C. STAHL

Program Product

OS/VS2 MVS
Resource Measurement
Facility (RMF)

General Information Manual

IBM

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Program Number 5740 - XXM

The Resource Measurement Facility (RMF) is a measurement collection tool that is designed to monitor selected areas of system activity and present the data collected in the form of SMF (System Management Facility) records and/or formatted reports.

This manual provides an overview and functional description of RMF.

IBM

This publication contains overview information for RMF. It is intended for installation managers and system programmers who are responsible for tuning an OS/VS2 (MVS) system. Readers should have a background in OS/VS2 (MVS).

This publication is for planning purposes only. The functions and capabilities described here are subject to change before the availability of RMF.

RMF is a program product that allows an installation to monitor selected areas of system activity and to obtain feedback in the form of SMF (System Management Facility) records and/or formatted reports.

The major topics by section are:

● Chapter 1: Introduction — highlights the categories of data collection, and the basic functions and system requirements of RMF.

● Chapter 2: Characteristics of RMF — describes the purpose of RMF and defines its categories of data collection.

● Chapter 3: Processing — briefly describes the input control options for RMF. the gathering techniques employed, and the processing considerations relevant to the INTERVAL, CYCLE, and STOP parameters.

● Appendix: RMF Reports — show example of each report described in Chapter 2.

When RMF becomes available, additional publications will be provided that contain detailed information about RMF options, reports, messages and codes, planning and operating considerations, and installation information.

Contents

The Resource Measurement Facility (RMF) is a measurement collection tool which an installation may use to monitor selected areas of system activity and obtain feedback in the form of SMF records and/or formatted reports.

Categories of Data Collection

RMF permits the gathering of information for the following classes of system activity:

- CPU activity
- Channel and channel-CPU overlap activity
- I/O device and contention activity for:
  - unit record devices
  - graphics devices
  - direct access storage devices
  - communication equipment
  - magnetic tape devices
  - character reader devices
- Paging activity
- Workload activity
- Page/swap data set activity
- ASM/RSM/SRM trace activity.

See Chapter 2 for a description of the information gathered for these areas.

Basic Functions

RMF controls the collection of measurement data which includes the tracing of ASM/RSM/SRM management variables, and the generation of reports for the system activities requested by the installation.

Resource Measurement

The OS/VS2 system maintains measurement data for the system's resources. RMF will collect the data relevant to the system activities requested. This may include such statistics as accumulated queue length, the number of cycles, busy samples, and number of Start I/Os for each monitored device.

Resource Reporting

Reports are produced for each requested system activity. The information appearing on the report may be 'directly derived data', that is, internal system measurements, or the information may be 'calculated data' such as standard deviation or sum. The data collected may be presented in the form of SMF records or formatted RMF reports. The reports may be made available for printing either at RMF termination or immediately after each measurement gathering interval, depending on the option specified by the installation. (See Chapter 3 for details on the control options which may be specified.)

Post Processing

To enable the installation to produce RMF reports during off-shift hours, RMF provides a post processor program (ERBMFPRT) that can be submitted as a batch job. Input to this program is either an SMF data set containing RMF records or any other data set with RMF records sorted on two fields: interval start date, and interval start time. The output is directed to the system printer and consists of the requested RMF reports and/or any messages denoting errors.

System Requirements

Software

RMF can be used with the latest level of OS/VS2 MVS as of the time RMF becomes available.

Hardware

There are no additional or special OS/VS2 MVS hardware requirements.

Storage Estimates

The approximate RMF auxiliary storage requirements for the system libraries are:

SYS1.LPALIB   12.7K
SYS1.LINKLIB   121.7K

The fixed storage requirements depend on the set of system activities being monitored.

Installation

There are no additional or special OS/VS2 MVS installation requirements.

Purpose

With RMF, an installation can monitor the utilization of individual CPUs, channels, devices, real storage, external page storage, and page and swap data sets. It can also monitor the service being provided to different classes or users, as well as monitoring fields from certain ASM/RSM/SRM control blocks. The data obtained aids the installation in:

● identifying system components whose overall utilization is exceptional

● identifying periods of system activity during which the utilization of particular resources is exceptional

● relating the service being provided to different classes of users to the specifications provided in the IPS (Installation Performance Specification)

● identifying bottlenecks of contention for resources.

Categories

The uses to which RMF can be applied are dependent upon the needs and goals of the individual installation. In Chapter 1 seven categories of data collection were listed that could be monitored by RMF. These seven areas are described in more detail below.

CPU Activity

The report produced when monitoring CPU activity provides the total wait time each CPU experienced during an RMF reporting interval and what percentage that is of the reporting interval. See Appendix for an example of this report.

Channel Activity

The report produced when monitoring channel activity provides the number of successful Start I/Os issued to each channel during the report interval and the percentage of time during the report interval each channel was busy, while simultaneously, the CPU was in the wait state. (The second value is used to measure I/O boundedness.) See Appendix for an example of this report.

I/O Device Activity

The report produced when monitoring I/O device activity provides the number of successful Start I/Os issued during the report interval to each device in each device class selected. It contains the percentage of time during the report interval in which each device was busy as well as the average number of requests which are enqueued and waiting to be serviced on each device at any given time. See Appendix for an example of this report.

Paging Activity

The report produced when monitoring paging activity provides detailed information about the demands made on the system paging facilities and the utilization of real storage and external page storage during the reporting interval. It also provides swapping statistics.

The paging rates monitored by RMF are:

- page reclaim rates
- non-swap page-in rates
- swap page-in rates
- total page-in rates
- non-swap page-out rates
- swap page-out rates
- total page-out rates.

These paging rates appear for one or more of the following:

- pageable system areas used for non-VIO data
- memory pages used for VIO data
- memory pages used for non-VIO data.

The page counts monitored include:

- pageable main storage page frames categorized by LPA/CSA, private area, unused, and total
- fixed main storage frames categorized by: SQA, LPA/CSA, private area, and total
- nucleus frames
- total online system frames
- total user pool auxiliary page slots
- auxiliary slots used for data set pages
- auxiliary slots used for virtual memory pages
- unused auxiliary slots
- bad auxiliary slots (unavailable).

All of the above page counts are sampled and reported with minimum, maximum, and average values for the interval (except for nucleus and total online frames which are snapshots at the end of the interval).

The swap information includes a count of swap sequences and a swap sequence rate calculated for the user. The following swap-out reasons are itemized and totaled in the report:

● input terminal wait

● output terminal wait

● long wait

● detected wait

● unilateral

● exchange on recommendation value

● ENQ exchange

● requested

● auxiliary storage shortage

● real pageable storage shortage

See Appendix for an example of this report.

Workload Activity

The report produced when monitoring workload activity provides information on the utilization of each performance group period (PGP) specified in the Installation Performance Specification (IPS) and can be reported at one of three levels. The most detailed level is known as the performance group period, the next is the performance group (PG) level, and the level with the least detail is the system summary. The data provided at the PGP level includes:

● performance group number

● performance group period number

● performance objective number

◄● domain number

● IOC service in the interval

● CPU service in the interval

● MSO service in the interval

● total service in the interval

● total service per second in the interval

● average absorption rate

● average transaction service rate

● workload level

● average transactions

● ended transactions

● average time of ended transactions

● number of swaps.

See Appendix for an example of this report.

Page/Swap Data Set Activity

The report produced when monitoring page/swap data set activity provides statistics on individual data set usage. These values are reported as the minimum, maximum, and average slot usage for the interval. See Appendix for an example of this report.

ASM/RSM/SRM Trace Activity

The report produced when monitoring trace activity provides sampled ASM/RSM/SRM values over the interval. The traceable fields and the system areas in which they exist are:

Paging Vector Table (PVT) Control Block

Field	Meaning
PVTAFC	available frame count
PVTPOOL	number of real storage frames available
PVTSQDC	SQA deficient count
PVTDFRS	number of times frame allocation request deferred
PVTNPIN	number paged in
PVTNPOUT	number paged out
PVTVAMI	number of VIO page-ins
PVTVAMO	number of VIO page-outs
PVTVAMR	number of VIO reclaims
PVTSPIN	number of pages swapped in
PVTSPOUT	number of pages swapped out
PVTNPREC	number of pages reclaimed
PVTNSWPS	number of successful swap-ins
PVTCAIN	number of non-VIO page-ins
PVTCAOUT	number of common area non-VIO page-outs
PVTCAREC	number of reclaims in common area non-VIO pages
PVTCFMCT	number of frames currently assigned to pageable common areas
PVTSPFR	number of frames freed by swap-out without output I/O
PVTCNTFX	global fixed frame count
PVTSQAFX	fixed SQA frame count
PVTCOMFX	fixed LPA/CSA frame count

Auxiliary Storage Manager Vector Table (ASMVT) Control Block

Field	Meaning
ASMBKSLT	count of unreserved local slots
ASMSLOTS	total local slots in open local page data sets
ASMVSC	total local slots allocated for VIO paging areas
ASMNVSC	total local slots allocated to non-VIO paging areas
ASMERRS	bad slots on local data sets
ASMIORQR	count I/O requests received by I/O control
ASMIOCNT	count of Start I/O requests made to IOS that have not completed
ASMIORQC	count of I/O requests completed and returned to RSM

System Resource Management (SRM) Data Area

Field	*Meaning*
RMCAUSSC	unilateral swap-out count
RMCANQSC	CPU enqueue exchange swap count
RMCATOSC	terminal output swap count
RMCAEXSC	exchange on recommendation value swap count
RMCARSSC	real storage shortage swap count
RMCATISC	terminal input swap count
RMCALWSC	long wait swap count
RMCAXSSC	auxiliary storage shortage swap count
RMCADWSC	detected wait swap count
RMCARQSC	requested swap count
CCVRBSWT	recent base system wait time
CCVRBSTD	recent base time of day
CCVEJST	low priority user job step time
CCVIMBBT	time of last CPU imbalance
CCVUTILP	system CPU utilization
CCVLGUTL	long term CPU utilization x 256
CCVENQCT	number of users non-swappable for enqueue reasons
CCVCPUCT	number of online CPUs
ICVIMBBT	time of last I/O imbalance
MCVSTCRI	highest system UIC
MCVFRCNT	number of pages needed to be stolen by force steal routine
RCVUICA	UIC average
RCVCPUA	CPU usage average
RCVAVQC	AVQ low count
RCVASMQA	ASM queue length average
RCVPTR	paging rate
RCVTOTDF	average logical channel utilization of all active logical channels

SRM Domain Tables

Field	*Meaning*
DMDTMPLT	current multiprogramming level target
DMDTCMPL	current multiprogramming level
DMDTINCU	users per domain in storage
DMDTOUTU	users per domain out of storage
DMDTRUA	average number of ready users

See Appendix for an example of this report.

The operation of RMF is controlled by a set of parameters that may be contained in the parm field of the START command that was issued to start RMF processing, in the PARM field of the EXEC statement in the RMF cataloged procedure, or in the RMF partitioned data set member.

Control Options

The options that control RMF execution are taken from the input source in the following priority order:

- START command parm value
- EXEC statement PARM field
- RMF partitioned data set member.

An option explicitly specified in the START command will take priority over any conflicting specifications of that parameter in the EXEC statement or the RMF partitioned data set member. An option explicitly specified in the EXEC statement will take priority over a conflicting specification in the RMF partitioned data set member. If there are parameters for which no values are specified in the START command, the EXEC statement, or the RMF partitioned data set member, the program default value (underlined in the explanations below) will be used.

CPU/NOCPU

Specifies whether or not system CPU activity is to be monitored by RMF.

CHAN/NOCHAN

Specifies whether or not system channel activity is to be monitored by RMF.

DEVICE(list)/NODEVICE

Specifies whether or not system device activity is to be monitored by RMF. If DEVICE is specified, a device list must indicate the classes of devices to be monitored as follows:

CHRDR/NOCHRDR	— Character reader devices.
COMM/NOCOMM	— Communications equipment.
DASD/NODASD	— Direct access storage devices.
GRAPH/NOGRAPH	— Graphics devices.
TAPE/NOTAPE	— Magnetic tape devices.
UNITR/NOUNITR	— Unit record devices.

PAGING/NOPAGING

Specifies whether or not the system paging activity is to be monitored by RMF.

$$\text{WKLD} \begin{Bmatrix} \text{(PERIOD)} \\ \overline{\text{(GROUP)}} \\ \text{(SYSTEM)} \end{Bmatrix} \text{/NOWKLD}$$

Specifies whether or not system workload activity is to be monitored by RMF. If WKLD is specified, the level of detail of the report to be produced must be indicated by one of the options in parentheses. PERIOD requests the most detailed workload activity reporting, GROUP requests an intermediate level of detail, and SYSTEM requests the least detail.

PAGESP/NOPAGESP

Specifies whether or not page/swap data set activity is to be monitored by RMF.

TRACE(field,opt list)/NOTRACE

Specifies whether or not certain fields of the Paging Vector Table (PVT), the Auxiliary Storage Manager Vector Table (ASMVT), the System Resource Management Data Areas, or SRM Domain Tables are to be monitored by RMF where field is a valid field name in the PVT, ASMVT, SRM domain table, or an SRM data area, and opt list indicates one or more of the following:

MIN — the minimum sampled value of the field over the period of the sampling.

MAX — the maximum sampled value of the field over the period of the sampling.

AVG — the average of the field's sampled values.

STDDEV — the standard deviation from the values sampled.

END — a snapshot of the last sampled value in the sampling period.

ALL — the default option or all of the options listed above.

A complete list of the traceable SRM data areas, the PVT, ASMVT and SRM domain table fields can be found in Chapter 2 under the heading "ASM/RSM/SRM Trace Activity".

CYCLE(value)

Specifies the frequency at which sampling observations are made. The range is from 50 to 9999 milliseconds. The default value is 250 milliseconds.

INTERVAL value[M]

Specifies the interval at which all data will be gathered for report formatting and/or SMF record writing. The range is from 1 to 60 minutes. The default is fifteen minutes (15M).

MEMBER (nn)

Specifies the value to be appended to ERBRMF to form the name of the partitioned data set member that contains the RMF options. The default is 00, indicating member ERBRMF00 in the partitioned data set named on the IEFRDER DD statement in the RMF cataloged procedure (normally SYS1.PARMLIB). This parameter may be specified in the parm field of the START command or EXEC statement PARM field, but should not be specified within a partitioned data set member.

OPTIONS/NOOPTIONS

Specifies whether or not a list of the keyword options to be used will be printed at the operator's console at RMF initialization. If the list is printed (OPTIONS specified) the operator will be able to respond with any desired changes to the option list.

Notes:
- OPTIONS may be abbreviated OPTN on the operator command.
- NOOPTIONS may be abbreviated NOOPTN on the operator command.
- If you do not plan to specify any options at RMF start time, you can avoid unnecessary console output and delay in activating RMF by specifying NOOPTIONS (or NOOPTN) in the RMF partitioned data set member. If any syntax errors are detected by RMF, OPTIONS will be forced.

RECORD/NORECORD

Specifies whether or not monitored data is to be written to the SMF data set. The complimentary SMF enabling procedures must precede RMF attempts to write SMF records for RECORD to take effect.

REPORT($\left\{ \begin{array}{l} \text{REALTIME} \\ \text{DEFER} \end{array} \right\}$)/NOREPORT

Specifies whether or not printed reports of the monitored data are to be produced. If the reports are to be produced (REPORT specified) the REALTIME and DEFER options indicate whether the reports are to be printed when formatted at the conclusion of a data gathering interval (REALTIME) or printed after RMF processing terminates (DEFER).

STOP value $\begin{bmatrix} M \\ H \end{bmatrix}$ /NOSTOP

Specifies the desired time duration for RMF activity in minutes (M) or hours (H). The range is from 1 minute to 1 week (168 hours or 10,080 minutes). The default value is 15 minutes. If neither M nor H is specified, minutes (M) is assumed. NOSTOP means RMF may only be terminated by a STOP command.

Note: The operator STOP command will terminate execution at any time regardless of the value specified for this parameter.

SYSOUT(class)

Specifies the SYSOUT class to which the formatted reports are directed. Class A is the default.

Gathering Techniques

Each class of system activity that can be monitored has a set of measurement gathering routines defined for it. When considering the validity of the data given in the reports and SMF records it is necessary to separate them into two categories: those obtained by exact count techniques and those obtained by sampling techniques.

Exact Count Technique

Certain system events such as the number of Start I/Os to a device, or the number of swap sequences which occur in a given time can be accurately counted by the system as they occur. RMF collects this data from the appropriate system counters at the beginning of the reporting interval, and again at the end of the interval. Since the counters are incremented continually as the events take place, RMF can determine an exact count for an event by calculating the difference between the counter at the start of the interval and its contents at the end of the interval.

Sampling Technique

Some data counts will fluctuate over an interval of time, such as the number of main storage frames occupied by SQA pages or user pool auxiliary storage slots, because of system requirements. Such data is acquired by sampling the counts at various times during the report interval and calculating the minimum value of the samples taken, the maximum value of the samples taken and the average value of the samples taken.

Statistical Accuracy

The reports produced from sampling techniques are statistically accurate for certain measureable quantities such as queue length averages and amounts of data set usage; however, since the data gathered are estimates of real values, the law of statistical sampling applies. The accuracy of these values is dependent on the number of samples taken during a measurement interval which is controlled by the operator START command at RMF initialization.

Processing Considerations

The frequency with which certain data is gathered and reported can have a great deal to do with its validity. Therefore, care should be taken when specifying certain RMF parameter values such as INTERVAL, CYCLE, and STOP.

INTERVAL and CYCLE Values

The CYCLE parameter specifies the frequency with which sampling observations are made for some of the paging, page/swap data set, ASM/RSM/SRM trace, channel, and device data. The INTERVAL parameter specifies the frequency with which unique sets of measurements are gathered. These values should be chosen carefully so that a statistically significant sample size will be generated in each reporting interval.

Since statistical theory states the accuracy of sampled data increases with the number of samples taken of random events, an installation should expect more precise results with:
- a decreased CYCLE time (for a fixed INTERVAL value) or
- an increased INTERVAL length (for a fixed CYCLE value).

STOP Value

The STOP parameter specifies the desired time duration for RMF activity. If the
STOP value specified is very large (the largest specifiable value is 168 hours), the
INTERVAL value specified is small (minimum is 1 minute) and REPORT
(DEFER) is also specified, the result may be the filling up of SYSOUT spool space.

CPU Activity Report

```
                                          C P U   A C T I V I T Y
             OS/VS2                   SYSTEM ID ASM4              DATE   2/06/76          INTERVAL 10.01.176      PAGE    1
             RELEASE 03.7             RPT VERSION 02              TIME 18.58.57


  CPU                    WAIT TIME            WAIT TIME          CPU SERIAL
  NUMBER                 HH.MM.SS.TTT         PERCENTAGE         NUMBER

    0                    00.04.19.758         43.20              023013

    1                    00.04.12.240         41.95              023014

  AVERAGE                                     42.57
```

```
                                      C H A N N E L    A C T I V I T Y
                                                                                                              PAGE    1
              OS/VS2                          SYSTEM ID ASM4                    DATE   2/06/76        INTERVAL 10.01.176
              RELEASE 03.7                     RPT VERSION 02                    TIME 18.58.57         CYCLE 0.250 SECONDS


        CHANNEL              CHANNEL          PERCENT          PERCENT
        NUMBER              ACTIVITY         CHANNEL          CHAN BUSY
   CPU  AND TYPE             COUNT            BUSY            & CPU WAIT


    0   0  BYTE MPX          3,762
        1  BLOCK MPX             0              0.00            0.00
        2  BLOCK MPX         6,613            16.22            7.98
        3  BLOCK MPX        11,326            14.35            8.57

        4  BLOCK MPX             0             0.00            0.00
        5  BLOCK MPX             0             0.00            0.00

   TOTAL                    21,721


    1   0  BYTE MPX            33
        1  BLOCK MPX             0             0.00            0.00
        2  BLOCK MPX         6,917            16.38            9.27
        3  BLOCK MPX        11,188            15.34            9.19

        4  BLOCK MPX             0             0.00            0.00
        5  BLOCK MPX             0             0.00            0.00

   TOTAL                    18,138
```

Direct Access Device Activity Report

```
                OS/VS2                       SYSTEM ID ASM4                  DATE   2/06/76           INTERVAL 10.01.176
                RELEASE 03.7                 RPT VERSION 02                  TIME  18.58.57           CYCLE 0.250 SECONDS
```

DEVICE ADDRESS	VOLUME SERIAL	DEVICE ACTIVITY COUNT	PERCENT BUSY	AVERAGE QLENGTH
1D0	DRUM01	0	0.00	0.00
1D0	DRUM01	0	0.00	0.00
1D0	DRUM01	0	0.00	0.00
1D0	DRUMC1	0	0.00	0.00
1D0	DRUM01	0	0.00	0.00
1D0	DRUM01	0	0.00	0.00
1D0	DRUM01	0	0.00	0.00
1D0	DRUM01	0	0.00	0.00
1E0	DRUM02	0	0.00	0.00
1E0	DRUM02	0	0.00	0.00
1E0	DRUM02	0	0.00	0.00
1E0	DRUM02	0	0.00	0.00
1E0	DRUM02	0	0.00	0.00
1E0	DRUM02	0	0.00	0.00
1E0	DRUM02	0	0.00	0.00
1E0	DRUM02	0	0.00	0.00
210	D89SU7	3,592	24.07	0.09
211	MER014	0	0.00	0.00
212	SWAP01	11	0.12	0.00
213	333002	5,261	23.99	0.14
250	SG2003	2,038	16.09	0.00
251	D89LIB	1,020	2.70	0.00
252	DLIB01	0	0.00	0.00
253	SWAP02	1,603	12.43	0.01
310	PAGE01	1,981	16.01	0.01
311	SPOOL1	345	1.29	0.01
312	333001	4,576	16.01	0.05
313	PAGE00	0	0.00	0.00
350	333000	4,547	20.33	0.08
351	USER01	8,991	35.09	0.13
352	PAGE02	2,074	19.88	0.01
TOTAL		36,044		

Main Storage Paging Rates from a Paging Activity Report

```
                                        P A G I N G   A C T I V I T Y                                        PAGE   1
        OS/VS2                    SYSTEM ID ASM4              DATE  2/06/76         INTERVAL 1C.01.176
        RELEASE 03.7              RPT VERSION 02              TIME 18.58.57         CYCLE 0.250 SECONDS

                                  MAIN STORAGE PAGING RATES PER SECOND
```

	PAGE RECLAIMS		PAGE IN				PAGE OUT			
CATEGORY	RATE	PERCENT OF TOTAL SUM	SWAP	NON SWAP	TOTAL RATE	PERCENT OF TOTAL SUM	SWAP	NON SWAP	TOTAL RATE	PERCENT OF TOTAL SUM
PAGEABLE SYSTEM AREAS (NON VIO)	0.00	0		0.09	0.09	0		0.04	0.04	0
ADDRESS SPACES VIO	0.31	14		0.43	0.43	2		0.33	0.33	2
NON VIO	1.87	86	22.81	3.82	26.63	98	17.76	0.04	17.80	98
SUM	2.19	100	22.81	4.25	27.06	100	17.76	0.37	18.13	100
TOTAL SYSTEM VIO	0.31	14		0.43	0.43	2		0.33	0.33	2
NON VIO	1.87	86	22.81	3.91	26.72	98	17.76	0.08	17.84	98
SUM	2.19	100	22.81	4.34	27.15	100	17.76	0.41	18.17	100

Main Storage Frame and Local Page Data Set Slot Counts from a Paging Activity Report

```
         MAIN STORAGE FRAME COUNTS              NUMBER OF SAMPLES           LOCAL PAGE DATA SET SLOT COUNTS
                                                      2,405
                      MIN      MAX      AVG                                            MIN        MAX        AVC
PAGEABLE FRAMES                                               AVAILABLE SLOTS       67,703     67,794     67,74C
    LPA/CSA          380      419      399
    PRIVATE AREA      49      315      145                    VIO SLOTS               276        293        283
    UNUSED             7      346      212                    NON-VIO SLOTS          1,878      1,968      1,924
    TOTAL PAGEABLE   706      785      757                    BAD SLOTS                  0          0          C
FIXED FRAMES                                                 TOTAL SLOTS           69,948     69,948     69,948
    SQA               87       87       87
    LPA/CSA            6       13        7
    PRIVATE AREA      34      112       60
    TOTAL FIXED      127      206      154

NUCLEUS FRAMES AT END OF INTERVAL          112

TOTAL ONLINE SYSTEM FRAMES AT END OF INTERVAL     1,024
```

Swap-Out and Swap Sequence Counts from a Paging Activity Report

```
                                         P A G I N G   A C T I V I T Y
        OS/VS2                          SYSTEM ID ASM4                DATE   2/06/76           INTERVAL 10.01.176        PAGE    2
        RELEASE 03.7                    RPT VERSION 02                TIME  18.58.57           CYCLE  0.250 SECONDS


                        SWAP OUT COUNTS                                                    SWAP SEQUENCE COUNTS
        ------------------------------------------------------------------              ------------------------------

                                 SWAP     RATE      PERCENT                              TOTAL SWAPS              801
        SWAP OUT                 OUT      PER       OF
        CATEGORY                 COUNT    SECOND    TOTAL
                                                                                        SWAPS PER
        INPUT TERMINAL WAIT       755     1.26       94                                 SECOND                   1.33

        OUTPUT TERMINAL WAIT       43     0.07        5                                 AVERAGE
                                                                                        PAGES PER
        LONG WAIT                   1     0.00        0                                 SWAP OUT                  13

        DETECTED WAIT               1     0.00        0
                                                                                        AVERAGE
        UNILATERAL                  0     0.00        0                                 PAGES PER
                                                                                        SWAP IN                   17
        EXCHANGE ON RECOMMENDATION VALUE   3  0.00    0

        ENQ EXCHANGE                0     0.00        0

        REQUESTED                   0     0.00        0

        AUXILIARY STORAGE SHORTAGE  0     0.00        0

        REAL PAGEABLE STORAGE SHORTAGE  0  0.00       0
                                 -------  -------   -------
        TOTAL                     803     1.34      100
```

```
                                W O R K L O A D    A C T I V I T Y                                                    PAGE    1
              OS/VS2                          SYSTEM ID ASM4                 DATE  2/C6/76               INTERVAL 10.01.176
              RELEASE 03.7                    RPT VERSION 02                 TIME 18.58.57              IPS = IEAIPSC1
          SYSTEM TUNING PARAMETERS                  REPORT BY PERFORMANCE GROUP        SERVICE DEFINITION COEFFICIENTS
          IOC = 0.0  CPU = 0.0  ERV =   5C0                PERIOD                      IOC =  5.0  CPU = 10.0  MSO =  0.0
```

**** PERFORMANCE ****			DOMAIN NUMBER	INTERVAL SERVICE (TOTAL, BY TYPE AND PER SECOND)	AVERAGE ABSORPTION RATE	AVERAGE TRANS SERV RATE	NORMALIZED WORKLOAD LEVEL	NUMBER OF SWAPS	AVERAGE TRANS-ACTIONS	ENDED TRANS-ACTIONS	AVE TIME OF ENDED TRANS HHH.MM.SS.TTT
GROUP NUMBER	GROUP PERIOD	OBJ NUMBER									
001	1	01	003	IOC= 370 CPU= 16,877 MSO= 0 TOT= 17,247 PER SEC= 28	9	9	49.44	0	2.97	1	000.11.04.738
001	2	01	0C3	ZEROS							
001	ALL	ALL	ALL	IOC= 370 CPU= 16,877 MSO= 0 TOT= 17,247 PER SEC= 28	9	9	49.44	0	2.97	1	000.11.04.738
002	1	01	001	IOC= 25,040 CPU= 128,851 MSO= 0 TOT= 153,891 PER SEC= 255	102	94	44.24	771	2.70	778	000.00.01.769
002	2	01	001	IOC= 8,005 CPU= 29,222 MSO= 0 TOT= 37,227 PER SEC= 61	118	117	42.83	23	.52	20	000.00.17.644
002	3	01	002	IOC= 7,095 CPU= 23,552 MSO= 0 TOT= 30,647 PER SEC= 50	164	164	39.95	8	.31	8	000.00.52.189
002	ALL	ALL	ALL	IOC= 40,140 CPU= 181,625 MSO= 0 TOT= 221,765 PER SEC= 368	110	104	43.41	802	3.54	806	000.00.02.664

Page Data Set Section of Page/Swap Data Set Activity Report

```
                              P A G E / S W A P   D A T A S E T   A C T I V I T Y
                                                                                                          PAGE      1
          OS/VS2                      SYSTEM ID ASM4                    DATE    2/06/76        INTERVAL 10.01.176
          RELEASE 03.7                RPT VERSION 02                    TIME  18.58.57         CYCLE  0.250 SECONDS


                                              PAGE DATA SET USAGE
                                              ----------------------

  PAGE                               MIN     MAX     AVG
  SPACE    VOLUME  DEV   DEVICE  SLOTS  SLOTS   SLOTS   SLOTS   BAD
  TYPE     SERIAL  ADDR  TYPE    ALLOC  USED    USED    USED    SLOTS      DATA SET NAME

  PLPA     SWAP01  212   3330    2088   889     889     889       0        PLPA912

  COMMON   089LIB  251   3330    2088   161     170     166       0        COM705

  LOCAL    PAGE01  310   3330    23200  667     762     711       0        LOC620

  LOCAL    PAGE02  352   3330    23374  660     735     694       0        LOC748

  LOCAL    SG2003  250   3330    23374  765     843     801       0        LOC911
```

Swap Data Set Section of Page/Swap Data Set Activity Report

```
                            P A G E / S W A P   D A T A S E T   A C T I V I T Y
                                                                                                        PAGE    3
        OS/VS2                    SYSTEM ID ASM4              DATE   2/03/76          INTERVAL 02.01.175
        RELEASE 03.7              RPT VERSION 02              TIME  16.39.22          CYCLE 0.250 SECONDS


                                            SWAP DATA SET USAGE
                                            ---------------------------
```

PAGE SPACE TYPE	VOLUME SERIAL	DEV ADDR	DEVICE TYPE	SWAP SETS ALLOC	MIN SETS USED	MAX SETS USED	AVG SETS USED	BAD SWAP SETS	DATA SET NAME
SWAP	333333	352	3330	12	1	1	1	0		SYS1.SWAP01
SWAP	333111	452	3330	4	0	1	0	0		SWP201
SWAP	333111	452	3330	4	0	0	0	0		SWP202
SWAP	333111	452	3330	4	0	0	0	0		SWP203
SWAP	333111	452	3330	4	0	0	0	0		THIS.BE.A.FORTY.FOUR.CHAR.LONG.DATA.SET.NAME
SWAP	333111	452	3330	4	0	0	0	0		SWP206
SWAP	333111	452	3330	4	0	0	0	0		SWP207
SWAP	333111	452	3330	4	0	0	0	0		SWP208
SWAP	333222	152	3330	4	0	0	0	0		SWP301
SWAP	333222	152	3330	4	0	0	0	0		SWP302
SWAP	333222	152	3330	4	0	0	0	0		SWP303
SWAP	333222	152	3330	4	0	0	0	0		SWP306
SWAP	333222	152	3330	4	0	0	0	0		X222
SWAP	333222	152	3330	4	0	0	0	0		THIS.BE.A.FORTY.FOUR.CHRS.LONG.DATA.SET.NAME
SWAP	333222	152	3330	4	0	0	0	0		SWP307
SWAP	333222	152	3330	4	0	0	0	0		SWP308
SWAP	333000	252	3330	4	0	0	0	0	* SWAP06

ASM/RSM/SRM Trace Activity Report   (Part 1 of 2)

OS/VS2   SYSTEM ID H155   DATE 1/05/76   INTERVAL 02.00.084
RELEASE 03.7   RPT VERSION 02   TIME 12.35.05   CYCLE 0.250 SECONDS

SECONDS/SET=   1.25   CYCLES/SAMPLE= 1   NUMBER OF SAMPLES=   183   SAMPLES/SET=   5   NUMBER OF SETS=   37

TIME MM.SS.TT	*	MINIMUM	AVERAGE	ASMSLOTS MAXIMUM	END	STD. DEV.	*	MINIMUM	AVERAGE	PVTAFC MAXIMUM	END	STD. DEV.	*
35.06.25	*	870	870	870	870	0.000E+00	*	142	144	148	142	2.280E+00	*
35.07.50	*	870	870	870	870	0.000E+00	*	133	136	142	133	3.564E+00	*
35.08.75	*	870	870	870	870	0.000E+00	*	131	131	133	131	8.944E-01	*
35.10.00	*	870	870	870	870	0.000E+00	*	127	129	132	127	2.168E+00	*
35.11.25	*	870	870	870	870	0.000E+00	*	121	126	130	130	3.240E+00	*
35.12.50	*	870	870	870	870	0.000E+00	*	129	129	131	130	8.367E-01	*
35.13.75	*	870	870	870	870	0.000E+00	*	128	128	130	128	8.944E-01	*
35.15.00	*	870	870	870	870	0.000E+00	*	127	127	129	129	8.367E-01	*
35.16.25	*	870	870	870	870	0.000E+00	*	129	129	129	129	0.000E+00	*
35.17.50	*	870	870	870	870	0.000E+00	*	129	129	129	129	0.000E+00	*
35.18.75	*	870	870	870	870	0.000E+00	*	129	129	129	129	0.000E+00	*
35.20.00	*	870	870	870	870	0.000E+00	*	130	131	133	131	1.095E+00	*
35.21.25	*	870	870	870	870	0.000E+00	*	130	131	132	130	8.944E-01	*
35.22.50	*	870	870	870	870	0.000E+00	*	131	132	135	135	1.643E+00	*
35.23.75	*	870	870	870	870	0.000E+00	*	139	139	141	139	1.095E+00	*
35.25.00	*	870	870	870	870	0.000E+00	*	142	145	153	153	4.658E+00	*
35.26.25	*	870	870	870	870	0.000E+00	*	164	172	176	176	5.495E+00	*
35.27.50	*	870	870	870	870	0.000E+00	*	176	176	176	176	0.000E+00	*
35.28.75	*	870	870	870	870	0.000E+00	*	176	176	176	176	0.000E+00	*
35.30.00	*	870	870	870	870	0.000E+00	*	176	176	176	176	0.000E+00	*
35.31.25	*	870	870	870	870	0.000E+00	*	176	176	176	176	0.000E+00	*
35.32.50	*	870	870	870	870	0.000E+00	*	176	176	176	176	0.000E+00	*
35.33.75	*	870	870	870	870	0.000E+00	*	176	176	176	176	0.000E+00	*
35.35.00	*	870	870	870	870	0.000E+00	*	176	176	176	176	0.000E+00	*
35.36.25	*	870	870	870	870	0.000E+00	*	176	176	176	176	0.000E+00	*
35.37.50	*	870	870	870	870	0.000E+00	*	176	176	176	176	0.000E+00	*
35.38.75	*	870	870	870	870	0.000E+00	*	176	176	176	176	0.000E+00	*
35.40.00	*	870	870	870	870	0.000E+00	*	176	176	176	176	0.000E+00	*
35.41.25	*	870	870	870	870	0.000E+00	*	176	176	176	176	0.000E+00	*
35.42.50	*	870	870	870	870	0.000E+00	*	176	176	176	176	0.000E+00	*
35.43.75	*	870	870	870	870	0.000E+00	*	176	176	176	176	0.000E+00	*
35.45.00	*	870	870	870	870	0.000E+00	*	176	176	176	176	0.000E+00	*
35.46.25	*	870	870	870	870	0.000E+00	*	176	176	176	176	0.000E+00	*
35.47.50	*	870	870	870	870	0.000E+00	*	176	176	176	176	0.000E+00	*
35.48.75	*	870	870	870	870	0.000E+00	*	171	172	176	171	2.236E+00	*
35.50.00	*	870	870	870	870	0.000E+00	*	166	169	171	166	2.739E+00	*
35.51.25	*	870	870	870	870	0.000E+00	*	149	155	161	149	6.110E+00	*
MAXIMUM	*	870	870	870	870		*	176	176	176	176		*
MINIMUM	*	870	870	870	870		*	121	126	129	127		*
AVERAGE	*	870	870	870	870		*	155	156	157	156		*

```
                                         T R A C E   A C T I V I T Y
                                                                                                            PAGE   2
            OS/VS2                    SYSTEM ID H155                DATE  1/05/76              INTERVAL 01.57.655
            RELEASE 03.7              RPT VERSION 02                TIME  11.27.06             CYCLE 0.250 SECONDS

        SECONDS/SET=   1.25   CYCLES/SAMPLE=  1        NUMBER OF SAMPLES=   390     SAMPLES/SET=   5     NUMBER OF SETS=  78
```

TIME MM.SS.TT	*	RMCAXSSC MINIMUM	*	CCVRBSTD MAXIMUM	*	PVTPOOL STD. DEV.	*	CCVEJST END	*	MINIMUM	AVERAGE	CCVIMBBT MAXIMUM	END STD. DEV.	*	CCVAPGCT MINIMUM	*
28.09.75	*	0	*	2716986	*	0.000E+00	*	2940558	*	2717649	2717936	2718368	2718368 3.938E+02	*	0	*
28.11.00	*	0	*	2719063	*	0.000E+00	*	2940558	*	2718368	2719077	2719831	2719831 5.176E+02	*	0	*
28.12.25	*	0	*	2720528	*	0.000E+00	*	2940558	*	2719831	2720385	2721207	2721207 5.767E+02	*	0	*
28.13.50	*	0	*	2723400	*	0.000E+00	*	2986166	*	2721207	2721207	2721207	2721207 0.000E+00	*	0	*
28.14.75	*	0	*	2724932	*	0.000E+00	*	2986208	*	2721207	2724327	2725632	2725632 1.770E+03	*	0	*
28.16.00	*	0	*	2726388	*	0.000E+00	*	2986208	*	2725632	2726085	2726388	2726388 4.141E+02	*	0	*
28.17.25	*	0	*	2728250	*	0.000E+00	*	2986208	*	2727115	2728162	2728945	2728945 6.581E+02	*	0	*
28.18.50	*	0	*	2729644	*	0.000E+00	*	2986208	*	2728945	2729364	2729644	2729644 3.829E+02	*	0	*
28.19.75	*	0	*	2731034	*	0.000E+00	*	2986208	*	2730339	2730617	2731034	2731034 3.807E+02	*	0	*
28.21.00	*	0	*	2731034	*	0.000E+00	*	2986208	*	2731034	2731735	2732422	2732422 4.908E+02	*	0	*
28.22.25	*	0	*	2733135	*	0.000E+00	*	2986208	*	2732422	2733128	2733813	2733813 4.919E+02	*	0	*
28.23.50	*	0	*	2734589	*	0.000E+00	*	2986208	*	2733813	2734585	2735347	2735347 5.424E+02	*	0	*
28.24.75	*	0	*	2736046	*	0.000E+00	*	2986208	*	2735347	2735766	2736046	2736046 3.829E+02	*	0	*
28.26.00	*	0	*	2737444	*	0.000E+00	*	2986208	*	2736745	2737024	2737444	2737444 3.829E+02	*	0	*
28.27.25	*	0	*	2737444	*	0.000E+00	*	2986208	*	2737444	2738144	2738320	2738320 3.918E+02	*	0	*
28.28.50	*	0	*	2739273	*	0.000E+00	*	2986208	*	2739273	2739553	2739975	2739975 3.845E+02	*	0	*
28.29.75	*	0	*	2740671	*	0.000E+00	*	2986208	*	2739975	2740672	2741376	2741376 4.953E+02	*	0	*
28.31.00	*	0	*	2742078	*	0.000E+00	*	2986208	*	2741376	2741797	2742078	2742078 3.845E+02	*	0	*
28.32.25	*	0	*	2742078	*	0.000E+00	*	2986208	*	2742777	2743050	2743460	2743460 3.741E+02	*	0	*
28.33.50	*	0	*	2744186	*	0.000E+00	*	2986208	*	2743460	2744360	2744986	2744986 6.431E+02	*	0	*
28.34.75	*	0	*	2745811	*	0.000E+00	*	2986208	*	2744986	2745793	2746547	2746547 5.524E+02	*	0	*
28.36.00	*	0	*	2747257	*	0.000E+00	*	2986208	*	2746257	2747110	2747944	2747944 5.858E+02	*	0	*
28.37.25	*	0	*	2747257	*	0.000E+00	*	2986208	*	2747944	2748361	2748640	2748640 3.812E+02	*	0	*
28.38.50	*	0	*	2749350	*	0.000E+00	*	2986208	*	2749350	2749639	2750073	2750073 3.960E+02	*	0	*
28.39.75	*	0	*	2750775	*	0.000E+00	*	2986208	*	2750073	2750773	2751471	2751471 4.943E+02	*	0	*
28.41.00	*	0	*	2752170	*	0.000E+00	*	2986208	*	2751471	2751890	2752170	2752170 3.829E+02	*	0	*
28.42.25	*	0	*	2753637	*	0.000E+00	*	2986208	*	2752866	2753328	2753637	2753637 4.223E+02	*	0	*
28.43.50	*	0	*	2755122	*	0.000E+00	*	2986208	*	2754447	2754582	2755122	2755122 3.019E+02	*	0	*
MAXIMUM	*	0	*	2755122	*		*	2986208	*	2754447	2754582	2755122	2755122		*	0	*
MINIMUM	*	0	*	2641589	*		*	742501	*	2638187	2638187	2638187	2638187		*	0	*
AVERAGE	*	0	*	2701098	*		*	2581426	*	2699315	2699905	2700607	2700607		*	0	*

OS/VS2 MVS Resource Measurement
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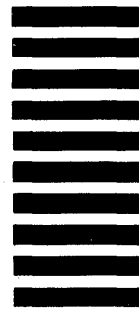
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