availability goals you have set for your system, its jobs, and subsystems and take action to:

- Resolve problems that are having the greatest effect on availability
- Make configuration changes to critical applications so that you use components with the highest availability
- Separate critical applications from applications that cause outage
- Install backup devices for devices that cause excessive outage

Chapter 5. Planning Information

This chapter describes the machine and programming requirements for RMF Version 3 and the compatibility information for RMF Version 3.

Machine Requirements

The machine requirements to run RMF Version 3 follow.

RMF Version 3 Release 5.1

RMF 3.5.1 supports IBM 438X, 308X, and 3090 series processors operating in System/370 extended-architecture mode with MVS/SP 2.2.3.

Display session output is formatted specifically for IBM 3270 type display stations, which support the following screen sizes:

- 1920 characters -- 24 lines by 80 columns
- 2560 characters -- 32 lines by 80 columns
- 3440 characters -- 43 lines by 80 columns

RMF printed reports (except Monitor III reports for Version 3 Release 5) require a 132-character or greater printer.

RMF Version 3 Release 5

Monitor III display sessions operate under ISPF control and the terminals supported are those that ISPF supports.

RMF Version 3

RMF Version 3 is designed to run on an IBM processor operating in System/370 extended-architecture (370-XA) mode.

Programming Requirements

The programming requirements to run RMF Version 3 follow.

RMF Version 3 Release 5.1

RMF 3.5.1 runs only on a system that includes MVS/SP 2.2.3 (5665-291 or 5740-XC6). RMF 3.5.1 is not a replacement for RMF 3.5. New users must install RMF 3.5 and 3.5.1.

For system managed storage (SMS) support, MVS/DFP Version 3 Release 1 (5665-XA3) is required.

RMF Version 3 Release 5

RMF 3.5 runs only on a system that includes MVS/SP 2.2.

For the Monitor III reporter, Interactive System Productivity Facility (ISPF) Version 2 Release 2 or later (5665-319) and its prerequisites are required.

For Monitor III color graphic reports support, Graphic Data Display Manager (GDDM) Version 1 Release 4 (5748-XXH) or Version 2 (5665-356) or higher level along with its Presentation Graphics Feature (PGF) are required.

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For the local session option of Monitor II, BTAM/SP (5665-279), or equivalent, is required.

To use the System Availability Management function, Information/Management Version 2 Release 1 (5665-953) or Version 3 (5665-383) or later releases and any prerequisites, or their equivalent, are required. Information/Management Version 2 Release 1 requires PTFs UZ90394 and UZ41735.

RMF Version 3 Release 4.1

RMF Version 3 Release 4.1 runs only on a system that includes MVS/SP-JES2 2.1.7 or MVS/SP-JES3 2.1.7.

RMF Version 3 Release 4

RMF Version 3 Release 4 runs only on a system that includes MVS/System Product Version 2 Release 1.3 (5665-291 or 5740-XC6).

For the local session option of Monitor II or Monitor III, BTAM/SP (5665-279) is needed.

RMF Version 3 Release 3

RMF Version 3 Release 3 runs only on a system that includes MVS/System Product Version 2 Release 1.3 (5665-291 or 5740-XC6).

Storage Requirements for Version 3 Release 5

The approximate RMF (including the System Availability Management function) auxiliary storage requirements for the system libraries are:

- SYS1.LPALIB 65,000 bytes (an increase of 5,000 bytes over RMF 3.4)
- SYS1.LINKLIB 1,350,000 bytes (an increase of 95,000 bytes over RMF 3.4)

Common area virtual storage requirements below 16 megabytes in virtual storage are unchanged from that of RMF Version 3 Release 4.

Fixed storage requirements for RMF include temporarily fixed PLPA and EPLPA code, temporarily fixed private space, SQA, and ESQA global fixed space (SP245). The amount of storage used depends on the set of options required for RMF processing.

Compatibility

RMF Version 3 Release 5.1 is the level of RMF required to function with MVS/SP 2.2.3.

RMF 3.5.1 is upwardly compatible with RMF 3.4 and RMF 3.5.

RMF Version 3.5 is the level of RMF required to function with MVS/SP 2.2. RMF 3.5 will not operate with MVS releases prior to MVS/SP 2.2.

RMF 3.5 no longer sets any bits in the Selectable Unit (SU) bit string.

RMF 3.5 is upwardly compatible with RMF 3.3 and RMF 3.4.

The RMF post processor has been modified to handle the new record changes and process records from previous RMF releases. The RMF 3.5 Monitor III reporter will handle data collected by RMF 3.4. Previous levels of the RMF post processor will not work on RMF 3.5 records.

Local 3270 Monitor III display sessions are no longer supported.

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Resource Measurement Facility (RMF)
Version 3
General Information Manual
Program Product

READER'S
COMMENT
FORM

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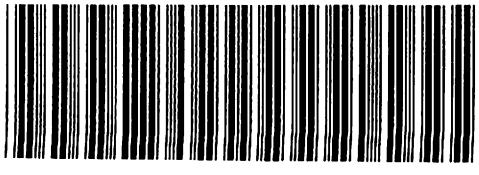

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