#SHAREorg

SHARE
Technology · Connections · Results

Analyzing/Measuring/Monitoring Memory Usage & Understanding z/OS Memory Management : Performance View

Z. Meral Temel
Garanti Technology

13 March 2012
10592

Agenda

Introduction – AS Virtual /Real Memory Map – CEC Memory Locations

Improvements In RSM/VSM/ASM Through z/OS v1R8 To Today

RSM/VSM/ASM Algorithms

UIC Calculation,Page Stealing,Logical Swapping

Types Of Memory Resources – Advantages /Disadvantages

- In Memory Areas
- DataSpace
- HiperSpace
- Memory Objects

CICS & DB2 Virtual/Real Memory Map & Usage

DFSORT & DB2 Utilities Memory Resource Usage Hints & Tips

RMF Panels & SMF Records Used & Meanings

Agenda

Memory Resource Related SMF113 Records - TLBs and Others

Important Changes And Analyzing Their Effects

- All Jobs Default Region Size Increase 32 MB To 64 MB
- LPAR Memory Capacity Increase Effect
- Finding Bottlenecks

List Of Important APARs

HW & SW Configuration Options Used

Who is GT ?

GARANTİ TECHNOLOGY

SHARE

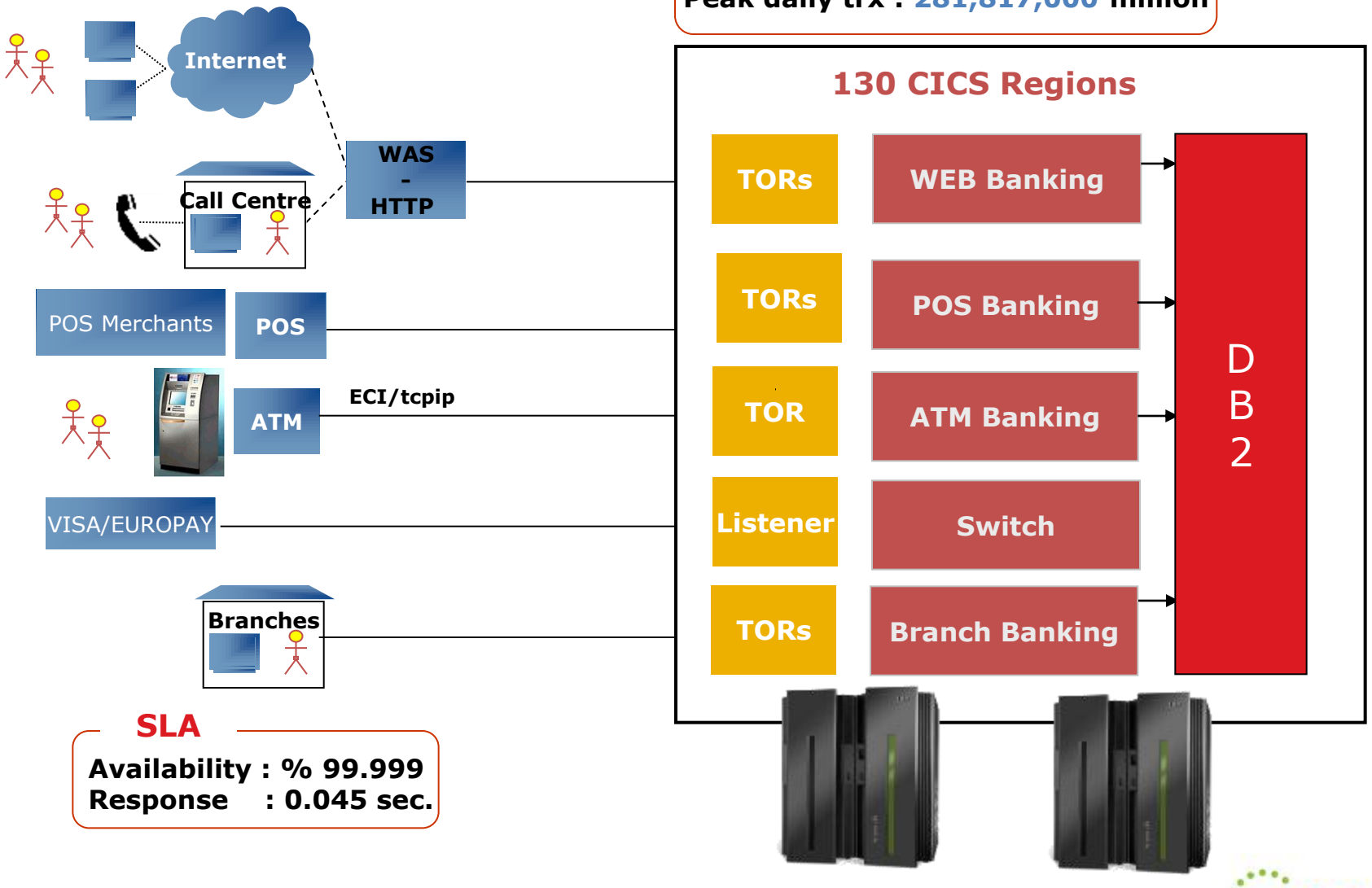
- A wholly-owned subsidiary of Garanti Bank, the second largest private bank in Turkey owned by Doğuş Group and BBVA.
- One of the largest private internal IT service providers in Turkey
- Most up-to-date IT infrastructure
- Tightly integrated and fully in-house developed, custom-fit IT solutions
- Uninterrupted transaction capability and infrastructure security
- Well-reputed as a company of “firsts”
- Visionary and continuous investment in technology since 90’s

Garanti

- Fast decision making and strong communication from top to down
- Centralized management reporting systems, enable management to take timely actions
- Advanced CRM applications
- Paperless banking

GT- CICS Configuration –TORs & AORs

Average daily trx : 205 million
Peak daily trx : 281,817,000 million



SLA

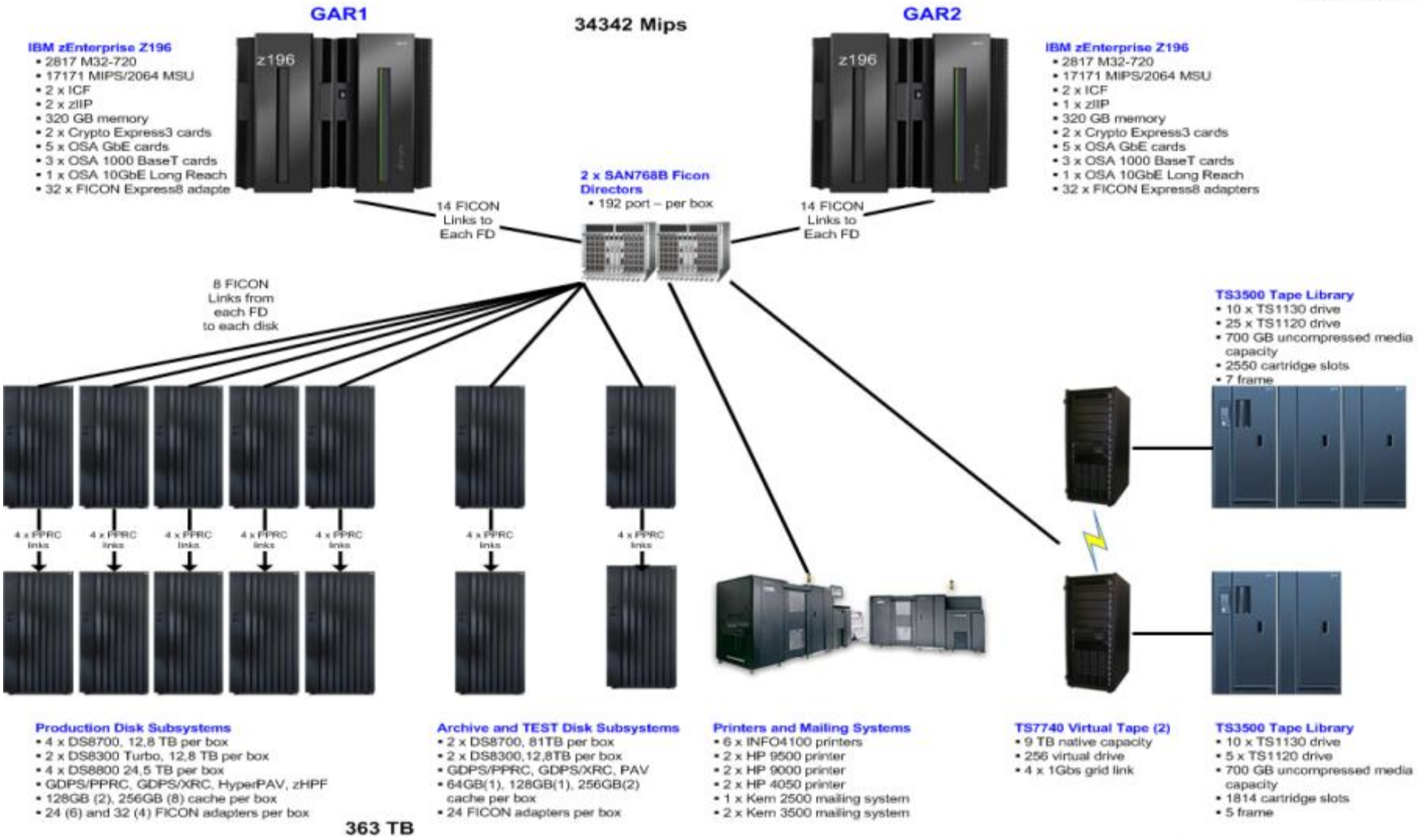
Availability : % 99.999
Response : 0.045 sec.

Our Customers

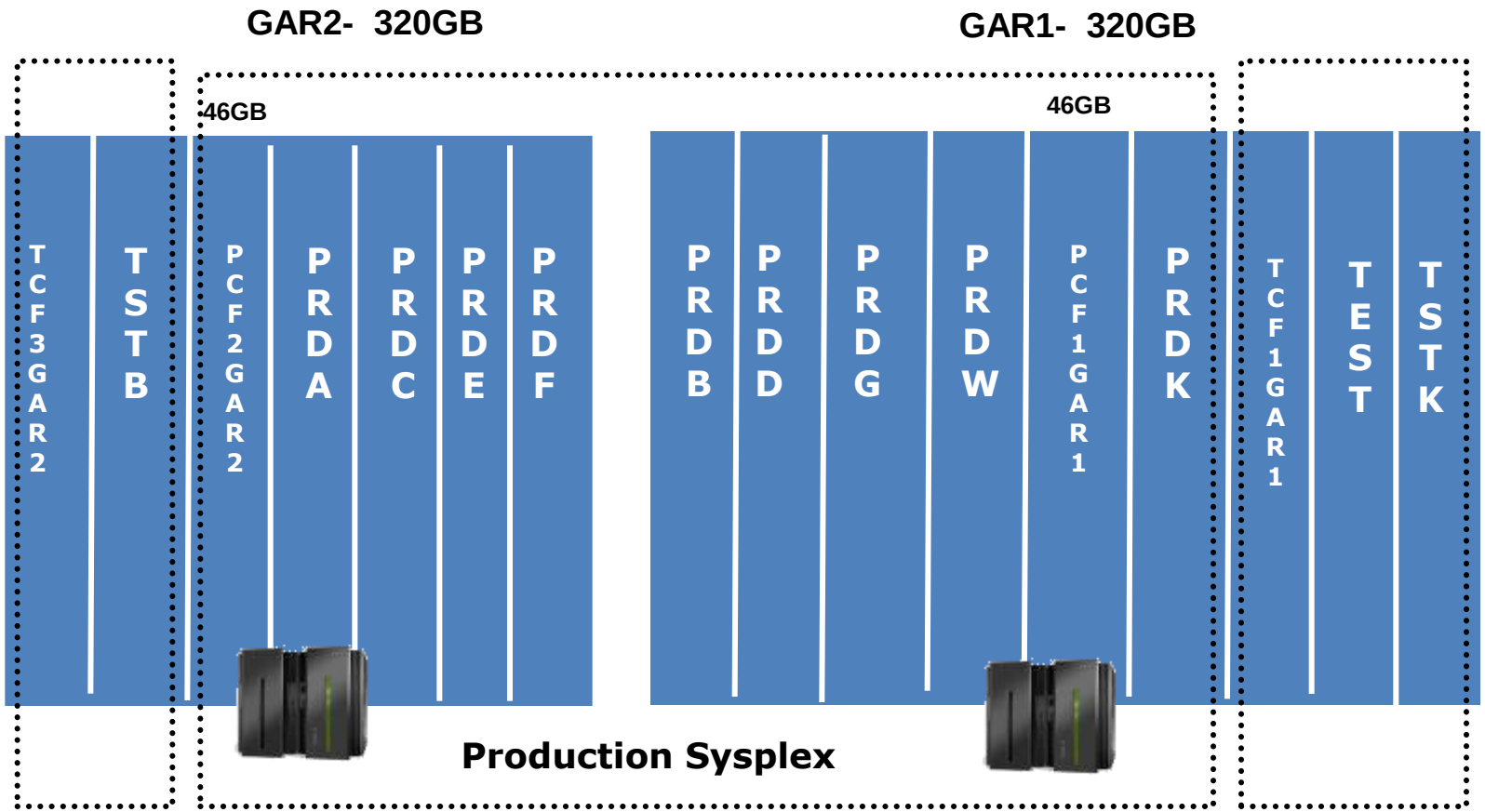
GT Is A Member Of …

- SHARE
- CMG
- GDPS Design Council
- zBLC

GT-Mainframe Configuration

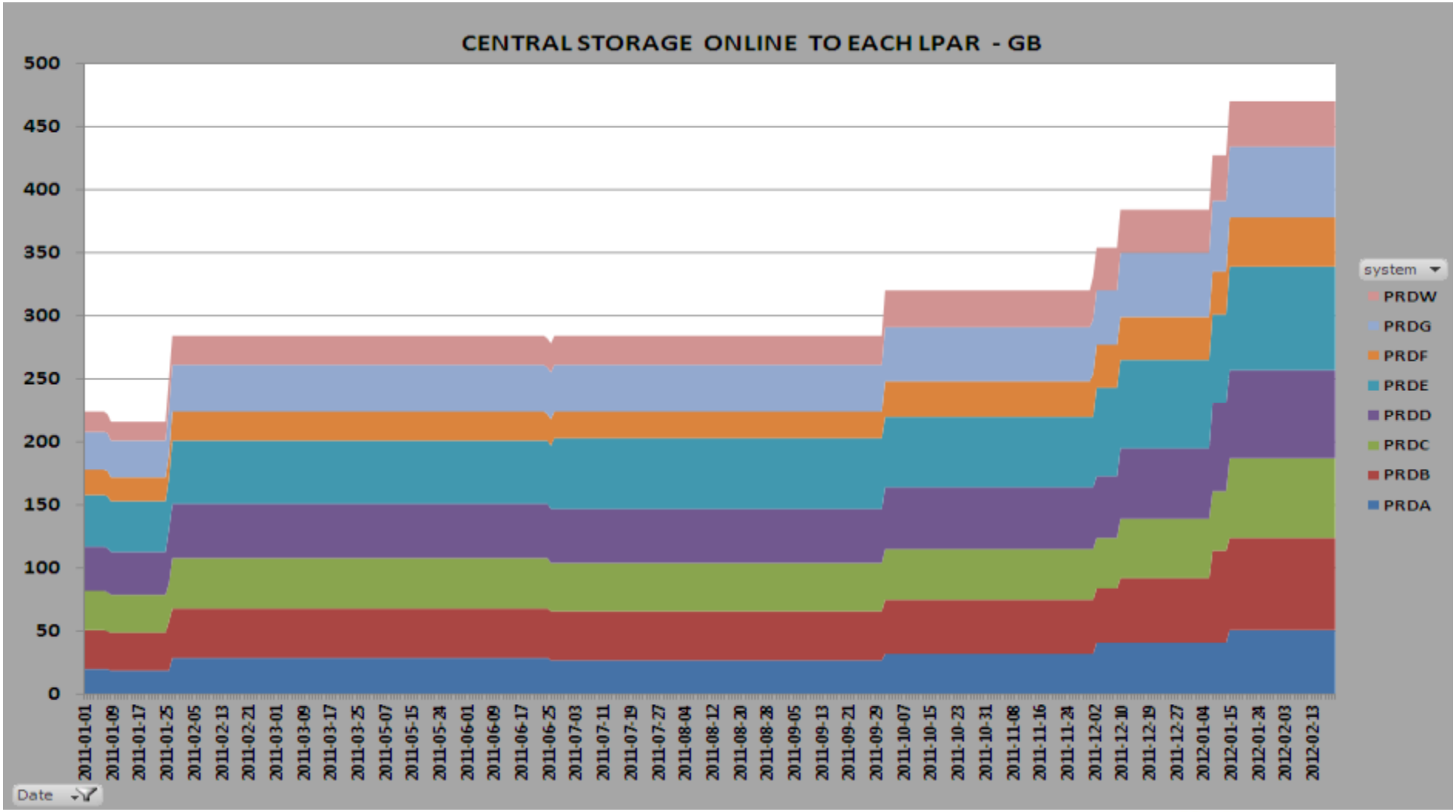


GT Parallel Sysplex Configuration - LPARS

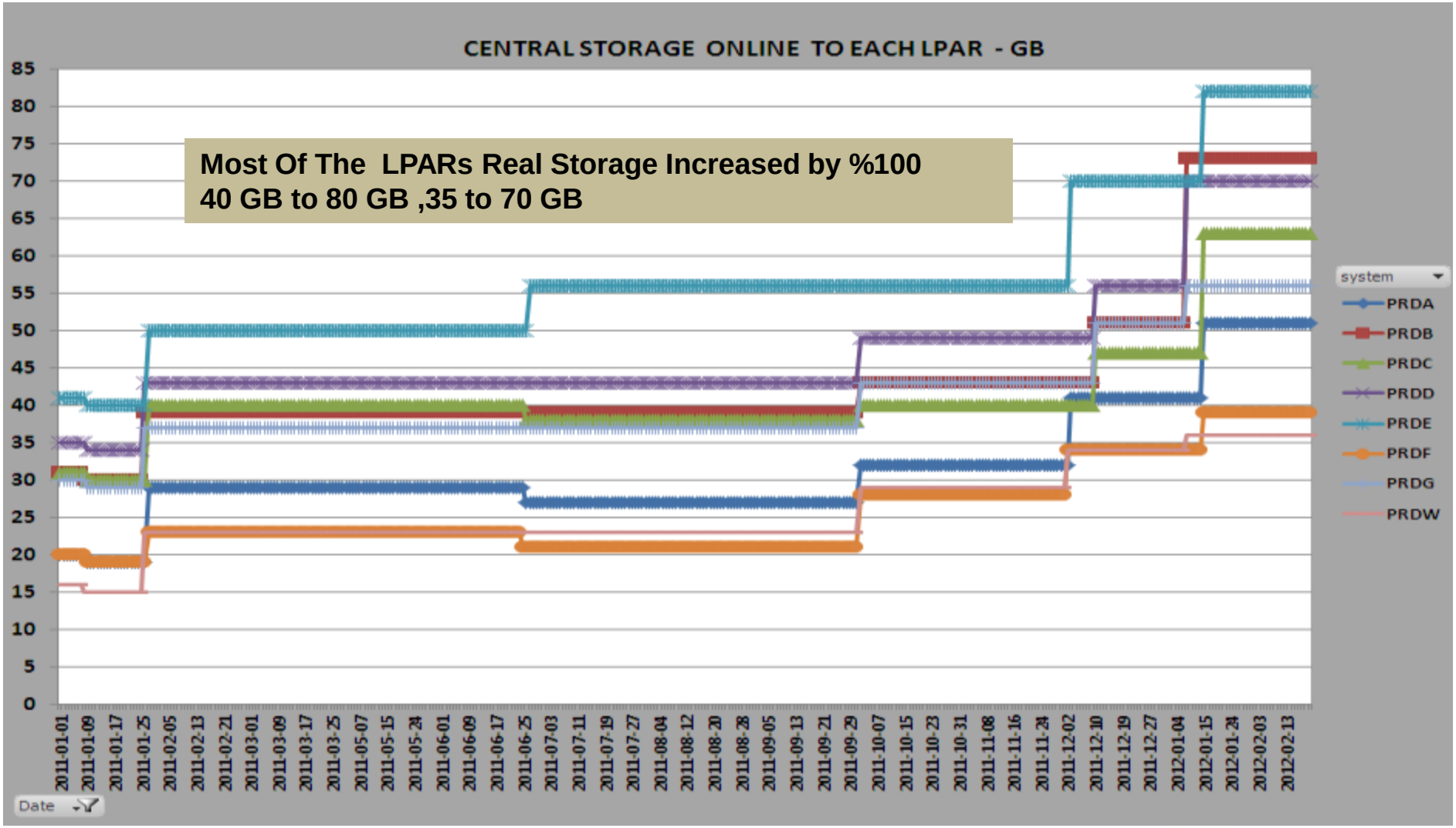


z/OS 1.12
DB2 V9
CICS TS 3.2

GT-Memory Upgrades



GT-Memory Upgrades



Book Configuration – GAR1 CEC

- 192 + 192 = 384 GB Memory Physically Installed
- 336 GB Enabled - 16 GB HSA - 320 GB Customer Usage

```
ERM config   CPU=20 SAP=6 ICF=2 IFL=0 ZAAP=0 zIIP=2 SP=10 UKNW=0 OP=30 XSTP=0 z196 ZHE 2817
Node Number(Phy)      01  01  ____ 01  01  01  01  01  ____ 01  01  01  01  ____ 01  01  01  01  01  01  ____ 01  01  01
Core Number           00  00  ____ 00  01  01  01  01  ____ 02  02  02  03  ____ 03  03  04  04  04  04  ____ 05  05  05
IPU  Number           1E  13  ____ 15  0D  00  06  04  ____ 07  08  09  03  ____ 0B  0C  01  0E  0F  10  ____ 02  12  2F
Physical PU Number    100 101 ____ 103 104 105 106 107 ____ 109 10A 10B 10C ____ 10E 10F 110 111 112 113 ____ 115 116 117
        PU Number     00  13  ____ 15  0D  00  06  04  ____ 07  08  09  03  ____ 0B  01  01  0E  0F  02  ____ 02  12  00
Opertional Mode CPU   ____ 13 ____ 15  0D  00  06  04  ____ 07  08  09  03  ____ 0B  ____ 01  0E  0F  ____ ____ 02  12  ____
                 ICF  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
                 SAP  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
                MSAP  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ 01  ____ ____ ____ 02  ____ ____ ____
                XSAP  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ 00
                 IFL  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
                zAAP  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
                zIIP  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
              Spare   00 ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
    Unknown PU Type   ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
Dedicate              ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
Opertional            ____ Y  ____ Y  Y  Y  Y  Y  ____ Y  Y  Y  Y  ____ Y  Y  Y  Y  Y  Y  ____ Y  Y  Y
Clock Stopped         ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____

Node Number(Phy)      ____ 03  03  03  03  03  03  03  03  03  03  ____ 03  ____ 03  03  03  03  03  03  ____ 03  03  03
Core Number           ____ 00  00  00  01  01  01  01  02  02  02  ____ 03  ____ 03  03  04  04  04  04  ____ 05  05  05
IPU  Number           ____ 18  19  22  24  16  17  21  1B  20  25  ____ 11  ____ 1C  1F  1D  1A  14  23  ____ 05  0A  26
Physical PU Number    ____ 301 302 303 304 305 306 307 308 309 30A ____ 30C ____ 30E 30F 310 311 312 313 ____ 315 316 317
        PU Number     ____ 18  19  00  00  16  17  00  00  00  00  ____ 11  ____ 00  03  00  00  14  04  ____ 05  0A  05
Opertional Mode CPU   ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ 11  ____ ____ ____ ____ ____ 14  ____ ____ 05  0A  ____
                 ICF  ____ ____ ____ ____ ____ 16  17  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
                 SAP  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ 04  ____ ____ ____ 05
                MSAP  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ 03  ____ ____ ____ ____ ____ ____ ____ ____
                XSAP  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
                 IFL  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
                zAAP  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
                zIIP  ____ 18  19  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
              Spare   ____ ____ ____ 00  00  ____ ____ 00  00  00  00  ____ ____ ____ 00  ____ 00  00  ____ ____ ____ ____ ____ ____
    Unknown PU Type   ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
Dedicate              ____ ____ ____ ____ ____ Y  Y  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
Opertional            ____ Y  Y  ____ ____ Y  Y  ____ ____ ____ ____ ____ Y  ____ ____ Y  ____ ____ Y  Y  ____ Y  Y  Y
Clock Stopped         ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
```

192 GB Memory Physical

192 GB Memory Physical

```
Number of CPU  = 20
Number of SAP  = 6
        XSAP   = Node Number=01 Physical PU Number=117
Number of CF   = 2
Number of IFL  = 0
Number of zAAP = 0
Number of zIIP = 2
Number of Spare = 10
```

Book Configuration – GAR2 CEC

- 192 + 192 = 384 GB Memory Physically Installed
- 336 GB Enabled - 16 GB HSA - 320 GB Customer Usage

```
ERM config   CPU=20 SAP=6 ICF=2 IFL=0 zAAP=0 zIIP=2 SP=10 UKNW=0 OP=30 XSTP=0 z196 zHE 2817
Node Number(Phy)     01  01  ____ 01  01  01  01  01  ____ 01  01  01  01  ____ 01  01  01  01  01  01  ____ 01  01  01
Core Number          00  00  ____ 00  01  01  01  01  ____ 02  02  02  03  ____ 03  03  04  04  04  04  ____ 05  05  05
IPU  Number          1E  13  ____ 15  0D  00  06  04  ____ 07  08  09  03  ____ 0B  0C  01  0E  0F  10  ____ 02  12  2F
Physical PU Number   100 101 ____ 103 104 105 106 107 ____ 109 10A 10B 10C ____ 10E 10F 110 111 112 113 ____ 115 116 117
        PU Number    00  13  ____ 15  0D  00  06  04  ____ 07  08  09  03  ____ 0B  01  01  0E  0F  02  ____ 02  12  00
Opertional Mode CPU  ____ 13  ____ 15  0D  00  06  04  ____ 07  08  09  03  ____ 0B  ____ 01  0E  0F  ____ ____ 02  12  ____
                ICF  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
                SAP  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
               MSAP  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ 01   ____ ____ ____ 02   ____ ____ ____
               XSAP  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ 00
                IFL  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
               zAAP  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
               zIIP  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
              Spare  00   ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
    Unknown PU Type  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
Dedicate             ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
Opertional           ____ Y   ____ Y   Y   Y   Y   Y   ____ Y   Y   Y   Y   ____ Y   Y   Y   Y   Y   Y   ____ Y   Y   Y
Clock Stopped        ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____

Node Number(Phy)     ____ 03  03  03  03  03  03  03  03  03  03  ____ 03  ____ 03  03  03  03  03  03  ____ 03  03  03
Core Number          ____ 00  00  00  01  01  01  01  02  02  02  ____ 03  ____ 03  03  04  04  04  04  ____ 05  05  05
IPU  Number          ____ 18  19  22  24  16  17  21  1B  20  25  ____ 11  ____ 1C  1F  1D  1A  14  23  ____ 05  0A  26
Physical PU Number   ____ 301 302 303 304 305 306 307 308 309 30A ____ 30C ____ 30E 30F 310 311 312 313 ____ 315 316 317
        PU Number    ____ 18  19  00  00  16  17  00  00  00  00  ____ 11  ____ 00  03  00  00  14  04  ____ 05  0A  05
Opertional Mode CPU  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ 11  ____ ____ ____ ____ ____ 14  ____ ____ 05  0A  ____
                ICF  ____ ____ ____ ____ ____ 16  17  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
                SAP  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ 04   ____ ____ ____ 05
               MSAP  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ 03   ____ ____ ____ ____ ____ ____ ____ ____
               XSAP  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
                IFL  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
               zAAP  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
               zIIP  ____ 18  19  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
              Spare  ____ ____ ____ 00  00  ____ ____ 00  00  00  00  ____ ____ ____ 00  ____ 00  00  ____ ____ ____ ____ ____
    Unknown PU Type  ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
Dedicate             ____ ____ ____ ____ ____ Y   Y   ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
Opertional           ____ Y   Y   ____ ____ Y   Y   ____ ____ ____ ____ ____ Y   ____ ____ Y   ____ ____ ____ Y   Y   ____ Y   Y   Y
Clock Stopped        ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
```

192 GB Memory Physical

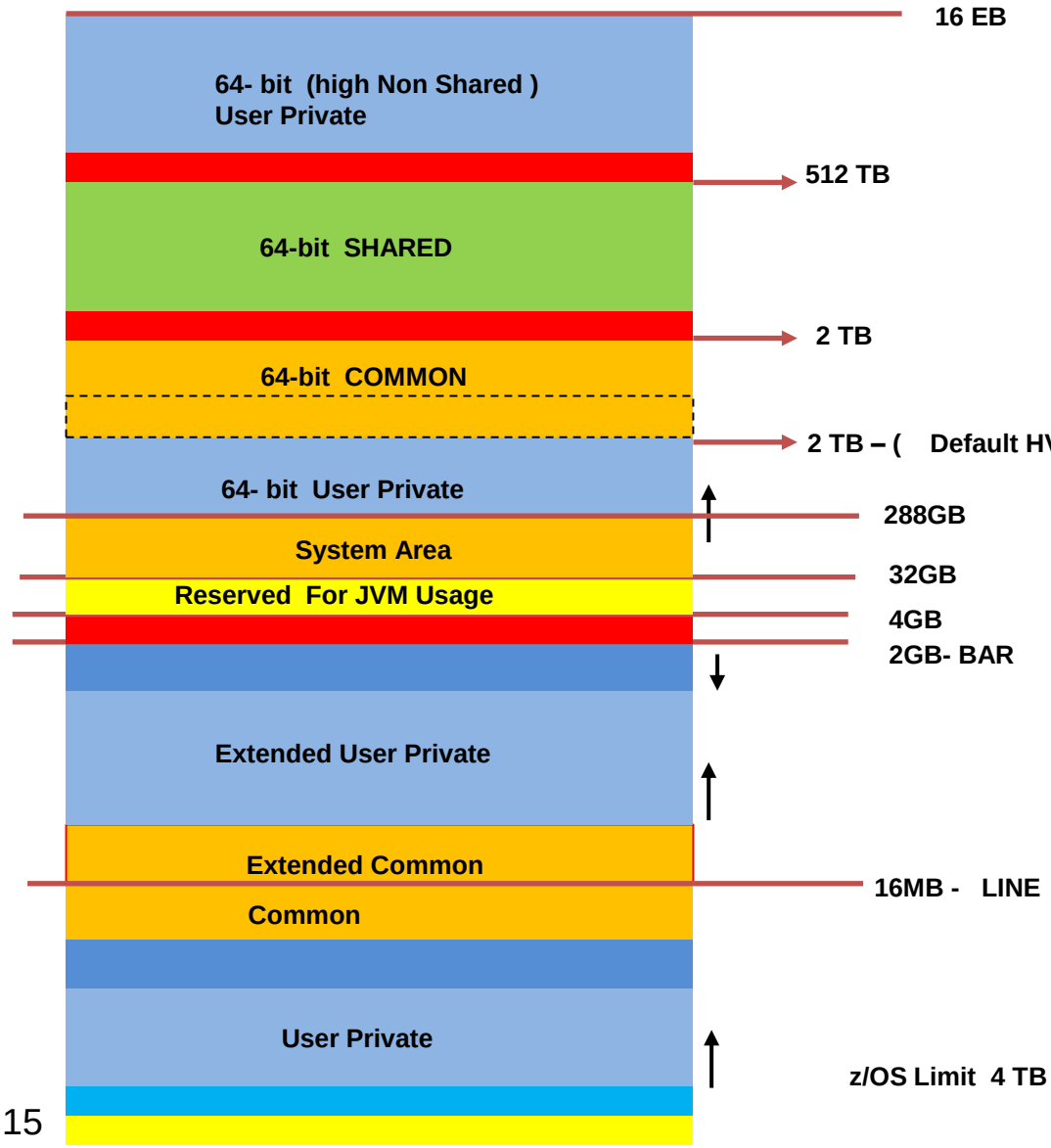
192 GB Memory Physical

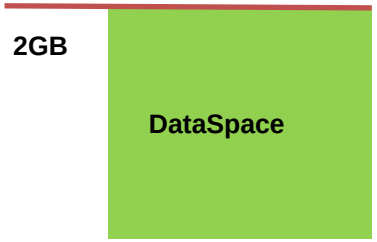
```
Number of CPU  = 20
Number of SAP  = 6
      XSAP  = Node Number=01 Physical PU Number=117
Number of CF   = 2
Number of IFL  = 0
Number of zAAP = 0
Number of zIIP = 2
Number of Spare = 10
```

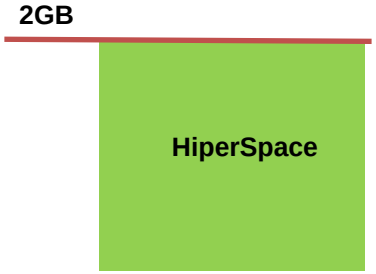
Memory Upgrade

- Batch Jobs That Use DFSORT Improved
- Batch Jobs That Use DB2 Utilities Improved
- More CICSes, Product Address Spaces…
- DB2 Local/Group Buffer Pool Size Increased
- System Paging Effect- Page Stealing Removed
- Real Storage Space For Dumps

Address Space Virtual/ Real Memory MAP







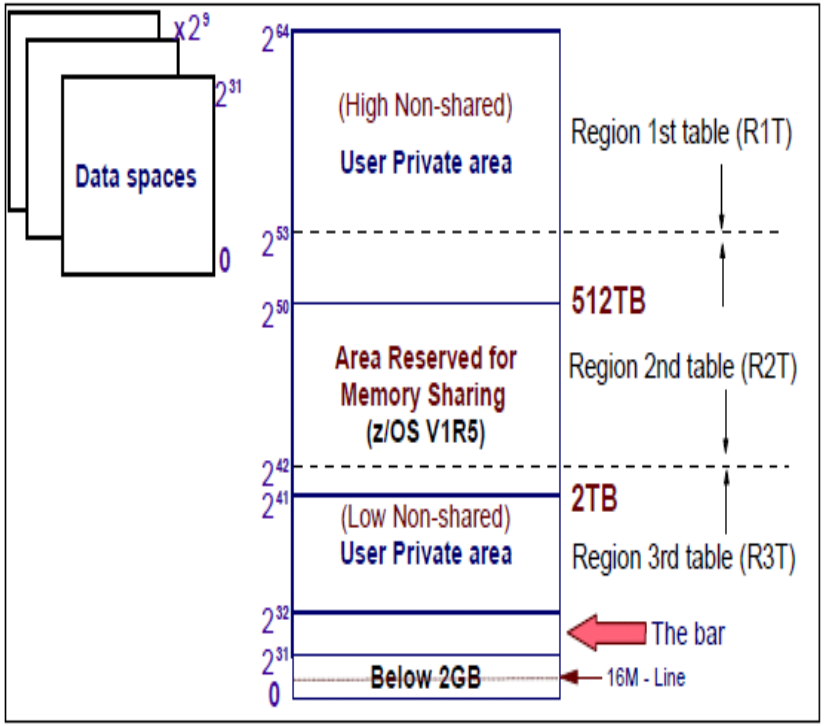
Virtual Storage Outside Address Space

Different Types Of Memory Related Resources

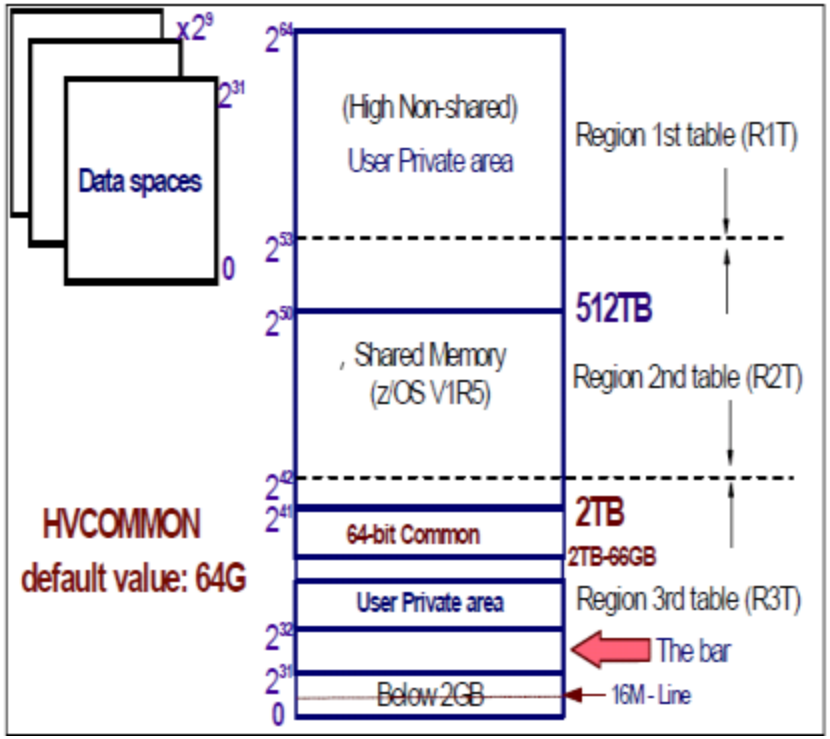
MAIN STORAGE	DATASPACE	HIPERSPACE	MEMORY OBJECT
• AS Virtual Storage • Contain Both Program &Data • 31-Bit Addressing • Byte Addressable Up To 2 GB • Defined In Code Or GETMAINed	• Is NOT in AS Virtual Storage • Contain Only Data • 31-Bit Addressing • Byte Addressable Up To 2 GB • Obtained via DSPSERV Macro	• Is NOT in AS Virtual Storage • Contain Only Data • 31-Bit Addressing • Not Byte Addressable • Maximum Size 2 GB • (DFSORT can create upto 16 HS) • Obtained via DSPSERV Macro	• AS Virtual Storage • Contain Only Data • 64-Bit Addressing • Byte Addressable • Created via IARV64 Macro

64-Bit Common Storage Implemented in z/OS V1R10

z/OS V1R9



z/OS V1R10



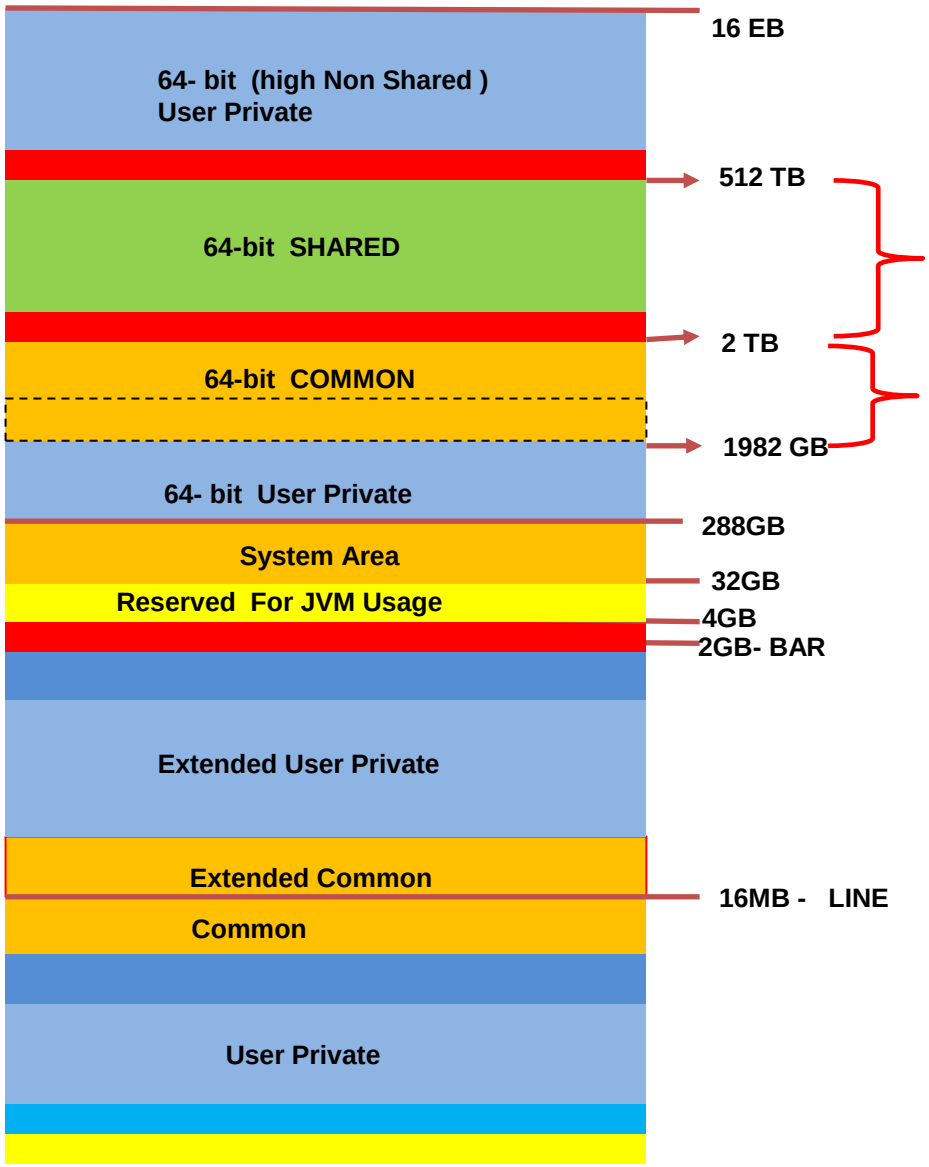
64-Bit Common Storage Implemented in z/OS V1R10

Storage attributes	Private (MVS)	CADS (AASF)	64-bit Shared (z/OS V1R5)	64-bit Common (z/OS V1R10)
Accessed by one space	Natural	Ideal for data isolation	Not best solution	Not best solution
Accessed by a set of spaces	Poorly efficient	Ideal for both RAS and efficiency	Natural if scalability not a problem	Possible but potential of overlays
Accessed by every space	Inappropriate	Ideal for 10's GB with RAS and efficiency	Possible but cumbersome when large scale	Easy for 100's GB but potential RAS exposures.
DREF storage	Yes for 31-bit No for 64-bit	Yes	No	Yes
Fixed storage	Yes	Yes for internal callers	No	Yes
Storage ownership	Task or address space	Task	System - storage must be explicitly freed	System - storage must be explicitly freed

Improvements In RSM/VSM/ASM Through z/OS V1R8 To Today

- z/OS V1R8 Improvements
  - New UIC Calculation
  - New Page Stealing Algorithm
  - Physical Swap Removing
- z/OS V1R9 Improvements
  - 64-bit Support For GRS
  - CPOOL Changes
- z/OS V1R10 Improvements
  - 64-Bit Common Storage
  - Large Page Support
  - SDUMP dump prioriterization for memory objects
  - VSM Getmain Changes
  - Criticalpaging With APAR
- z/OS V1R11 Improvements
- z/OS V1R12 Improvements
  - 64-Bit SHARED Memory For z/OS UNIX and 64-Bit System Area
  - Large Page Support To Back The Nucleus
  - Large Page Coalesce Support
  - SDUMP Improvements
  - RMF cpools to 64 bit
- z/OS V1R13 Improvements
  - CTRACE
  - SSRB move to 64-bit
  - Communication Server CTrace move to 64-bit:

64-Bit Common And Shared Exploiters In Our Environment -1



- DB2 DBM1,MSTR,DIST Address Spaces
- DB2 Utillity Programs/Jobs
- HZSPROC-HealthChecker AS
- TCPIPROC

- Master AS
- RMF
- TCPIPROC
- JESAUX
- PFA
- Some CICSes

WHERE TO LOOK ?

- RMF Monitor III STORM Panel
- SMF71

64-Bit Common And Shared Exploiters In Our Environment -2

RMF Monitor III STORM Panel

HARDCOPY RMF V1R12 Storage Memory Objects Line 1 of 37

Samples: 100 System: PRDA Date: 03/07/12 Time: 13.31.40 Range: 100 Sec

System Summary

-- Memory Objects --			--------- Frames ----------				--- Area Used % ----		
Common	Shared	Large	Common	Fixed	Shared	1 MB	Common	Shared	1 MB
29	5	0	5085	2696	26833	0	0.0	0.0	0.0

Jobname	C	Service Class	ASID	---- Memory Objects --- Total	Comm	Shr	Large	Frames 1 MB	----- Bytes ----- Total	Comm	Shr
PDA2DBM1	S	SYSSTC	0125	590	0	4	0	0	240G	0	214G
CSFPRDA	S	SYSSTC	0108	257	0	0	0	0	2303M	0	0
SMSPDSE1	S	SYSTEM	0009	35	0	0	0	0	414M	0	0
PTXM150	S	SYSSTC	0206	20	0	0	0	0	78.0M	0	0
PDA2IRLM	S	SYSSTC	0117	18	0	0	0	0	29.0M	0	0
TRACE	S	SYSSTC	0004	14	0	0	0	0	14.0M	0	0
GRS	S	SYSTEM	0007	10	0	0	0	0	236G	0	0
SMSPDSE	S	SYSTEM	0008	10	0	0	0	0	74.0M	0	0
SMSVSAM	S	SYSTEM	0010	5	0	0	0	0	18.0M	0	0
RMF	S	SYSSTC	0043	5	5	0	0	0	5120K	5120K	0
RESOLVER	S	SYSSTC	0017	4	0	0	0	0	4096K	0	0
PDA2MSTR	S	SYSSTC	0111	4	0	4	0	0	214G	0	214G
OMVS	S	SYSTEM	0016	3	0	0	0	0	931M	0	0
JES2AUX	S	SYSSTC	0053	3	3	0	0	0	3072K	3072K	0
ADHCPDA2	S	SYSSTC	0102	3	0	3	0	0	86.1G	0	86.1G
HZSPROC	S	SHIGH	0106	3	0	1	0	0	8195M	0	1024K
ENF	S	SYSSTC	0114	3	0	0	0	0	8192K	0	0
ADHMSTR	S	SYSSTC	0142	3	0	3	0	0	86.1G	0	86.1G
MASTER	S	SYSTEM	0001	2	2	0	0	0	2048K	2048K	0
ZFS	S	SYSSTC	0049	2	0	0	0	0	22.0M	0	0
TCPIPROC	S	SYSSTC	0051	2	1	1	0	0	128G	1024K	128G
PFA	S	SHIGH	0118	2	2	0	0	0	6144K	6144K	0
PAT1GARC	S	SCICHIGA	0149	2	1	0	0	0	1025M	1024K	0
PAA2GARC	S	SCICHIGA	0150	2	0	0	0	0	3072M	0	0
PWA6GARC	S	SCICHIGA	0151	2	0	0	0	0	3072M	0	0

MEMLIMIT

- Controls The Amount of Virtual Storage Of An AS Above The Bar
  (In Other Words Total Amount of Virtual Storage That it can allocate using MOs)
- Can Be Set By SMF, In JCL, By IEFUSI
- For Our AS Default is 512 MB and Set By SMF

Question : By Which Method It is SET For An Address Space ?

WHERE TO LOOK ? **SMF30MES field (In MXG SMF30MLS in jobs SAS file)**

Question : What is The Value of this during execution Of a Step For An Address Space ?

WHERE TO LOOK ? **SMF30MEM field (In MXG MEMLIMIT in jobs,steps and similiar SAS file)**

SMF30MES	1	binary	Source of Memlimit, which is one of the following:

Value	Meaning
X'01'	MEMLIMIT set by SMF.
X'02'	MEMLIMIT set explicitly in the JCL with MEMLIMIT parameter on JOB or EXEC statement.
X'03'	MEMLIMIT is unlimited based on REGION=0 specification.
X'04'	MEMLIMIT set by IEFUSI (even if IEFUSI did not change the value).
X'OA'	System provided a default for MEMLIMIT based on REGION=0 specification and a subsequent curtailment of REGION in the IEFUSI exit.

Important APARs

OA38056 ABEND0C4 IAXV2 PIC 4 PROTECTION EXCEPTION
OA37831 ABENDA78 REASON 18 TRYING TO FREE STORAGE APPEARES TO BE FIXED
OA38221 PLPA PAGE OF ZEROES ABEND0C1
OA38128 HIGH PAGING DURING IARV64 PAGEOUT PROCESSING ***

OA38400 ABEND073 RC28 IN LOCK MANAGER CALLED FROM IAXV6 WHILE PROCESSING A PAGE FAULT BY AN SRB

OA38534 ABEND0C4 IN IGVHCHK1 +X'3672' AT HBB7780 WHEN COPYING A LONG IEASYSXX MLPA SPECIFICATION

OA38742 DIFFERENCE IN ASMIORQR / ASMIORQC COUNTS BECOME LARGE ENOUGH TO AFFECT FRAME STEAL PROCESSING AND ASMIORQR INCREMENTED TOO HIGH***

OA38754 IARV64 REQUEST(GETSTOR) WILL CAUSE RSM TO INCREMENT THE RAXLVABYTES COUNT, REGARDLESS OF WHETHER AUTH OR UNAUTH

OA38818 IAXSA ABEND0C4 DATASPACE SEGMENT TABLE IAXUE ABENDC0D RC41000211 FOLLOWING ABEND0C4 IN IAXSA

Resources Used To Analize & Monitor

SMF Records : Type71, Type16,Type74, Type30 - MXG

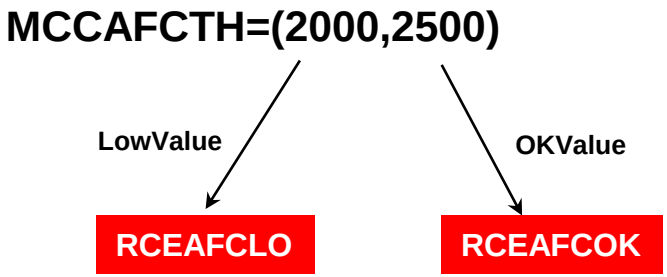
RMF Monitor I Reports

RMF Monitor III Panels
(20 Sec Interval Data Is Being Saved In SQL Database Using RMF DDS Interface)

Cross Checking RMF Report Fields & SMF71,SMF30 Fields

Page Stealing – MCCAFCTH Parameter

- DETERMINES WHEN SRM SHOULD PERFORM PAGE STEALING
- With OA14409, THRESHOLDS ARE NOT STATIC ANYMORE
  SRM started automaticly adjusting these thresholds according to Central Storage Usage
- The idea behind OA14409 was to remove the restriction to have customers change the threshold depending on changes related to Real Storage configuration.
- The System Is Maintaining The Threesholds By Its Own
- Increasing The Thresholds is only recommended when performance problem will be seen.



- INITIAL THRESHOLD VALUES CALCULATED AS

RCEAFCLO = MAX (LowValueDEfinedInMCCAFCTHParameter,400,0.2%OfPageableStorage)

RCEAFCOK = MAX (MaxValueDEfinedInMCCAFCTHParameter,600,0.4%OfPageableStorage)

Page Stealing

IS THERE A WAY TO MONITOR RCEAFCOK THAT SYSTEM IS CHANGING DYNAMICLY?

YES, Using The Following Formula…& SMF71CAM & SMF71MNF SMF Fields….

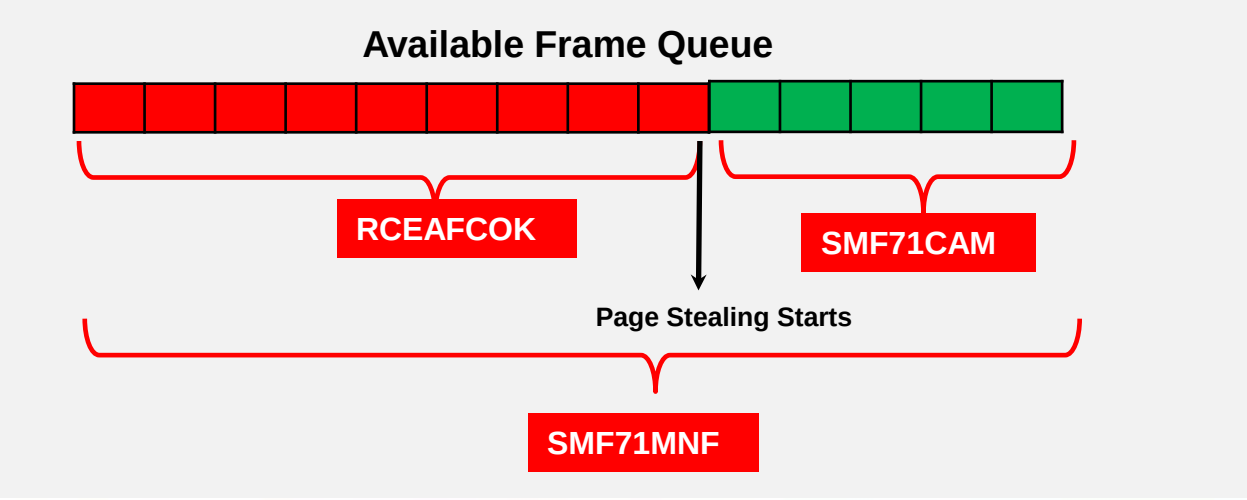
SMF71CAM = MAX(0,RCEAFC - MAX(RCEAFCOK,2048*MCCAFCOK*MCCDEFAM))

RCEAFCOK = SMF71MNF – SMF71CAM

SMF71CAM → Minimum Number Of Available Central Storage Frames
Of Frames That Are In Available Frame Queue,Before System is Brought To RCEAFCOK Threshold

SMF71MNF → Minimum # Of Unused Central Storage Frames
Minimum Value RCEAFC is observed During 15 minute Interval

It Is Recommended To Monitor These Values To Determine If you Have Enough Memory or Need To Add More



Page Stealing

DAILY INTERVAL REPORT OF RCEAFCOK

SQL Server Reporting Services

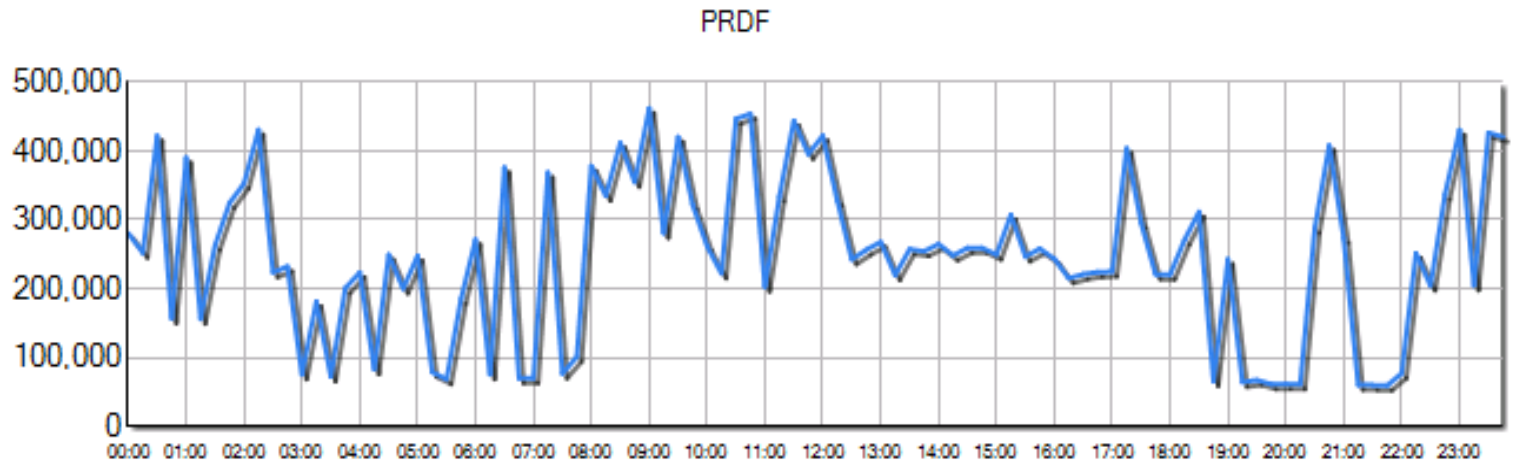
Home > SLM > MAINFRAME > MVS > CPUDQT > Memory >

RCEAFCOKChangeDailyTrend

View | Properties | History | Subscriptions

New Subscription

1 of 1 | 100% | Find | Next | Select a format | Export



Page Stealing

Sample Data, Before Our Memory Upgrade ,When SMF1CAM Became 0 And System Started Page Stealing

SMFTIME	Time	pvtafcmn(MXGnameOfsmf71mnf)	CSFRAVMN(MXGnameOfSMF71CAM)	RCEAFCOK	RCEAFCOK(MB)	smf71mnf(MB)	smf71cam(MB)
2011-09-07	03:15:00.040	503497	1782M	59597	233	2015	1782
2011-09-07	03:30:00.020	417362	1446M	57376	224	1670	1446
2011-09-07	03:45:00.050	200979	601M	52030	203	804	601
2011-09-07	04:00:00.050	64084	66M	48753	190	256	66
2011-09-07	04:15:00.050	46450	0	47584	186	186	0
2011-09-07	04:30:00.020	46442	0	47576	186	186	0
2011-09-07	04:45:00.020	47000	0	48147	188	188	0
2011-09-07	05:00:00.060	548341	1958M	60480	236	2194	1958
2011-09-07	05:15:00.020	654769	2373M	63267	247	2620	2373
2011-09-07	05:30:00.070	702285	2559M	64327	251	2810	2559
2011-09-07	05:45:00.020	1238045	4652M	77359	302	4954	4652
2011-09-07	06:00:00.060	618500	2232M	62208	243	2475	2232
2011-09-07	06:15:00.040	1795898	6831M	91007	355	7186	6831
2011-09-07	06:30:00.020	2226040	8511M	101571	397	8908	8511
2011-09-07	06:45:00.020	657113	2383M	63108	247	2630	2383
2011-09-07	07:00:00.020	655503	2376M	63251	247	2623	2376
2011-09-07	07:15:00.050	2402593	9201M	105794	413	9614	9201
2011-09-07	07:30:00.020	2324533	8896M	103908	406	9302	8896
2011-09-07	07:45:00.020	2311016	8843M	103629	405	9248	8843
2011-09-07	08:00:00.040	663385	2407M	63389	248	2655	2407
2011-09-07	08:15:00.020	641481	2322M	62710	245	2567	2322
2011-09-07	08:30:00.020	633845	2292M	62568	244	2536	2292
2011-09-07	08:45:00.020	588309	2114M	61488	240	2354	2114

RMF Monitor I

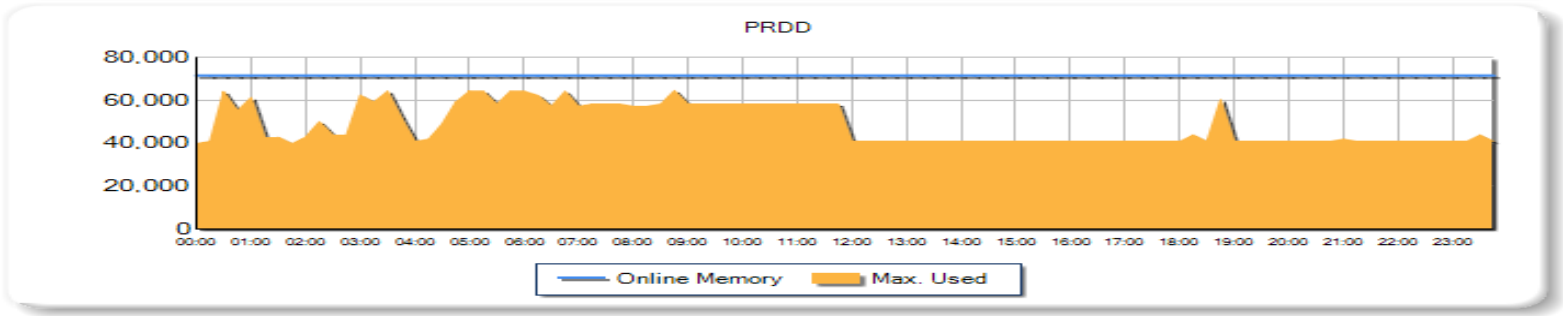
SMF71MNF . It is minimum value of RCEAFC & It can NOT be negative (IBM will change the explanation in RMF Book)

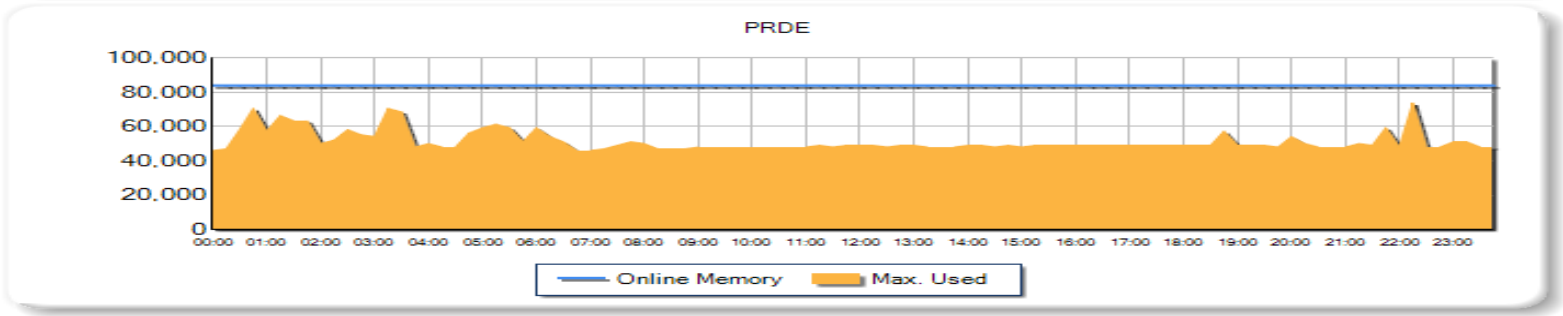
```
          z/OS V1R12                SYSTEM ID PRDA              START 03/06/2012-00.00.00  INTERVAL 000.14.59
                                    RPT VERSION V1R12 RMF       END   03/06/2012-00.15.00  CYCLE 1.000 SECONDS
OPT = IEAOPTPP    MODE = ESAME                CENTRAL STORAGE MOVEMENT RATES - IN PAGES PER SECOND
-------------------------------------------------------------------------------------------------------------------------------
   HIGH UIC (AVG) = 65535    (MAX) = 65535  (MIN) = 65535
                      WRITTEN TO        READ FROM        *--- CENTRAL STORAGE FRAME COUNTS ----*
                    CENTRAL STOR      CENTRAL STOR            MIN           MAX           AVG
   HIPERSPACE    RT          0.00              0.06              7        46,884         1,107
   PAGES
   VIO           RT          0.00              0.00              0             0             0
   PAGES
                                                  FRAME AND SLOT COUNTS
-------------------------------------------------------------------------------------------------------------------------------
                        CENTRAL STORAGE                                      LOCAL PAGE DATA SET SLOT COUNTS
                    ---------------------------                          ---------------------------------------------
                          MIN         MAX         AVG                                    MIN         MAX         AVG
   (90 SAMPLES)
   AVAILABLE          8050908     8114797     8093382   AVAILABLE SLOTS  5,399,719   5,399,722   5,399,722
   SQA                 18,767      18,845      18,800   VIO SLOTS              204         207         205
   LPA                  7,383       7,383       7,383
   CSA                 31,485      31,750      31,676   NON-VIO SLOTS           68          68          68
  LSQA                145,103     145,955     145,606
  REGIONS+SWA        5291988     5355687     5313229   BAD SLOTS                0           0           0
  TOTAL FRAMES      13631484    13631484    13631484   TOTAL SLOTS      5,399,994   5,399,994   5,399,994
                        FIXED FRAMES                                 SHARED FRAMES AND SLOTS
                    ---------------------------                      ---------------------------------------------
  NUCLEUS              2,722       2,722       2,722   CENTRAL STORAGE      8,749       8,869       8,789
  SQA                 17,369      17,447      17,402
  LPA                     87          87          87   FIXED TOTAL            215         256         216
  CSA                  4,730       4,730       4,730   FIXED BELOW 16 M         0           0           0
  LSQA                35,663      36,262      36,023   AUXILIARY SLOTS          0           0           0
  REGIONS+SWA       2224137     2226746     2226008   TOTAL                16,251      16,371      16,291
  BELOW 16 MEG           90          94          90
  BETWEEN 16M-2G      37,944      39,985      39,297                MEMORY OBJECTS AND FRAMES
  TOTAL FRAMES      2284925     2287932     2286972                ---------------------------------------------
                                                                   OBJECTS COMMON          29          29          29
                    STORAGE REQUEST RATES                           SHARED                 5           5           5
                    ---------------------------                     LARGE                  0           0           0
  GETMAIN REQ          8,213                                     FRAMES COMMON       5,085       5,085       5,085
   FRAMES BACKED       3,365                                      COMMON FIXED        2,696       2,696       2,696
  FIX REQ < 2 GB         136                                      SHARED             11,560      11,752      11,572
   FRAMES < 2 GB       7,740                                      1 MB                   0           0           0
  REF FAULTS 1ST       6,543
   NON-1ST                13
```

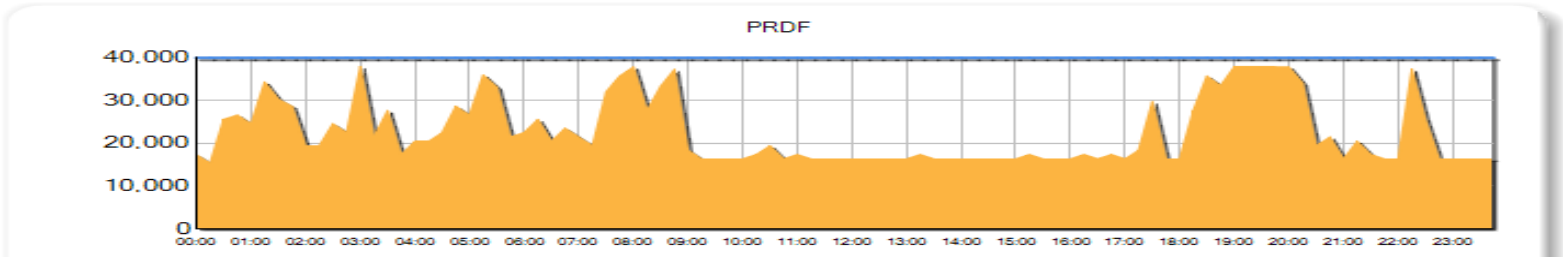
Daily Reports -Maximum Real Memory Used

Online Memory (SMF71TFC+SMF71FIN) - Minimum Available (SMF71CAM)

From: GTPerformansYonetim@garanti.com.tr
To: Meral Temel (Garanti Teknoloji)
Cc:
Subject: CSFRAVMN was executed at 22.02.2012 09:30:06







DB2 AS Memory Resources -1

How much Real Memory Allocated by my PDB1 DB2 DBM1 Address Space ?

Look RMF Monitor III STORF Panel

Includes # of both 31-bit backed + 64-bit backed by real storage frames

DB2 SMF record fieldname = QW0225RL

Total Frames 4247000* 4K = 16 GB

MXG value QW0225RL in Asumdbss SAS file

In RMF DDS Actual Value In terms of frames = 4247000

```
          HARDCOPY      RMF V1R12  Storage Frames                  Line 1 of 226

 Samples: 20       System: PRDB  Date: 03/05/12  Time: 14.58.00  Range: 20    Sec

            Service     -- Frame Occup.-- - Active Frames - AUX    PGIN
 Jobname  C Class    Cr TOTAL   ACTV  IDLE  WSET FIXED   DIV SLOTS RATE

 PDB1DBM1 S SYSSTC      4247K 4247K     0 4247K 3680K 10498     0    0
 POC1GARC S SCICHIGBS    320K  320K     0  320K  1668     0     0    0
 POE1GARC S SCICHIGBS    304K  304K     0  304K  1571     0     0    0
 POI1GARC S SCICHIGBS    295K  295K     0  295K  1591     0     0    0
 POA1GARC S SCICHIGBS    286K  286K     0  286K  1551     0     0    0
 POJ1GARC S SCICHIGBS    271K  271K     0  271K  1524     0     0    0
 POD1GARC S SCICHIGBS    266K  266K     0  266K  1589     0     0    0
 POG1GARC S SCICHIGBS    262K  262K     0  262K  1560     0     0    0
 POB1GARC S SCICHIGBS    248K  248K     0  248K  1478     0     0    0
 IXGLOGR  S SYSTEM       220K  220K     0  220K  9658     0     0    0
```

DB2 AS Memory Resources -2

How many Memory Objects Allocated by my PDB1 DB2 DBM1 Address Space ?

Look RMF Monitor III STORM Panel

Does NOT SHOW # Of Actual Backed by Real But Total In Virtual Storage

Total Frames 4247000* 4K = 16 GB

Total 1006 MO allocated: 4 of them from 64-bitSHARED 1002 of them from 64-bit Private

Does NOT mean 1006MB ,MO can be 1MB and MULTIPLES of 1MB

```
            HARDCOPY      RMF V1R12  Storage Memory Objects          Line 1 of 48

Samples: 20       System: PRDB  Date: 03/05/12  Time: 14.58.00  Range: 20     Sec

------------------------------ System Summary -------------------------------
-- Memory Objects --    ---------- Frames ----------     --- Area Used % ----
Common Shared  Large    Common  Fixed Shared    1 MB     Common Shared    1 MB
    30      5      0      5197   3859  26710       0        0.0    0.0     0.0

-------------------------------------------------------------------------------
            Service                 ---- Memory Objects ---  Frames  ----- Bytes -----
Jobname  C  Class       ASID    Total   Comm    Shr Large    1 MB    Total  Comm    Shr

PDB1DBM1 S  SYSSTC      0120     1006      0      4     0       0     245G     0   214G
CSFPRDB  S  SYSSTC      0107      257      0      0     0       0    2303M     0      0
SMSPDSE1 S  SYSTEM      0009       71      0      0     0       0     261M     0      0
PTXM150  S  SYSSTC      0142       65      0      0     0       0     260M     0      0
PDB1IRLM S  SYSSTC      0096       23      0      0     0       0    40.0M     0      0
TRACE    S  SYSSTC      0004       15      0      0     0       0    15.0M     0      0
SMSVSAM  S  SYSTEM      0010       14      0      0     0       0    27.0M     0      0
GRS      S  SYSTEM      0007       10      0      0     0       0     236G     0      0
SMSPDSE  S  SYSTEM      0008       10      0      0     0       0    74.0M     0      0
RMF      S  SYSSTC      0040        5      5      0     0       0    5120K  5120K     0
RESOLVER S  SYSSTC      0017        4      0      0     0       0    4096K     0      0
PDB1MSTR S  SYSSTC      0108        4      0      4     0       0     214G     0   214G
```

DB2 AS Memory Resources -3

How much is my PDB1 DB2 DBM1 Address Space's 64-bit Virtual Storage ?

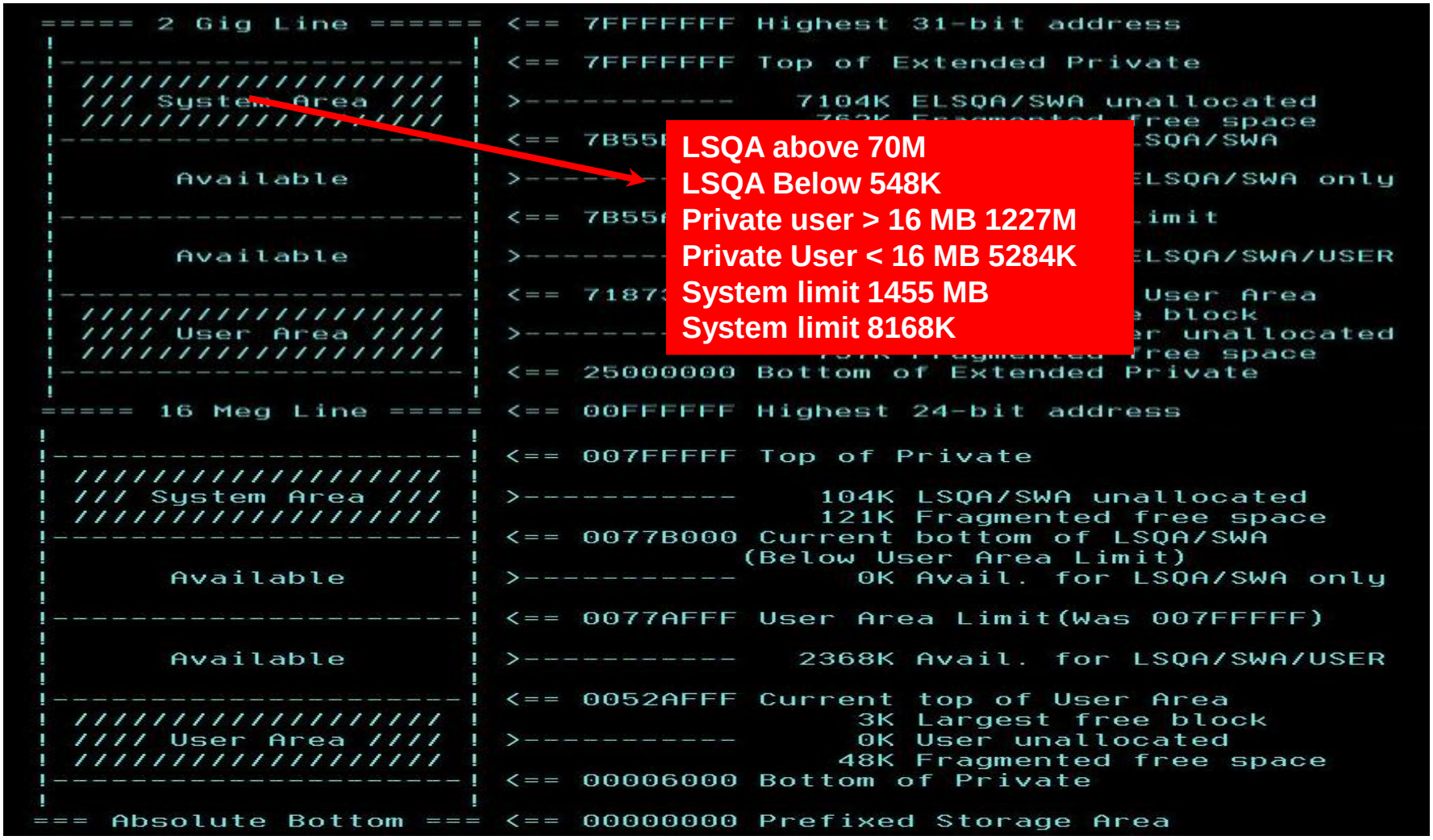
Look RMF Monitor III STORM Panel

Average 245 GB VIRTUAL storage allocated in Above bar for owned by PDB1DBM1

Total Average amount of storage allocated by memory objects in 64-bit high virtual memory with this address space as the owner
Comm Average amount of 64-bit common storage allocated with this address space as the owner
Shr Average amount of shared storage allocated by memory objects in 64-bit high virtual memory with this address space as the owner

```
            HARDCOPY      RMF V1R12  Storage Memory Objects          Line 1 of 48

Samples: 20       System: PRDB  Date: 03/05/12  Time: 14.58.00  Range: 20     Sec

------------------------------- System Summary ------------------------------
-- Memory Objects --    ---------- Frames ----------     --- Area Used % ----
Common Shared  Large    Common   Fixed Shared    1 MB     Common Shared    1 MB
    30      5      0      5197    3859  26710       0        0.0    0.0     0.0

-------------------------------------------------------------------------------
            Service                ---- Memory Objects ---   Frames   ----- Bytes -----
Jobname  C  Class       ASID    Total   Comm    Shr Large    1 MB    Total  Comm    Shr

PDB1DBM1 S  SYSSTC      0120     1006      0      4     0       0     245G     0   214G
CSFPRDB  S  SYSSTC      0107      257      0      0     0       0    2303M     0      0
SMSPDSE1 S  SYSTEM      0009       71      0      0     0       0     261M     0      0
PTXM150  S  SYSSTC      0142       65      0      0     0       0     260M     0      0
PDB1IRLM S  SYSSTC      0096       23      0      0     0       0    40.0M     0      0
TRACE    S  SYSSTC      0004       15      0      0     0       0    15.0M     0      0
SMSVSAM  S  SYSTEM      0010       14      0      0     0       0    27.0M     0      0
GRS      S  SYSTEM      0007       10      0      0     0       0     236G     0      0
SMSPDSE  S  SYSTEM      0008       10      0      0     0       0    74.0M     0      0
RMF      S  SYSSTC      0040        5      5      0     0       0    5120K  5120K     0
RESOLVER S  SYSSTC      0017        4      0      0     0       0    4096K     0      0
PDB1MSTR S  SYSSTC      0108        4      0      4     0       0     214G     0   214G
```

CICS Virtual Storage Map (31-Bit Part)



CICS Virtual Storage (31-Bit + 64-Bit) & Real Backed

HARDCOPY RMF V1R12 Storage Frames Line 1 of 196

Samples: 100 System: PRDE Date: 03/07/12 Time: 16.54.20 Range: 100 Sec

Jobname	C	Service Class	Cr	-- Frame Occup.-- TOTAL	ACTV	IDLE	- Active Frames - WSET	FIXED	AUX DIV	PGIN SLOTS	RATE
PDD1DBM1	S	SYSSTC		4285K	4285K	0	4285K	3711K	6289	0	0
PDE2DBM1	S	SYSSTC		1524K	1524K	0	1524K	1161K	10177	0	0
PSI1GARC	S	SCICHIGES		317K	317K	0	317K	2978	0	0	0
PSA1GARC	S	SCICHIGES		307K	307K	0	307K	3084	0	0	0
PSE3GARC	S	SCICHIGES		303K	303K	0	303K	2356	0	0	0

HARDCOPY RMF V1R12 Storage Memory Objects Line 28 of 60

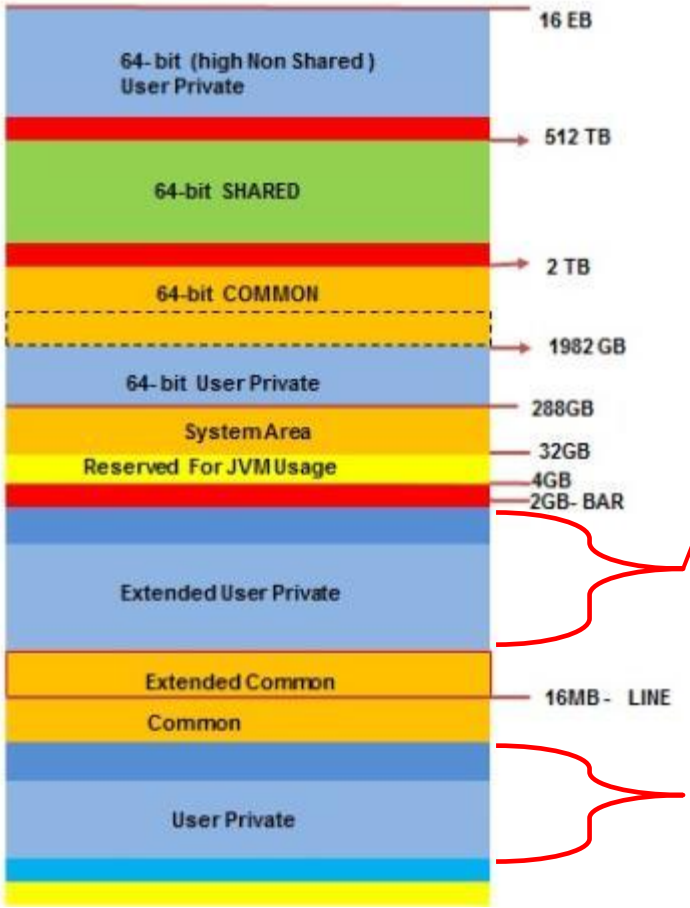
Samples: 100 System: PRDE Date: 03/07/12 Time: 16.54.20 Range: 100 Sec

System Summary

-- Memory Objects -- Common	Shared	Large	--------- Frames ---------- Common	Fixed	Shared	1 MB	--- Area Used % ---- Common	Shared	1 MB
29	8	0	4892	2696	53639	0	0.0	0.0	0.0

Jobname	C	Service Class	ASID	---- Memory Objects --- Total	Comm	Shr	Large	Frames 1 MB	----- Bytes ----- Total	Comm	Shr
PSB3GARC	S	SCICHIGE	0148	2	0	0	0	0	3072M	0	0
PSC3GARC	S	SCICHIGE	0149	2	0	0	0	0	3072M	0	0
PSD3GARC	S	SCICHIGE	0150	2	0	0	0	0	3072M	0	0
PSE3GARC	S	SCICHIGE	0151	2	0	0	0	0	3072M	0	0
PSF2GARC	S	SCICHIGE	0152	2	0	0	0	0	3072M	0	0
PSF4GARC	S	SCICHIGE	0153	2	0	0	0	0	3072M	0	0
PSF6GARC	S	SCICHIGE	0154	2	0	0	0	0	3072M	0	0
PSF7GARC	S	SCICHIGE	0155	2	0	0	0	0	3072M	0	0
PSG3GARC	S	SCICHIGE	0156	2	0	0	0	0	3072M	0	0
PSI3GARC	S	SCICHIGE	0157	2	0	0	0	0	3072M	0	0
PSJ3GARC	S	SCICHIGE	0158	2	0	0	0	0	3072M	0	0
PSH3GARC	S	SCICHIGE	0159	2	0	0	0	0	3072M	0	0
PST2GARC	S	SCICHIGE	0160	2	0	0	0	0	3072M	0	0
PST4GARC	S	SCICHIGE	0161	2	0	0	0	0	3072M	0	0
PSA1GARC	S	SCICHIGE	0162	2	0	0	0	0	3072M	0	0

User Private Area In Our Environment



WHERE TO LOOK ?

SMF30ERG (In MXG PVTSHI in steps file)

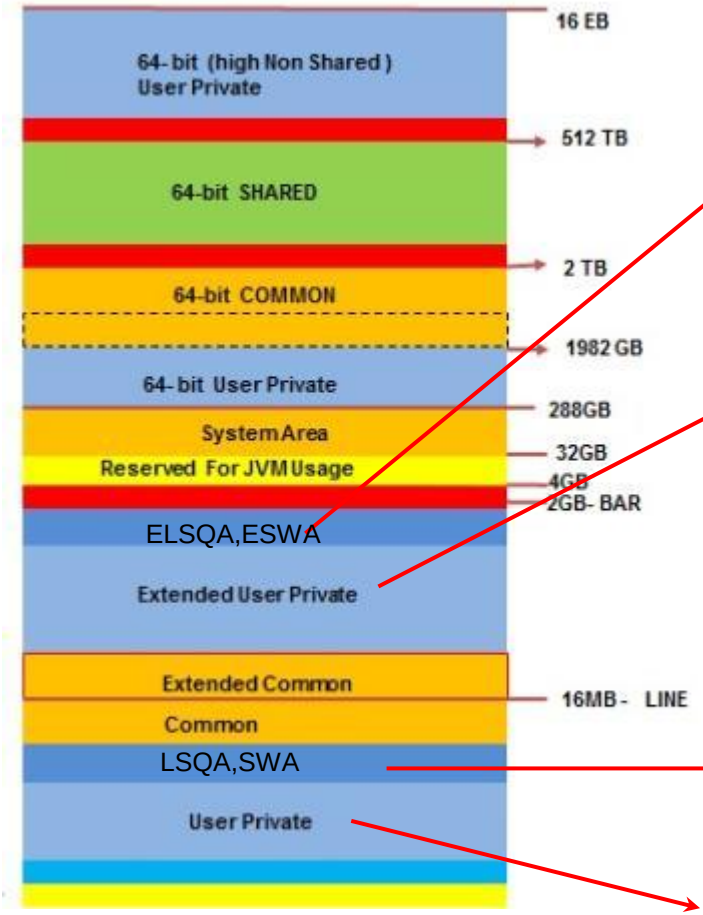
- For All Systems Same = 1456 MB
- = 2GB – Total of Extended Common Areas Defined

- For All Systems Same = 8168K
- = 16 MB – Total of Common Areas Defined – 8K

WHERE TO LOOK ?

SMF30RGB (In MXG PVTSLOW in steps file)

User PrivateArea (User Subpools& LSQA,SWA Actual Usage)



SMF30EAR (In MXG LSQSZHI in steps file)
Max Virtual Storage In Bytes Allocated From LSQA,SWA Subpool Above Line

SMF30EUR (In MXG USRSZHI in steps file)
Max Virtual Storage In Bytes Allocated From User Subpool Above Line
Note : DFSORT Does Getmains & free
To See The Actual Available-
SMF16 To See Actuals For These

SMF30ARB (In MXG LSQSZLOW in steps file)
Max Virtual Storage In Bytes Allocated From LSQA,SWA Subpool Below Line

SMF30URB (In MXG USRSZLOW in steps file)
Max Virtual Storage In Bytes Allocated From User Subpool Below Line

Private Storage Sample -1

PVTBOT	PVTSZHI	PVTSZLOW	SYSTEM	USRSZHI	USRSZLOW	JOB	LSQSZHI	LSQSZLOW
1708K	1456M	8168K	PRDF	54M	1708K	DFRMM	13M	500K
1536K	1456M	8168K	PRDB	110M	1536K	DFRMM	11M	500K
1660K	1456M	8168K	PRDW	63M	1660K	DFRMM	11M	500K
8K	1456M	8168K	PRDG	8K	8K	PGSGCICS	39M	228K
5520K	1456M	8168K	PRDG	1280M	5520K	PGSGCICS	55M	460K
8K	1456M	8168K	PRDG	8K	8K	PGS2CICS	24M	228K
5512K	1456M	8168K	PRDG	1219M	5512K	PGS2CICS	34M	420K
8K	1456M	8168K	PRDG	8K	8K	PGS3CICS	15M	228K
5508K	1456M	8168K	PRDG	1218M	5508K	PGS3CICS	19M	396K
8K	1456M	8168K	PRDG	8K	8K	PIC1GSGC	12M	228K
5512K	1456M	8168K	PRDG	1119M	5512K	PIC1GSGC	18M	404K
12K	1456M	8168K	PRDG	504K	12K	DAS2SRV	9756K	216K
8K	1456M	8168K	PRDG	496K	8K	DAS2SRV3	9972K	268K
20K	1456M	8168K	PRDG	629M	20K	DAS2SRV4	123M	396K

Private Storage Sample -2

PVTBOT	PVTSZHI	PVTSZLOW	SYSTEM	USRSZHI	USRSZLOW	JOB	LSQSZHI	LSQSZLOW
224K	1456M	8168K	PRDW	148K	224K	TNPX7D01	11M	312K
452K	1456M	8168K	PRDW	712K	452K	TNPX7D01	10M	452K
4K	1456M	8168K	PRDW	0	4K	TNPX7D01	9980K	300K
456K	1456M	8168K	PRDC	992K	456K	TNFY007C	10M	452K
8K	1456M	8168K	PRDC	0	8K	TNFY007C	10M	288K
7812K	1456M	8168K	PRDC	63M	7812K	TNFY007C	14M	480K
8K	1456M	8168K	PRDC	0	8K	TNFY007C	9936K	288K
8K	1456M	8168K	PRDC	0	8K	TNFY007C	9928K	288K
456K	1456M	8168K	PRDB	992K	456K	TNFY007B	11M	448K
8K	1456M	8168K	PRDB	0	8K	TNFY007B	10M	288K
7812K	1456M	8168K	PRDB	63M	7812K	TNFY007B	14M	484K
8K	1456M	8168K	PRDB	0	8K	TNFY007B	9M	288K
8K	1456M	8168K	PRDB	0	8K	TNFY007B	9M	288K
448K	1456M	8168K	PRDC	716K	448K	TNMR7009	10M	428K
456K	1456M	8168K	PRDC	896K	456K	TDAC1811	10M	464K
8K	1456M	8168K	PRDC	0	8K	TDAC1811	9M	288K
8K	1456M	8168K	PRDC	0	8K	TDAC1811	9M	288K
8K	1456M	8168K	PRDC	0	8K	TDAC1811	9M	288K
456K	1456M	8168K	PRDB	868K	456K	TDBA2031	11M	440K
472K	1456M	8168K	PRDB	4876K	472K	TDBA2031	11M	452K
8K	1456M	8168K	PRDB	0	8K	TDBA2031	9M	292K
8K	1456M	8168K	PRDB	0	8K	TDBA2031	9M	292K
456K	1456M	8168K	PRDB	864K	456K	TDPL6011	11M	440K
456K	1456M	8168K	PRDB	864K	456K	TDPL6011	11M	440K
452K	1456M	8168K	PRDB	704K	452K	TDPL6011	11M	432K
492K	1456M	8168K	PRDB	2364K	492K	TDPL6011	12M	448K
648K	1456M	8168K	PRDB	2992K	648K	TDPL6011	12M	428K

INCREASING THE SIZE OF DB2 GLOBAL/LOCAL BUFFER POOLS

DB2 Group Buffer Pool Structures' Size Were Increased by Total 2 GB

Structure Name	Before (MB)	After(MB)	Difference(MB)
DSNPD01_GBP0	118	95	23
DSNPD01_GBP1	1369	783	586
DSNPD01_GBP16K0	59	59	0
DSNPD01_GBP16K1	99	99	0
DSNPD01_GBP2	1369	1173	196
DSNPD01_GBP21	6001	6001	0
DSNPD01_GBP24	1446	1446	0
DSNPD01_GBP31	6001	6001	0
DSNPD01_GBP32K	245	197	48
DSNPD01_GBP40	9300	9300	0
DSNPD01_GBP5	587	334	253
DSNPD01_GBP6	392	236	156
DSNPD01_GBP7	1612	685	927
DSNPD01_GBP8K0	60	60	0
DSNPD01_LOCK1	512	512	0
DSNPD01_SCA	70	70	0
DSNPDRM_GBP0	19	19	0
DSNPDRM_GBP1	51	51	0
DSNPDRM_GBP2	42	42	0
DSNPDRM_LOCK1	30	30	0
DSNPDRM_SCA	12	12	0
TOTAL	29394	27205	2189

DB2 DBM1 AS Change In 64-Bit Storage – Sample SSID PDA2

```
            HARDCOPY      RMF V1R12  Storage Memory Objects          Line 1 of 37

 Samples: 20       System: PRDA   Date: 03/02/12  Time: 20.37.20  Range: 20     Sec

 ------------------------------- System Summary -------------------------------
 -- Memory Objects --    ---------- Frames ----------      --- Area Used % ----
 Common Shared  Large    Common   Fixed Shared    1 MB     Common Shared    1 MB
     29      5      0      5085    2696  11597       0        0.0    0.0     0.0

 ------------------------------------------------------------------------------
            Service           ---- Memory Objects ---   Frames  ----- Bytes -----
 Jobname  C Class       ASID    Total   Comm    Shr Large   1 MB    Total   Comm    Shr

 PDA2DBM1 S SYSSTC      0125      446      0      4     0      0     238G      0   214G
```

```
            HARDCOPY      RMF V1R12  Storage Memory Objects          Line 1 of 37

 Samples: 20       System: PRDA   Date: 03/02/12  Time: 20.37.40  Range: 20     Sec

 ------------------------------- System Summary -------------------------------
 -- Memory Objects --    ---------- Frames ----------      --- Area Used % ----
 Common Shared  Large    Common   Fixed Shared    1 MB     Common Shared    1 MB
     29      5      0      5085    2696  11606       0        0.0    0.0     0.0

 ------------------------------------------------------------------------------
            Service           ---- Memory Objects ---   Frames  ----- Bytes -----
 Jobname  C Class       ASID    Total   Comm    Shr Large   1 MB    Total   Comm    Shr

 PDA2DBM1 S SYSSTC      0125      544      0      4     0      0     239G      0   214G
```

```
            HARDCOPY      RMF V1R12  Storage Memory Objects          Line 1 of 37

 Samples: 20       System: PRDA   Date: 03/02/12  Time: 20.38.00  Range: 20     Sec

 ------------------------------- System Summary -------------------------------
 -- Memory Objects --    ---------- Frames ----------      --- Area Used % ----
 Common Shared  Large    Common   Fixed Shared    1 MB     Common Shared    1 MB
     29      5      0      5085    2696  11613       0        0.0    0.0     0.0

 ------------------------------------------------------------------------------
            Service           ---- Memory Objects ---   Frames  ----- Bytes -----
 Jobname  C Class       ASID    Total   Comm    Shr Large   1 MB    Total   Comm    Shr

 PDA2DBM1 S SYSSTC      0125      590      0      4     0      0     240G      0   214G
```

DB2 DBM1 AS Change In 64-Bit Storage – Sample SSID PDA2

```
         HARDCOPY     RMF V1R12  Storage Frames                  Line 1 of 168

Samples: 20       System: PRDA  Date: 03/02/12  Time: 20.37.20  Range: 20    Sec

           Service     -- Frame Occup.-- - Active Frames - AUX   PGIN
Jobname  C Class    Cr TOTAL  ACTV  IDLE  WSET FIXED   DIV SLOTS RATE

PDA2DBM1 S SYSSTC     2113K 2113K     0 2113K 1689K 10487     0    0
```

```
         HARDCOPY     RMF V1R12  Storage Frames                  Line 1 of 170

Samples: 20       System: PRDA  Date: 03/02/12  Time: 20.37.40  Range: 20    Sec

           Service     -- Frame Occup.-- - Active Frames - AUX   PGIN
Jobname  C Class    Cr TOTAL  ACTV  IDLE  WSET FIXED   DIV SLOTS RATE

PDA2DBM1 S SYSSTC     2129K 2129K     0 2129K 1693K 10487     0    0
```

```
         HARDCOPY     RMF V1R12  Storage Frames                  Line 1 of 168

Samples: 20       System: PRDA  Date: 03/02/12  Time: 20.38.00  Range: 20    Sec

           Service     -- Frame Occup.-- - Active Frames - AUX   PGIN
Jobname  C Class    Cr TOTAL  ACTV  IDLE  WSET FIXED   DIV SLOTS RATE

PDA2DBM1 S SYSSTC     2148K 2148K     0 2148K 1705K 10487     0    0
```

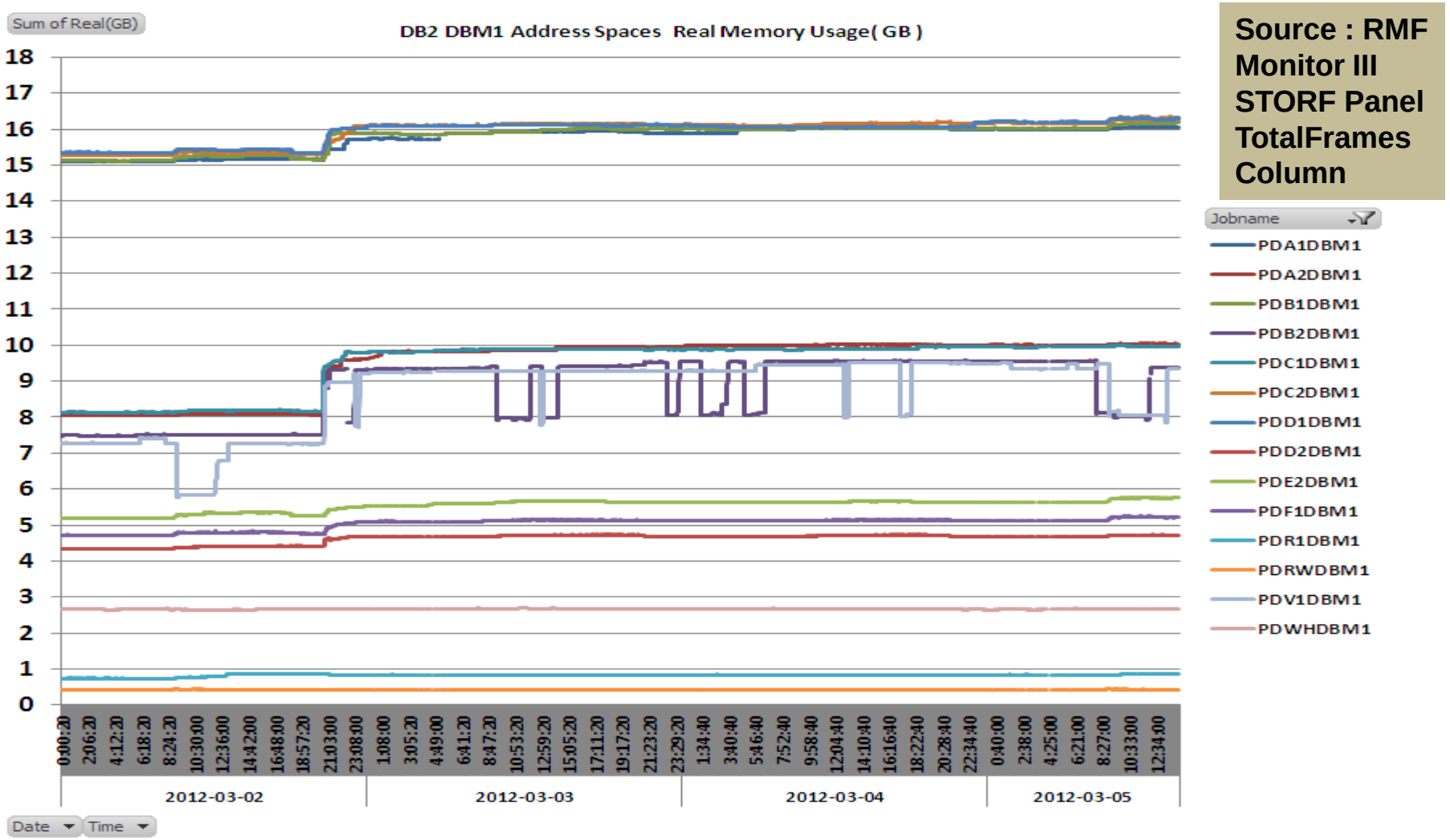
2162K

DB2 DBM1 AS Change In 64-Bit Storage – Sample SSID PDA2

```
PDA2DBM1 S SYSSTC     2162K 2162K     0 2162K 1719K 10487     0    0
PDA2DBM1 S SYSSTC     2175K 2175K     0 2175K 1732K 10487     0    0
PDA2DBM1 S SYSSTC     2188K 2188K     0 2188K 1745K 10487     0    0
PDA2DBM1 S SYSSTC     2201K 2201K     0 2201K 1759K 10487     0    0
PDA2DBM1 S SYSSTC     2214K 2214K     0 2214K 1773K 10487     0    0
PDA2DBM1 S SYSSTC     2227K 2227K     0 2227K 1785K 10487     0    0
PDA2DBM1 S SYSSTC     2239K 2239K     0 2239K 1798K 10487     0    0
PDA2DBM1 S SYSSTC     2251K 2251K     0 2251K 1810K 10487     0    0
PDA2DBM1 S SYSSTC     2264K 2264K     0 2264K 1822K 10487     0    0
PDA2DBM1 S SYSSTC     2277K 2277K     0 2277K 1835K 10487     0    0
PDA2DBM1 S SYSSTC     2289K 2289K     0 2289K 1846K 10487     0    0
PDA2DBM1 S SYSSTC     2301K 2301K     0 2301K 1858K 10487     0    0
```

```
          HARDCOPY      RMF V1R12  Storage Frames                    Line 1 of 181

Samples: 20       System: PRDA  Date: 03/05/12  Time: 18.28.00  Range: 20    Sec

            Service     -- Frame Occup.-- - Active Frames - AUX   PGIN
Jobname   C Class    Cr TOTAL  ACTV  IDLE  WSET FIXED   DIV SLOTS RATE

PDA2DBM1  S SYSSTC     2630K 2630K     0 2630K 2179K 10491     0    0
PWA7GARC  S SCICHIGAS   255K  255K     0  255K  1436     0     0    0
PWA6GARC  S SCICHIGAS   229K  229K     0  229K  1328     0     0    0
PAA1GARC  S SCICHIGAS   176K  176K     0  176K  2153     0     0    0
PAA2GARC  S SCICHIGAS   175K  175K     0  175K  2145     0     0    0
PMQ3MSTR  S SMQHIG      135K  135K     0  135K  1132     0     0    0
ZFS       S SYSSTC      133K  133K     0  133K   977     0     0    0
IXGLOGR   S SYSTEM      117K  117K     0  117K  4758     0     0    0
```

DB2 DBM1 AS Real Storage AllocationChange After BF increase



Source : RMF Monitor III STORF Panel TotalFrames Column

Changes In SMF71 Fields In Each z/OS Version

From z/OS v1r10 To z/OS V1R12 Added

SMF71GRN
SMF71FBN
SMF71FRN
SMF71FFN
SMF711RN
SMF71NRN

From z/OS V1R12 To z/OS v1r13 Added

SMF71RFL
SMF71LFA
SMF71L7M
SMF71L7X
SMF71L7A
SMF71TLS

From z/OS V1R12 To z/OS V1R13 Part Related To Physical Swaping Removed

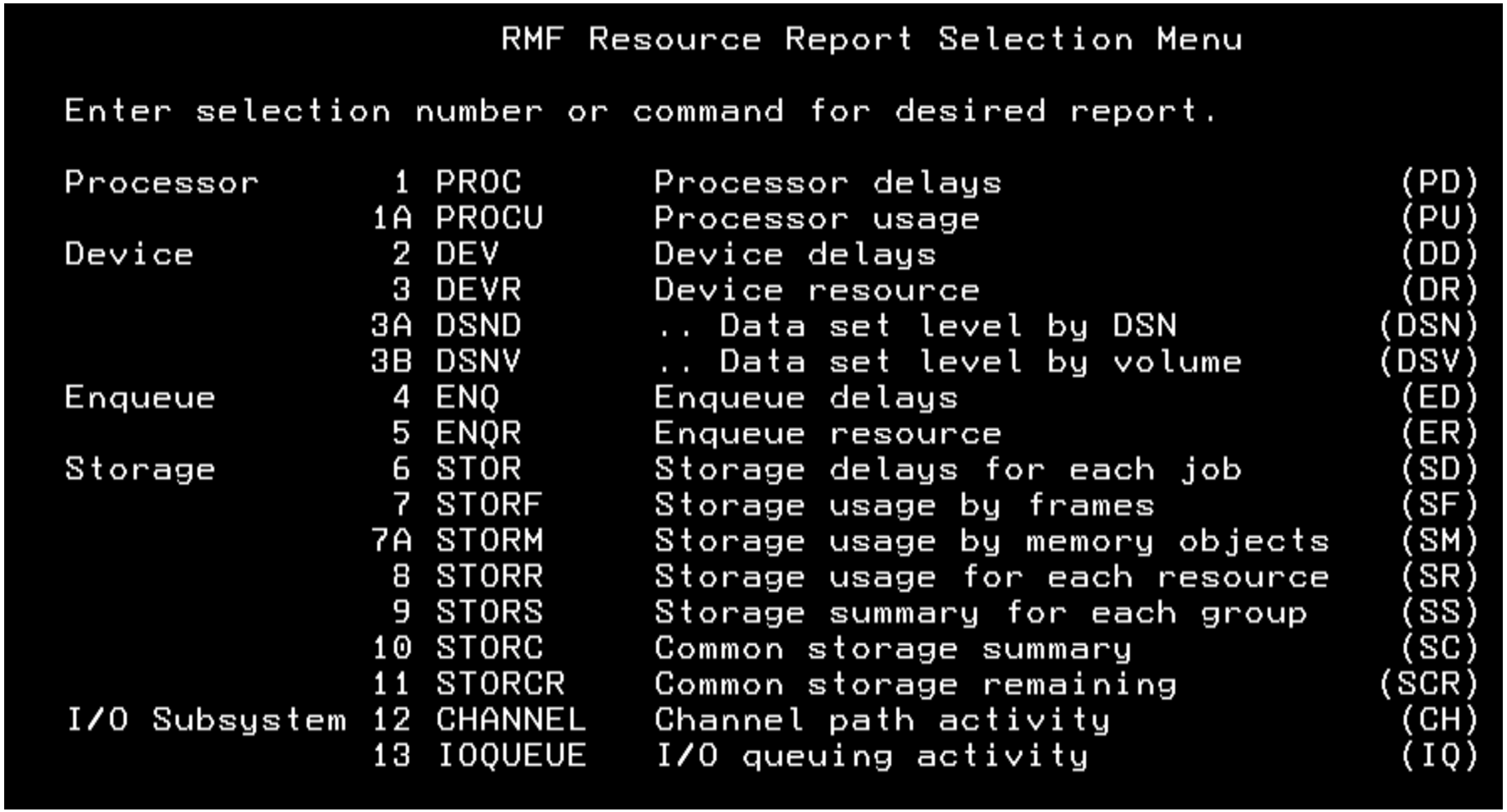
SMF71TOT
SMF71AXD
SMF71LES
SMF71LAX
SMF71ESD
SMF71MIG

RMF Monitor III

```
                        RMF - Performance Management                 z/OS V1R12 RMF

 Enter selection number or command on selection line.

   1 Postprocessor    Postprocessor reports for Monitor I, II, and III       (PP)
   2 Monitor II       Snapshot reporting with Monitor II                     (M2)
   3 Monitor III      Interactive performance analysis with Monitor III      (M3)

   U USER             User-written applications (add your own ...)           (US)

   R RMF SR           Performance analysis with the Spreadsheet Reporter
   P RMF PM           RMF PM Java Edition
   N News             What's new in z/OS V1R12 RMF

                                 T TUTORIAL    X EXIT

   RMF Home Page:     http://www.ibm.com/systems/z/os/zos/features/rmf/

          5694-A01 Copyright IBM Corp. 1994, 2010. All Rights Reserved
                        Licensed Materials - Property of IBM
```

```
                        RMF Monitor III Primary Menu                 z/OS V1R12 RMF

 Enter selection number or command on selection line.

   S SYSPLEX          Sysplex reports and Data Index                         (SP)
   1 OVERVIEW         WFEX, SYSINFO, and Detail reports                      (OV)
   2 JOBS             All information about job delays                       (JS)
   3 RESOURCE         Processor, Device, Enqueue, and Storage                (RS)
   4 SUBS             Subsystem information for HSM, JES, and XCF           (SUB)

   U USER             User-written reports (add your own ...)                (US)


                        O OPTIONS    T TUTORIAL    X EXIT

        5694-A01 Copyright IBM Corp. 1986, 2010. All Rights Reserved
                      Licensed Materials - Property of IBM
```

RMF Monitor III Panels



```
                    RMF Resource Report Selection Menu

Enter selection number or command for desired report.

Processor        1 PROC      Processor delays                    (PD)
                1A PROCU     Processor usage                     (PU)
Device           2 DEV       Device delays                       (DD)
                 3 DEVR      Device resource                     (DR)
                3A DSND      .. Data set level by DSN            (DSN)
                3B DSNV      .. Data set level by volume         (DSV)
Enqueue          4 ENQ       Enqueue delays                      (ED)
                 5 ENQR      Enqueue resource                    (ER)
Storage          6 STOR      Storage delays for each job         (SD)
                 7 STORF     Storage usage by frames             (SF)
                7A STORM     Storage usage by memory objects     (SM)
                 8 STORR     Storage usage for each resource     (SR)
                 9 STORS     Storage summary for each group      (SS)
                10 STORC     Common storage summary              (SC)
                11 STORCR    Common storage remaining            (SCR)
I/O Subsystem   12 CHANNEL   Channel path activity                (CH)
                13 IOQUEUE   I/O queuing activity                 (IQ)
```

RMF Monitor III – Storage Usage By Frames

HARDCOPY RMF V1R12 Storage Frames Line 1 of 194

Samples: 20 System: PRDE Date: 02/15/12 Time: 11.06.20 Range: 20 Sec

Jobname	C	Service Class	Cr	-- Frame Occup.-- TOTAL	ACTV	IDLE	- Active Frames - WSET	FIXED	AUX DIV	SLOTS	PGIN RATE
PDD1DBM1	S	SYSSTC		4066K	4066K	0	4066K	3472K	10421	0	0
PDE2DBM1	S	SYSSTC		1413K	1413K	0	1413K	1046K	10137	0	0
PSI1GARC	S	SCICHIGES		315K	315K	0	315K	2968	0	0	0
PSI3GARC	S	SCICHIGES		306K	306K	0	306K	1529	0	0	0
PSA1GARC	S	SCICHIGES		280K	280K	0	280K	2921	0	0	0
PSC3GARC	S	SCICHIGES		266K	266K	0	266K	2997	0	0	0
PSA3GARC	S	SCICHIGES		264K	264K	0	264K	1314	0	0	0
PSG1GARC	S	SCICHIGES		257K	257K	0	257K	3677	0	0	0
PSC1GARC	S	SCICHIGES		257K	257K	0	257K	2974	0	0	0
PSJ1GARC	S	SCICHIGES		252K	252K	0	252K	2943	0	0	0
PSJ3GARC	S	SCICHIGES		246K	246K	0	246K	1298	0	0	0
PSB1GARC	S	SCICHIGES		243K	243K	0	243K	3501	0	0	0
PSD1GARC	S	SCICHIGES		243K	243K	0	243K	2411	0	0	0
PSG3GARC	S	SCICHIGES		242K	242K	0	242K	1226	0	0	0
PSE1GARC	S	SCICHIGES		241K	241K	0	241K	1813	0	0	0
PSB3GARC	S	SCICHIGES		240K	240K	0	240K	1216	0	0	0
PSD3GARC	S	SCICHIGES		239K	239K	0	239K	1193	0	0	0
PSE3GARC	S	SCICHIGES		238K	238K	0	238K	1799	0	0	0
IXGLOGR	S	SYSTEM		235K	235K	0	235K	10356	0	0	0
PSF2GARC	S	SCICHIGES		190K	190K	0	190K	4086	0	0	0
PSF6GARC	S	SCICHIGES		188K	188K	0	188K	4068	0	0	0
PSF8GARC	S	SCICHIGES		181K	181K	0	181K	1005	0	0	0
PSF4GARC	S	SCICHIGES		178K	178K	0	178K	995	0	0	0
PSH1GARC	S	SCICHIGES		170K	170K	0	170K	3628	0	0	0
PSH3GARC	S	SCICHIGES		163K	163K	0	163K	943	0	0	0
ZFS	S	SYSSTC		143K	143K	0	143K	983	0	0	0
NETSSIPE	S	SHIGH		120K	120K	0	120K	557	0	0	0
SMSPDSE1	S	SYSTEM		108K	108K	0	108K	614	0	0	0
PTXM150	S	SYSSTC		89685	89685	0	89685	4655	69	0	0
PSF5GARC	S	SCICHIGES		89389	89389	0	89389	2643	0	0	0
PSF7GARC	S	SCICHIGES		85000	85000	0	85000	624	0	0	0
CSFPRDE	S	SYSSTC		70474	70474	0	70474	375	0	0	0
SMSVSAM	S	SYSTEM		68477	68477	0	68477	790	0	0	0

RMF Monitor III – Storage Usage By Memory Objects

HARDCOPY RMF V1R12 Storage Memory Objects Line 1 of 59

Samples: 20 System: PRDE Date: 02/15/12 Time: 11.06.20 Range: 20 Sec

System Summary

-- Memory Objects --			--------- Frames ----------				--- Area Used % ----		
Common	Shared	Large	Common	Fixed	Shared	1 MB	Common	Shared	1 MB
28	8	0	4599	2696	54651	0	0.0	0.0	0.0

Jobname	C	Service Class	ASID	---- Memory Objects --- Total	Comm	Shr	Large	Frames 1 MB	----- Bytes ----- Total	Comm	Shr
PDD1DBM1	S	SYSSTC	0117	942	0	4	0	0	245G	0	214G
PDE2DBM1	S	SYSSTC	0115	276	0	4	0	0	235G	0	214G
CSFPRDE	S	SYSSTC	0055	261	0	0	0	0	2307M	0	0
SMSPDSE1	S	SYSTEM	0009	74	0	0	0	0	390M	0	0
PTXM150	S	SYSSTC	0205	63	0	0	0	0	252M	0	0
SMSVSAM	S	SYSTEM	0010	24	0	0	0	0	37.0M	0	0
PDD1IRLM	S	SYSSTC	0110	22	0	0	0	0	33.0M	0	0
TRACE	S	SYSSTC	0004	16	0	0	0	0	16.0M	0	0
PDE2IRLM	S	SYSSTC	0111	15	0	0	0	0	23.0M	0	0
GRS	S	SYSTEM	0007	10	0	0	0	0	236G	0	0
SMSPDSE	S	SYSTEM	0008	10	0	0	0	0	74.0M	0	0
RMF	S	SYSSTC	0042	5	5	0	0	0	5120K	5120K	0
ADHMSTR	S	SYSSTC	0135	5	0	5	0	0	92.1G	0	92.1G
RESOLVER	S	SYSSTC	0040	4	0	0	0	0	4096K	0	0
PDD1MSTR	S	SYSSTC	0096	4	0	4	0	0	214G	0	214G
PDE2MSTR	S	SYSSTC	0097	4	0	4	0	0	214G	0	214G
OMVS	S	SYSTEM	0016	3	0	0	0	0	931M	0	0
JES2AUX	S	SYSSTC	0050	3	3	0	0	0	3072K	3072K	0
TCPIPROC	S	SYSSTC	0062	3	1	2	0	0	256G	1024K	256G
HZSPROC	S	SHIGH	0098	3	0	1	0	0	8195M	0	1024K
ENF	S	SYSSTC	0102	3	0	0	0	0	8192K	0	0
ADHCPDD1	S	SYSSTC	0129	3	0	3	0	0	86.1G	0	86.1G
ADHCPDE2	S	SYSSTC	0132	3	0	3	0	0	86.1G	0	86.1G
MASTER	S	SYSTEM	0001	2	2	0	0	0	2048K	2048K	0
ZFS	S	SYSSTC	0048	2	0	0	0	0	22.0M	0	0
PSG3GARC	S	SCICHIGE	0092	2	0	0	0	0	3072M	0	0
PFA	S	SHIGH	0106	2	2	0	0	0	6144K	6144K	0

RMF Monitor III – Storage Usage For Each Resource

```
          HARDCOPY     RMF V1R12  Storage Resource Delays          Line 1 of 5

Samples: 20      System: PRDE  Date: 02/15/12  Time: 11.06.20  Range: 20    Sec

--------------------------- Central Storage Summary ---------------------------
--------------- % Frames ----------------    Frames  System
NUC  SQA  CSA  LPA  ACTV  IDLE  AVAIL SHR    Online   UIC
  0    0    0    0    59     0     39   0    21758K   65535

----------------------------- Page/Swap Activity -------------------------------
Volume DEV      CU           ACT CON DSC PND Pend    SPACE  - AVG Active Users-
Serial Type     Type     PAV  %   %   %   %  Reasons TYPE   TOTL LOCL SWAP COMM

PGON35 33909    2107     1.0H  0   0   0   0 None    LOCL    0.0  0.0  0.0  0.0
PGON36 33909    2107     1.0H  0   0   0   0 None    LOCL    0.0  0.0  0.0  0.0
PGON37 33909    2107     1.0H  0   0   0   0 None    LOCL    0.0  0.0  0.0  0.0
PGON41 33903    2107     1.0H  0   0   0   0 None    COMM    0.0  0.0  0.0  0.0
                                                   PLPA    0.0  0.0  0.0  0.0
```

RMF Monitor III – Storage Delay Summary

HARDCOPY RMF V1R12 Storage Delay Summary Line 1 of 74

Samples: 20 System: PRDE Date: 02/15/12 Time: 11.06.20 Range: 20 Sec

Central Storage Summary

% Frames								Frames	System
NUC	SQA	CSA	LPA	ACTV	IDLE	AVAIL	SHR	Online	UIC
0	0	0	0	59	0	39	0	21758K	65535

Group	T	-- Users --		- Average Number Delayed For-						- Average Frames-			PGIN
		TOTL	ACTV	ANY	COMM	LOCL	SWAP	OUTR	OTHR	ACTV	IDLE	FIXED	RATE
SYSTEM	W	107	3	0	0	0	0	0	0	6943K	5903	4584K	0.0
SYSOTHER	S	0	0	0	0	0	0	0	0	0	0	0	0.0
SYSSTC	S	84	3	0	0	0	0	0	0	6271K	5718	4540K	0.0
SYSTEM	S	23	0	0	0	0	0	0	0	672K	185	44453	0.0
WBATCOPR	W	1	0	0	0	0	0	0	0	3708	0	114	0.0
SBATHIG	S	1	0	0	0	0	0	0	0	3708	0	114	0.0
WCICS	W	28	6	0	0	0	0	0	0	5529K	0	55116	0.0
SCICHIGE	S	28	6	0	0	0	0	0	0	5529K	0	55116	0.0
WSYSTEM	W	58	0	0	0	0	0	0	0	361K	4691	6787	0.0
SHIGH	S	15	0	0	0	0	0	0	0	155K	4155	2205	0.0
SLOW	S	11	0	0	0	0	0	0	0	8155	0	618	0.0
SMED	S	11	0	0	0	0	0	0	0	33365	0	829	0.0
SMON	S	9	0	0	0	0	0	0	0	157K	0	2255	0.0
SOEMVS	S	12	0	0	0	0	0	0	0	7544	536	880	0.0
RCICCMSE	R	1	0	0	0	0	0	0	0	13658	0	172	0.0
RCICENC1	R	1	0	0	0	0	0	0	0	535	0	55	0.0
RCICTSQE	R	1	0	0	0	0	0	0	0	38827	0	217	0.0
RDB2GENL	R	2	0	0	0	0	0	0	0	1813	0	138	0.0
RDB2GRD	R	5	0	0	0	0	0	0	0	53585	0	642	0.0
RDB2PTXM	R	2	0	0	0	0	0	0	0	90771	0	4761	0.0
RGARCSA1	R	1	0	0	0	0	0	0	0	280K	0	2921	0.0
RGARCSA3	R	1	0	0	0	0	0	0	0	264K	0	1314	0.0
RGARCSB1	R	1	0	0	0	0	0	0	0	243K	0	3501	0.0
RGARCSB3	R	1	0	0	0	0	0	0	0	240K	0	1216	0.0
RGARCSC1	R	1	0	0	0	0	0	0	0	257K	0	2974	0.0
RGARCSC3	R	1	0	0	0	0	0	0	0	266K	0	2997	0.0
RGARCSD1	R	1	0	0	0	0	0	0	0	243K	0	2411	0.0
RGARCSD3	R	1	0	0	0	0	0	0	0	239K	0	1193	0.0

RMF Monitor III – Common Storage

HARDCOPY RMF V1R12 Common Storage Line 1 of 192

Samples: 20 System: PRDE Date: 02/24/12 Time: 10.11.00 Range: 20 Sec

System Information	Percent CSA	Percent ECSA	Percent SQA	Percent ESQA	Amount CSA	Amount ECSA	Amount SQA	Amount ESQA
IPL Definitions					4456K	350M	1568K	134M
Peak Allocation Values	23	53	52	38	1010K	187M	815K	51M
Average CSA to SQA Conversion	0	0			0	0		
Average Use Summary	22	52	28	36	994K	181M	442K	48M
Available at End of Range	78	48	72	64	3462K	169M	1126K	86M

Unalloc Common Area: 4456K

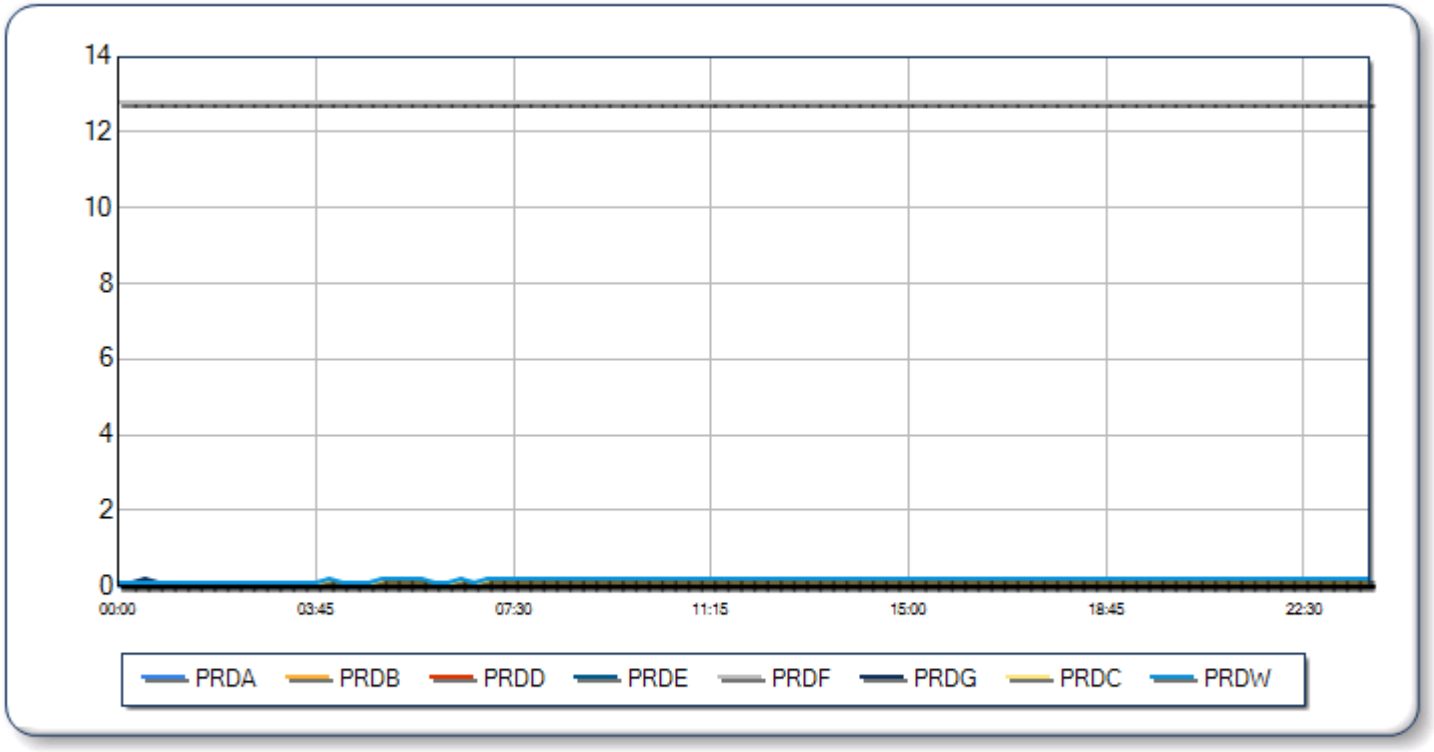
Jobname	Act	C	Service Class	ASID	ELAP Time	Percent Used CSA	Percent Used ECSA	Percent Used SQA	Percent Used ESQA	Amount Used CSA	Amount Used ECSA	Amount Used SQA	Amount Used ESQA
%MVS						3	22	21	26	121K	77M	328K	35M
%REMAIN						2	1	0	0	84624	2510K	3936	22520
TSS		S	SYSSTC	0035	6.3D	6	0	0	0	283K	1247K	2784	4814
MASTER		S	SYSTEM	0001	6.3D	5	1	2	2	233K	4187K	27896	2663K
VTMPE		S	SYSSTC	0066	6.3D	1	5	0	0	22848	16M	0	11534
XCFAS		S	SYSTEM	0006	6.3D	0	0	0	3	0	1216	160	3614K
POMETE		S	SMON	0128	6.3D	0	0	2	0	112	157K	32016	240K
ENF		S	SYSSTC	0110	6.3D	2	0	0	0	78952	710K	3808	128K
PDD1DBM1		S	SYSSTC	0127	6.3D	0	2	0	0	4096	6088K	64	45736
POMDCOL		S	SYSSTC	0107	6.3D	0	2	0	0	440	5874K	0	2840
RMFGAT		S	SYSSTC	0099	6.3D	0	0	0	2	0	73592	64	2095K
RMF		S	SYSSTC	0040	6.3D	0	0	0	1	0	663	0	2006K
PDE2DBM1		S	SYSSTC	0126	6.3D	0	1	0	0	4096	4290K	64	46408
PDD1MSTR		S	SYSSTC	0104	6.3D	0	1	0	0	13848	3698K	64	8184
PDE2MSTR		S	SYSSTC	0105	6.3D	0	1	0	0	13848	3673K	64	9128
PDD1IRLM		S	SYSSTC	0114	6.3D	0	1	0	0	0	3193K	256	7330
PDE2IRLM		S	SYSSTC	0118	6.3D	0	1	0	0	0	3179K	256	6752
TWTE		S	SHIGH	0097	6.3D	1	0	0	0	36336	2912	0	600
OPTE		S	SHIGH	0096	6.3D	1	0	0	0	36336	35512	0	600
PDD1DIST		S	SYSSTC	0136	6.3D	0	1	0	0	136	2789K	64	1600
PDE2DIST		S	SYSSTC	0135	6.3D	0	1	0	0	136	2765K	64	1600
CONSOLE		S	SYSTEM	0011	6.3D	0	0	1	0	2864	104K	11672	30824
POMZ2HI		S	SMON	0132	6.3D	0	1	0	0	2984	2498K	96	42928
PTXM150		S	SYSSTC	0144	6.3D	0	1	0	0	80	2391K	0	12376

Daily Reports – SLOT UTILIZATION

SLOTUTIL = 100* (SMF71MNA- SMF71MNU)/ SMF71MNA

16/02/2012

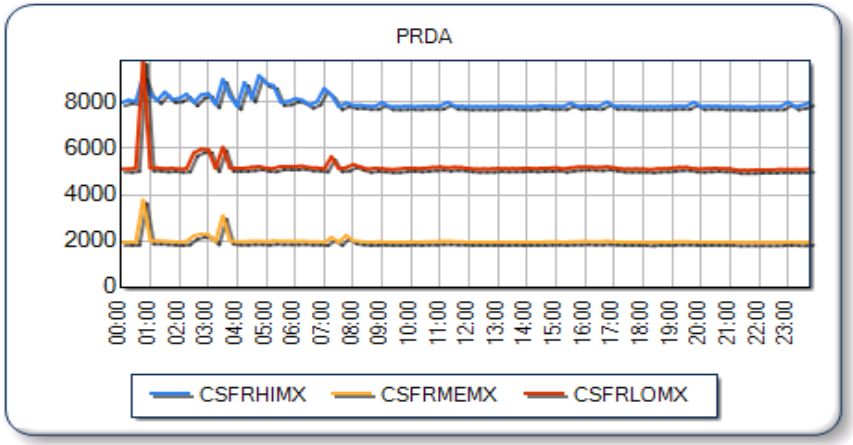
MXG FIELD SLOTUTIL

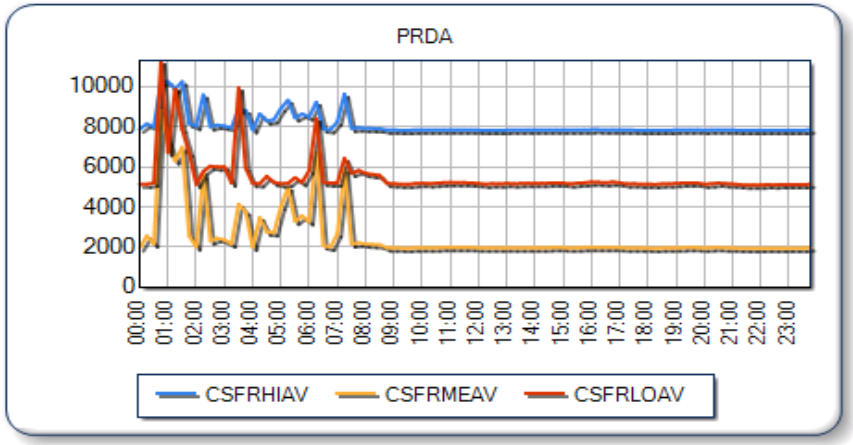


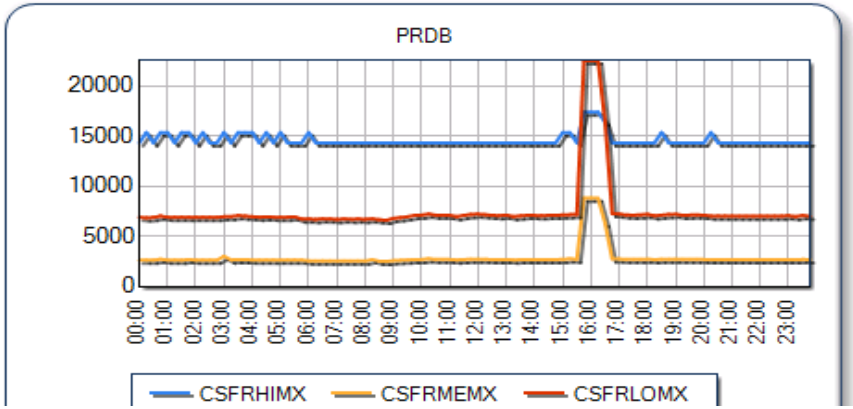
	PRDA	PRDB	PRDD	PRDE	PRDF	PRDG	PRDC	PRDW
2012-02-16 00:00	0.00	0.10	0.10	0.10	12.80	0.10	0.10	0.10
2012-02-16	0.00	0.10	0.10	0.10	12.80	0.10	0.10	0.10

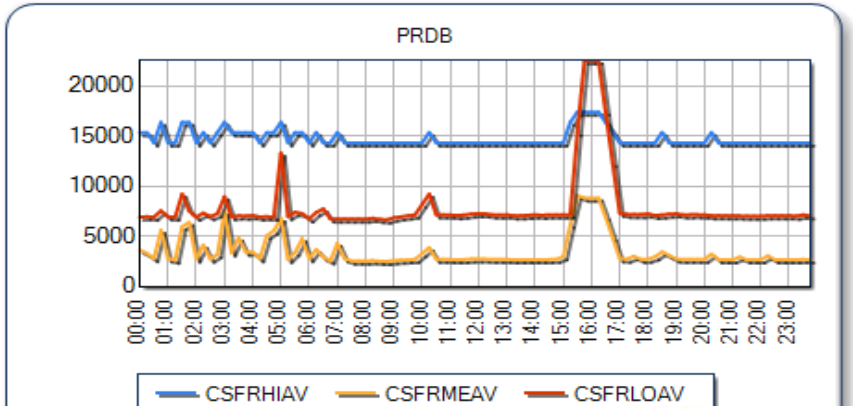
Daily Report –High-Medium-Low-Impacted Frame

- There are actually 4 Buckets In Which Frames Are counted.
- Low Impacted Frame Buckets Are 3 and 4. Less Referenced
- Before z/OS V1R8, Frame Counting was done every 10 seconds
- With z/OS V1R8,# Of Frames Counted Based on UIC,time since last swap-in and pageable frames of ASes in every 1 second.









RMF Monitor III – Hidden Fields

CPC PANEL - Online Memory Of LPAR : Field Name : CPCPCSMB
MODIFY RMF III –CPC Panel USING `RMF UTIL` In ISPF Command Panel

```
          HARDCOPY      RMF V1R12  CPC Capacity                      Line 1 of 22

Samples: 20       System: PRDA  Date: 03/08/12  Time: 02.18.40  Range: 20     Sec

Partition:    PRDA        2817 Model 720
CPC Capacity:     2064    Weight % of Max: ****    4h Avg:         Group: CAR2LMT
Image Capacity:   1850    WLM Capping %:    0.0    4h Max:   409   Limit:   1850

Partition  --- MSU ---   Cap  Proc     Logical Util %    - Physical Util % -
             Def    Act  Def   Num     Effect   Total   LPAR  Total   MemOnl

*CP          206          60.0                          0.2   99.7
PRDA          23    238  NO   13.0       17.7    17.7   0.0   11.5    53248
PRDC          56    577  NO   13.0       43.0    43.0   0.0   28.0    65536
PRDE          74    760  NO   15.0       49.0    49.1   0.0   36.8    84992
PRDF          43    445  NO   13.0       33.2    33.2   0.0   21.6    40960
TCF2GAR2       1      5  NO    1.0        4.5     4.6   0.0    0.2     4096
TSTB           8     28  NO    3.0        8.9     9.1   0.0    1.4    25600
TSTK           1      2  NO    2.0        1.0     1.1   0.0    0.1     1024
PHYSICAL                                               0.1    0.1        0

*ICF           0          2.0                          0.0    100
PCF2GAR2       0          2.0        100     100       0.0    100
PHYSICAL                                               0.0    0.0

*IIP         510          6.0                          0.2   20.6
PRDA         100     NO   1.0        0.4     0.4       0.0    0.4
PRDC         100     NO   1.0        0.3     0.3       0.0    0.3
PRDE         100     NO   1.0        1.1     1.1       0.0    1.1
PRDF         100     NO   1.0       18.4    18.4       0.0   18.4
TSTB         100     NO   1.0        0.3     0.3       0.0    0.3
TSTK          10     NO   1.0        0.0     0.0       0.0    0.0
PHYSICAL                                               0.2    0.2
```

DFSORT Hints - Summary

- Use DSA as 128 without increasing Region ,it wont hurt but it will show you how much theoratic it can use and that you can benefit … Check ICEMNVLZ
- Check ICEINMRG field In Order To Decide Whether you need to increase Region Of A Job or Not
- Using memory objects for DFSORT cause more zIIP To Be Used
- Don't Increase TMAXLIM But Play With DSA
- Collect SMF16 – Can Be Formatted Using Sample Programs
- Even In Short Version,There Is Good Information

DB2 Utilities Hints Summary

Check DSNU397I message whether you can get benefit from parallelism by increasing Region Size Or NOT
This Message Shows Performance Degragation Related To Virtual Storage Usage

IBM recommends not to use SORTNUM but leave decision to code

Recommendation For In Main Storage available to DFSORT setting ,Region
- **1 GB data can well be sorted in 10 MB of memory**
- **10 GB data should already have around 30 MB of memory**
- **100 GB data should have at least 70-80 MB memory available**

For Steps that is using DB2 utilities, don't check smf30eur (USRZHI) where DB2 utilities are doing getmain to check available memory in order to decide how many TCBs can be created.

Default Region Change Effect

DFSORT Message:
ICE247I Intermediate Merge Entered - Performance May be Degragated

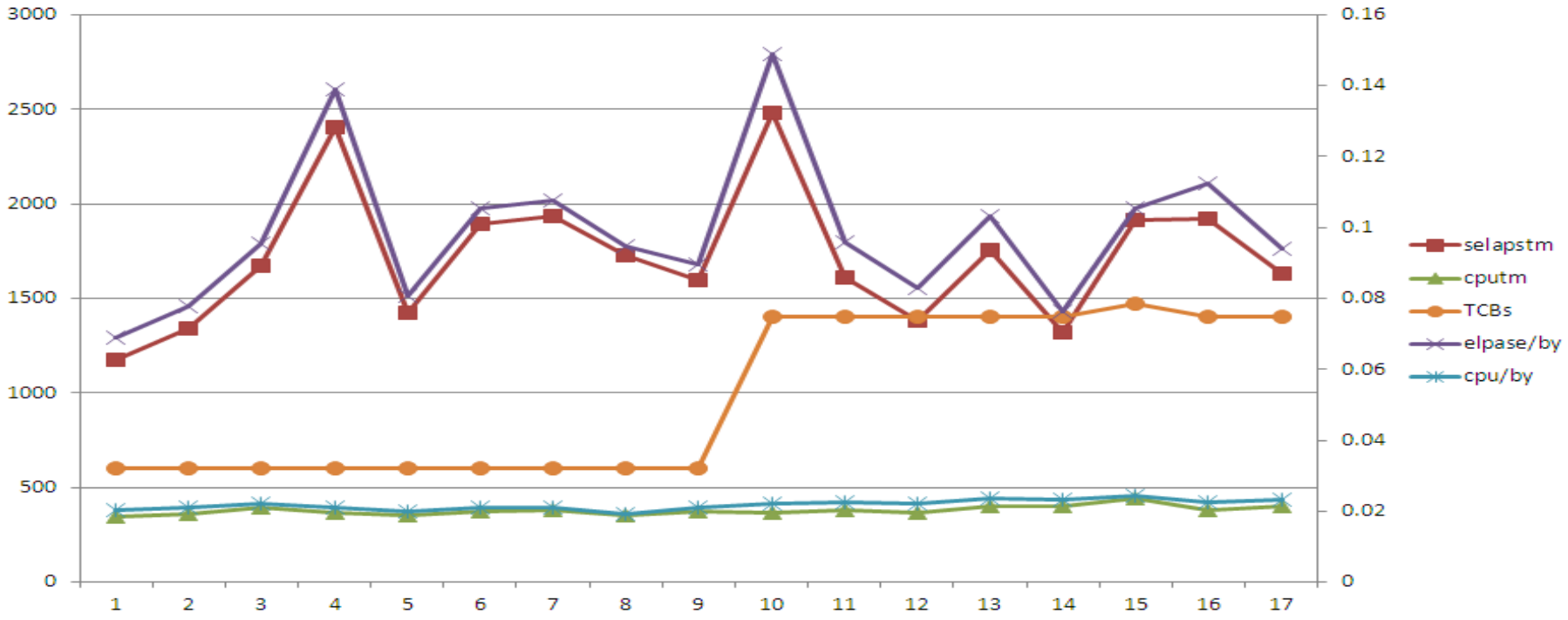
SMF16 Record : ICEINMRG

DB2 Utilities Message:
DSNU397I NUMBER OF TASKS CONSTRAINED BY VIRTUAL STORAGE

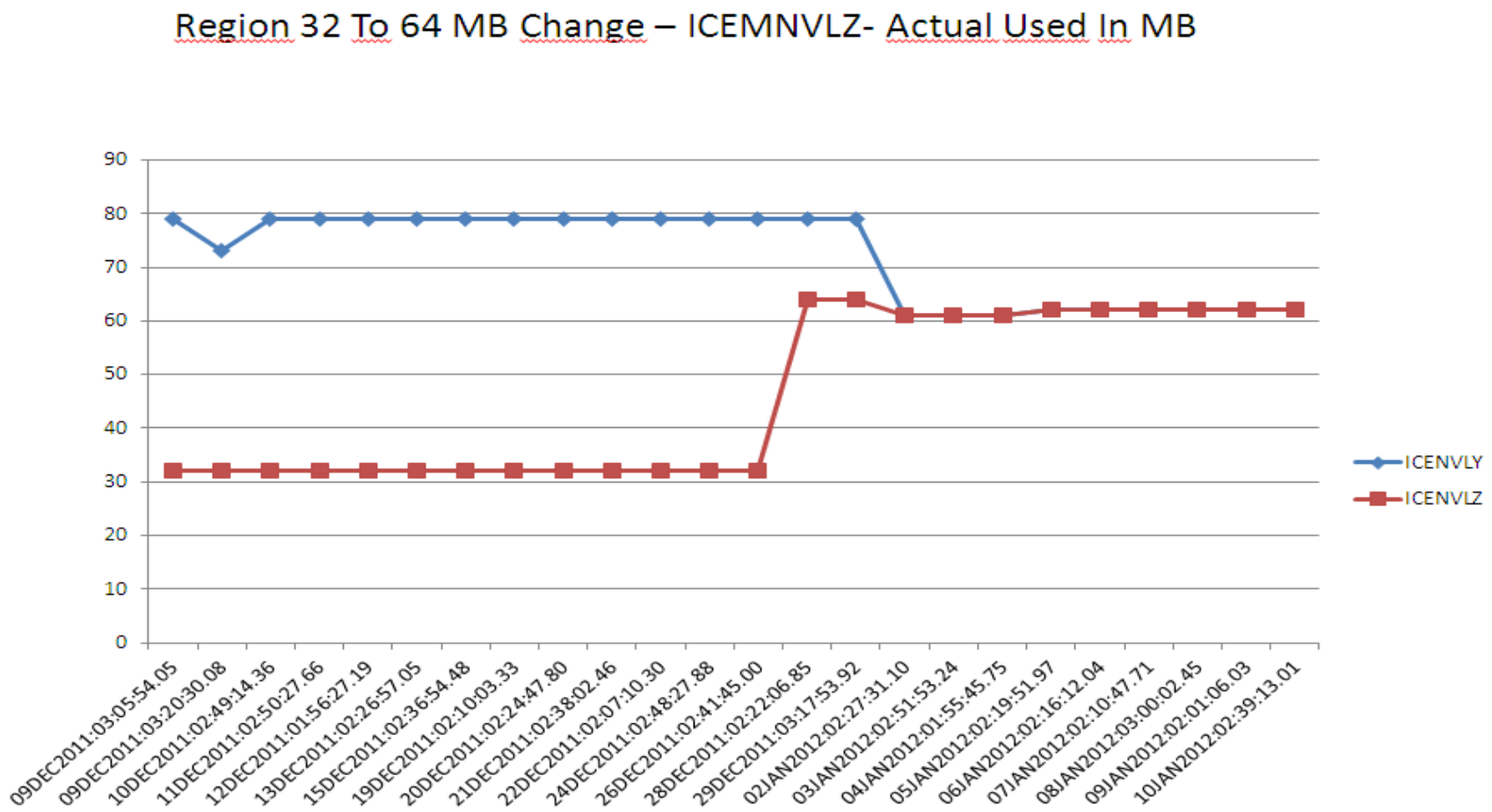
SHARE Requirement About REGION paramater - IEFUSI Exit : SSMVSE99007

Default Region Change Effect

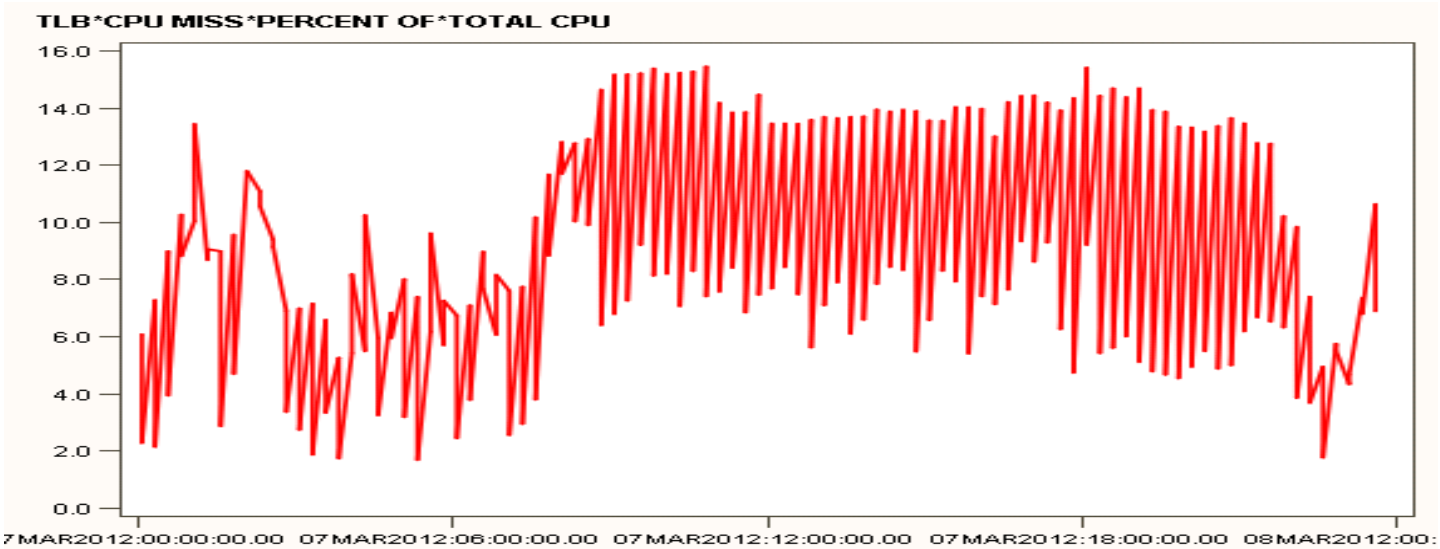
Sample Job With similiar size of data each day – TNSLPRCI
3 subtasks ,each with 10 TCBs ,20 steps
6 subtasks,each with 14 TCBs,20 steps



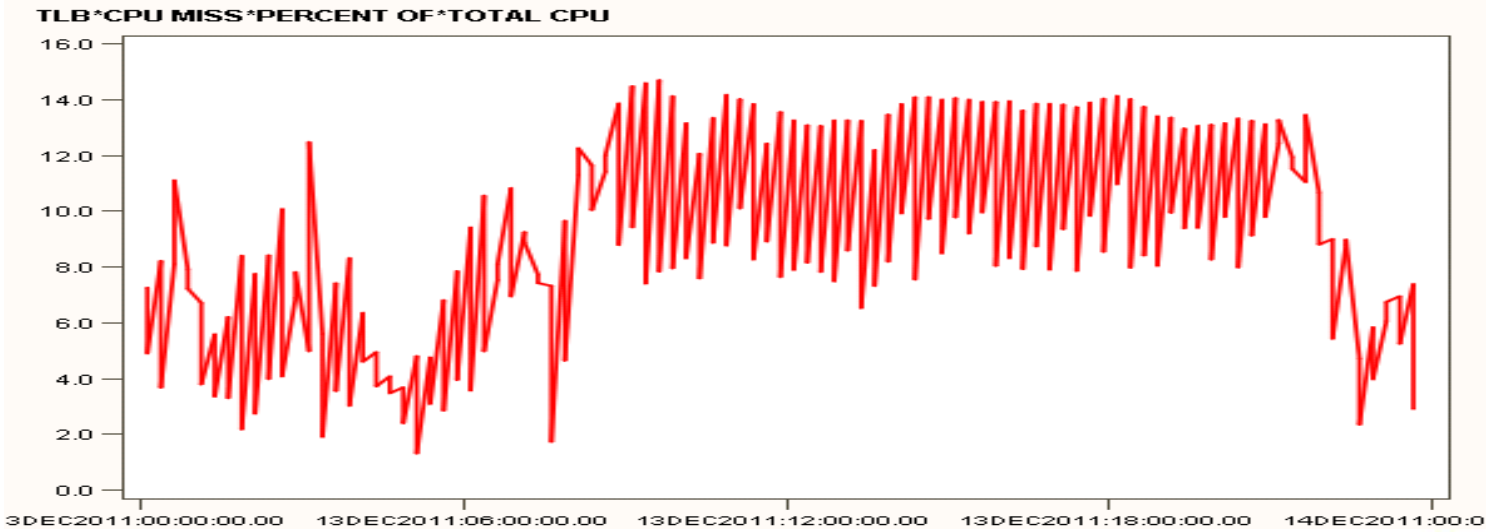
Default Region Change Effect



SMF113 TLB1 Misses



Before



After

SMF113 TLB1 Study Of IBM

*** *New - This is an evolving use of CPU MF* ***

CPU MF can help measure the impact of 1 MB Pages in your environment

Test	CPI	PRBSTATE	Est Instr Cmplx	Est Finite CPI	Est SCPL1M	L1MP	L15P	L2LP	L2RP	MEMP	Rel Nest Intensity	LPARCPU	GHz	TLB1 Miss CPU% of Total CPU	TLB1 Cycles per Miss	PTE% of all TLB1 Misses
DB2 V10 4K PageFix=YES	4.46	1.29	2.63	1.83	26	7.13	94.72	4.64	0.01	0.63	0.09	28.2	4.4	16.0	83	19.2
DB2 V10 1MB PageFix=YES	4.26	1.13	2.58	1.68	23	7.25	96.56	3.03	0.01	0.41	0.06	33.9	4.4	15.6	65	13.7
	1.05					0.98	0.98	1.53						1.03	1.28	1.40

- **DB2 10 for z/OS Beta provides ability to specify 1 MB Pages for DB2 Buffer Pools**
- **1 MB Pages can help reduce TLB Page Table Entry Misses**
- **CPU MF can be used to help measure the 1 MB Page impact for your environment**
  - DB2 10 for z/OS Beta Customer ran DB2 Batch job that exercised 4k and 1MB pages (PageFix=Yes). LFArea=40M
    - The batch job executed 30M Selects, 20M Inserts, and 10M Fetchs
  - *CPU MF showed the following – but this is not necessarily representative of 1 MB Page results*
    - 40% reduction in Page Table Entry % (PTE) of all TLB1 Misses
    - 28% reduction TLB1 Cycles per Miss, 3% reduction TLB1 Miss CPU% of Total CPU
    - Lower CPI and Nest Intensity
    - DB2 Accounting report showed 1.4 % reduction in CPU time

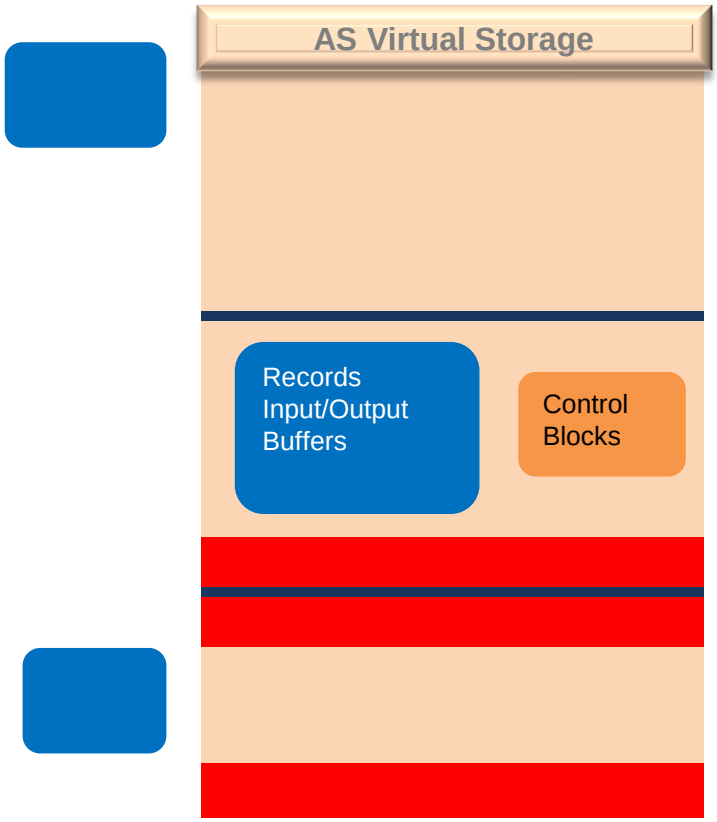
Warning: These numbers come from a synthetic Benchmark and do not represent a production workload

- **As you implement 1 MB Page exploiters, use CPU MF to help measure the impact**
  - **Measure it in its intended Production LPAR**

SORT Memory Usage 10 Methods

1. In Main Storage Sort
2. Basic Disk Work Sort
3. DataSpace Only Sort
4. DataSpace/Disk Sort
5. Memory Object Only Sort
6. Memory Object/Disk Sort
7. HiperSpace Only Sort
8. HiperSpace/Disk Sort
9. Memory Object Work Only Sort
10. Memory Object Work/Disk Work Sort

Sort Memory Usage – In Main Storage Sort



Related DFSORT Parameters

SIZE
TMAXLIM
DSA

Maximum Amount Of Virtual Storage Allocated HERE – (Above 16 MB)

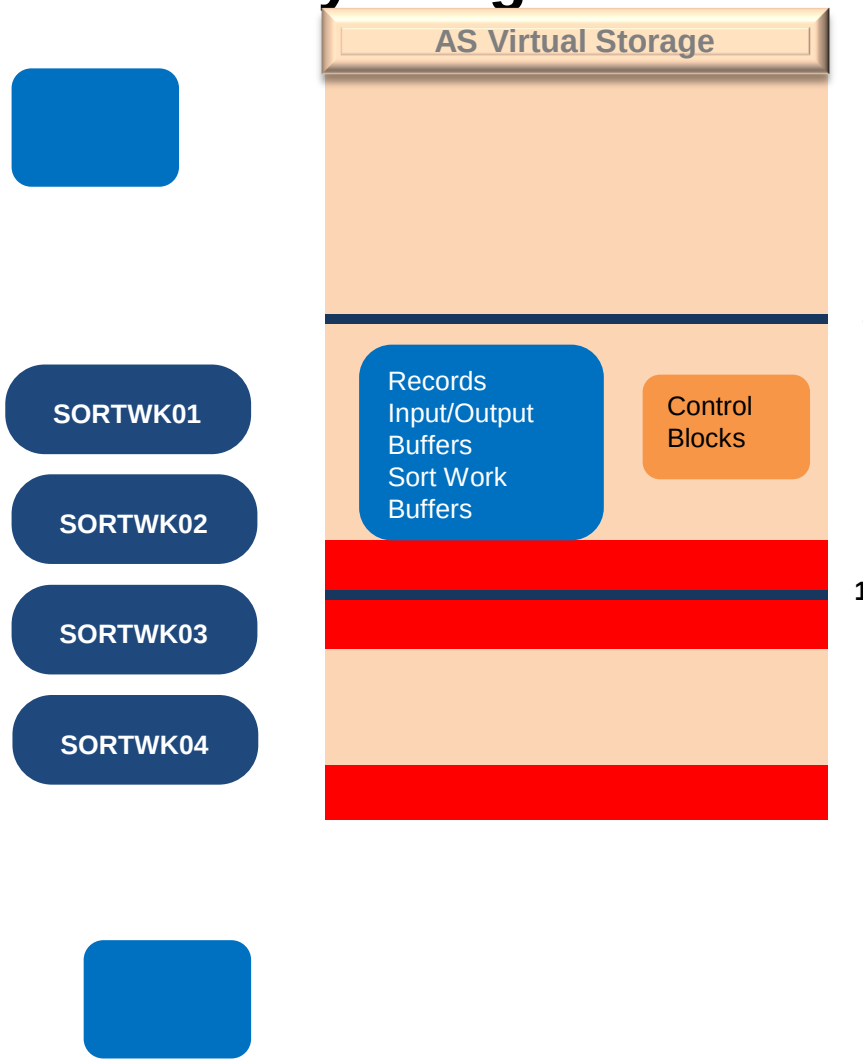
MVS –REGION Parameter

How To Monitor Performance & Usage

ICEMNVY,ICEMNVZ - SMF16 Record
CPUTIME
ELAPSETIME
ICEINMRG

Read Entire Sortin Into Main Storage
Sort The Data
Write 1 Sorted String Into Sortout

Sort Memory Usage – Basic Disk Sort Work



Related DFSORT Parameters

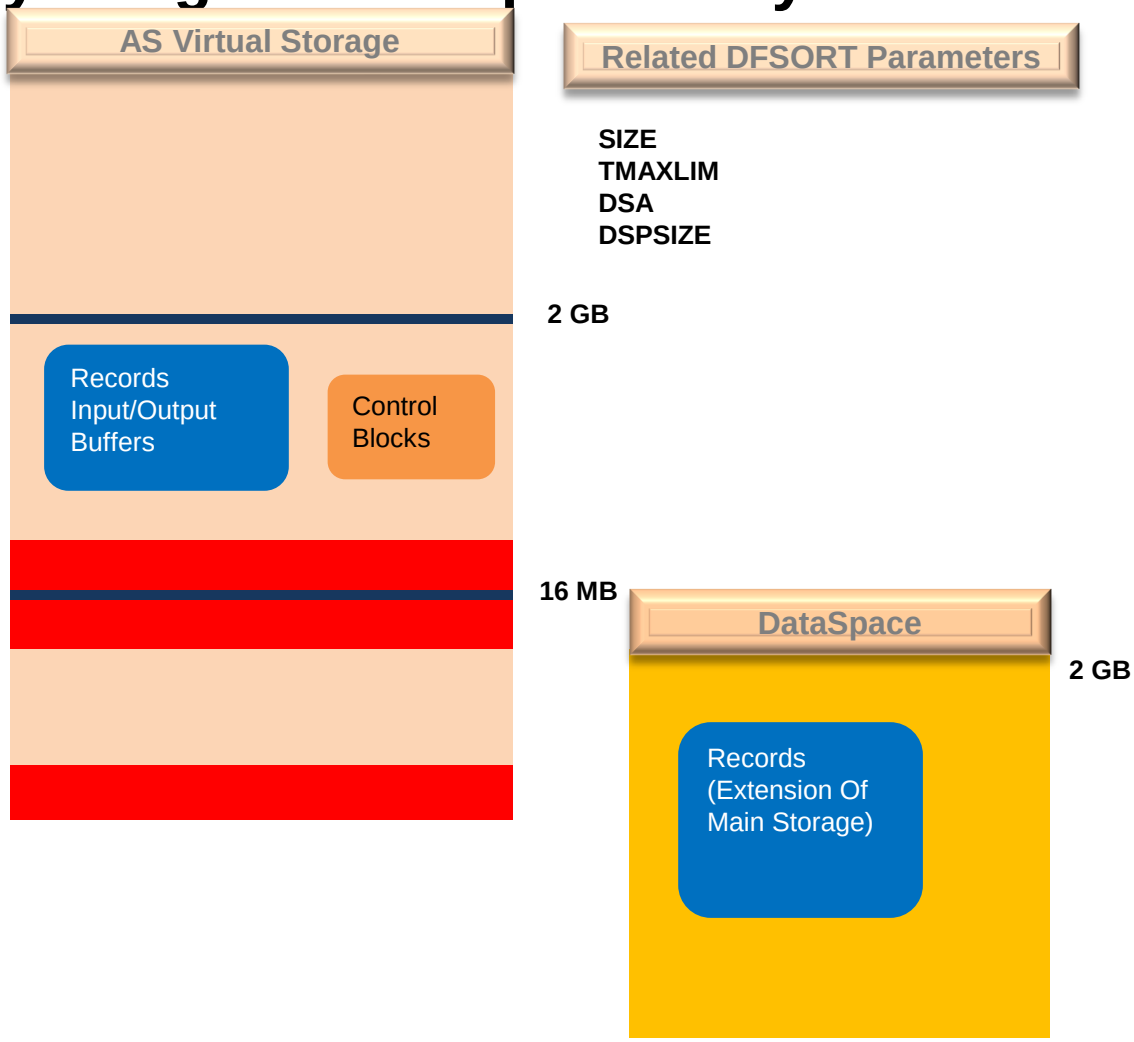
MVS –REGION Parameter

SIZE
TMAXLIM
DSA
DYNALLOC

1. **Read from SORTIN as much as fit in main storage**
2. **Sort the Data in main storage and write to SORT WORK**
3. **Read another bunch of records from SORTIN into main Storage**
4. **Sort current bunch of records and write sorted Data To SORT WORK**
5. **Repeat Steps Until end of SORTIN**
6. **Read sorted Data From SORT WORK and write to SORTOUT**

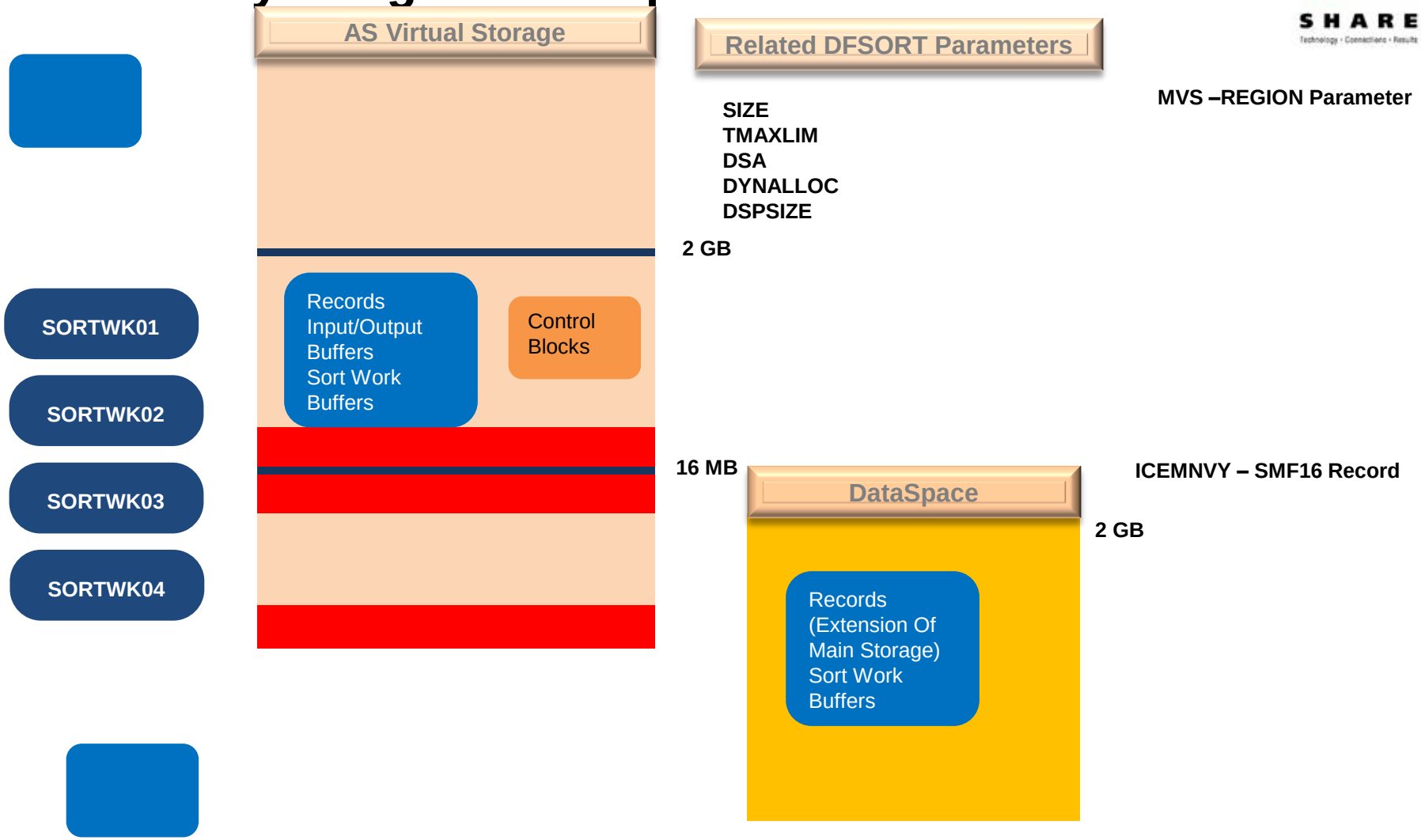
ICEMNVY,ICEMNVZ – SMF16 Record

Sort Memory Usage – DataSpace Only Sort

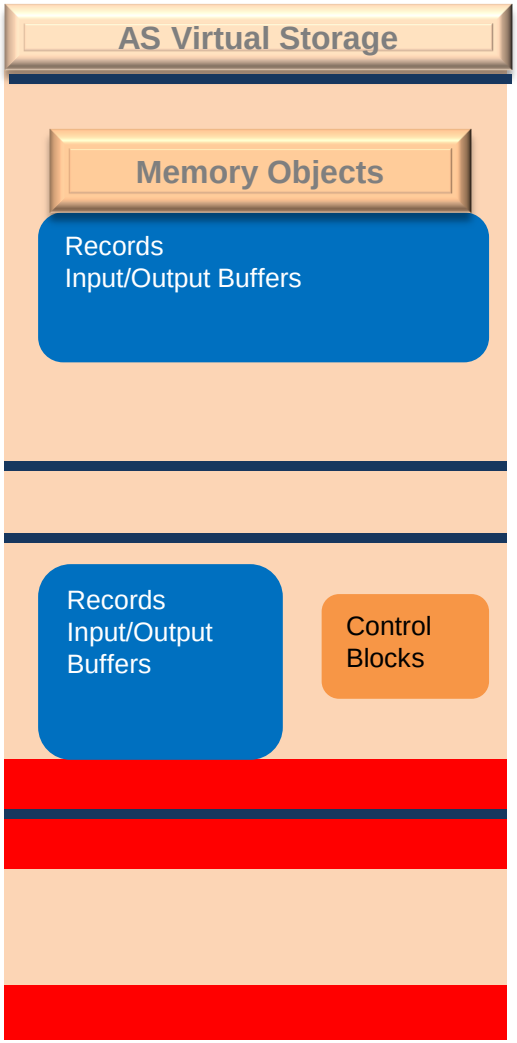


- Similar to In Main Storage except now a Dataspace is used as an extension of main storage
- This allows up to 2GB to be sorted entirely in a Dataspace

Sort Memory Usage – DataSpace/Disk Sort



Sort Memory Usage – Memory Object Only Sort



4 GB

2 GB

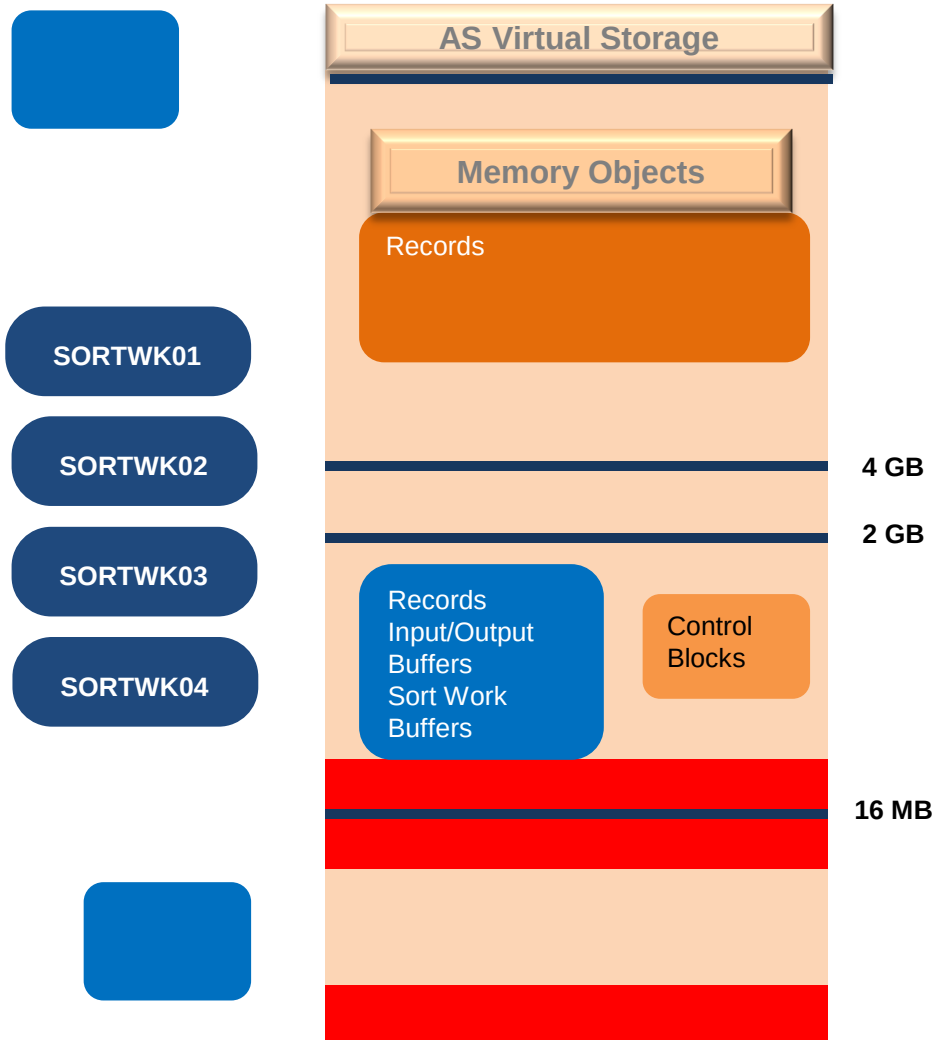
16 MB

Related DFSORT Parameters

SIZE
TMAXLIM
DSA
MOSIZE

MVS –REGION Parameter
MVS-MEMLIMIT Parameter

Sort Memory Usage – Memory Object/Disk Work Sort



Related DFSORT Parameters

SIZE
TMAXLIM
DSA
DYNALLOC
MOSIZE

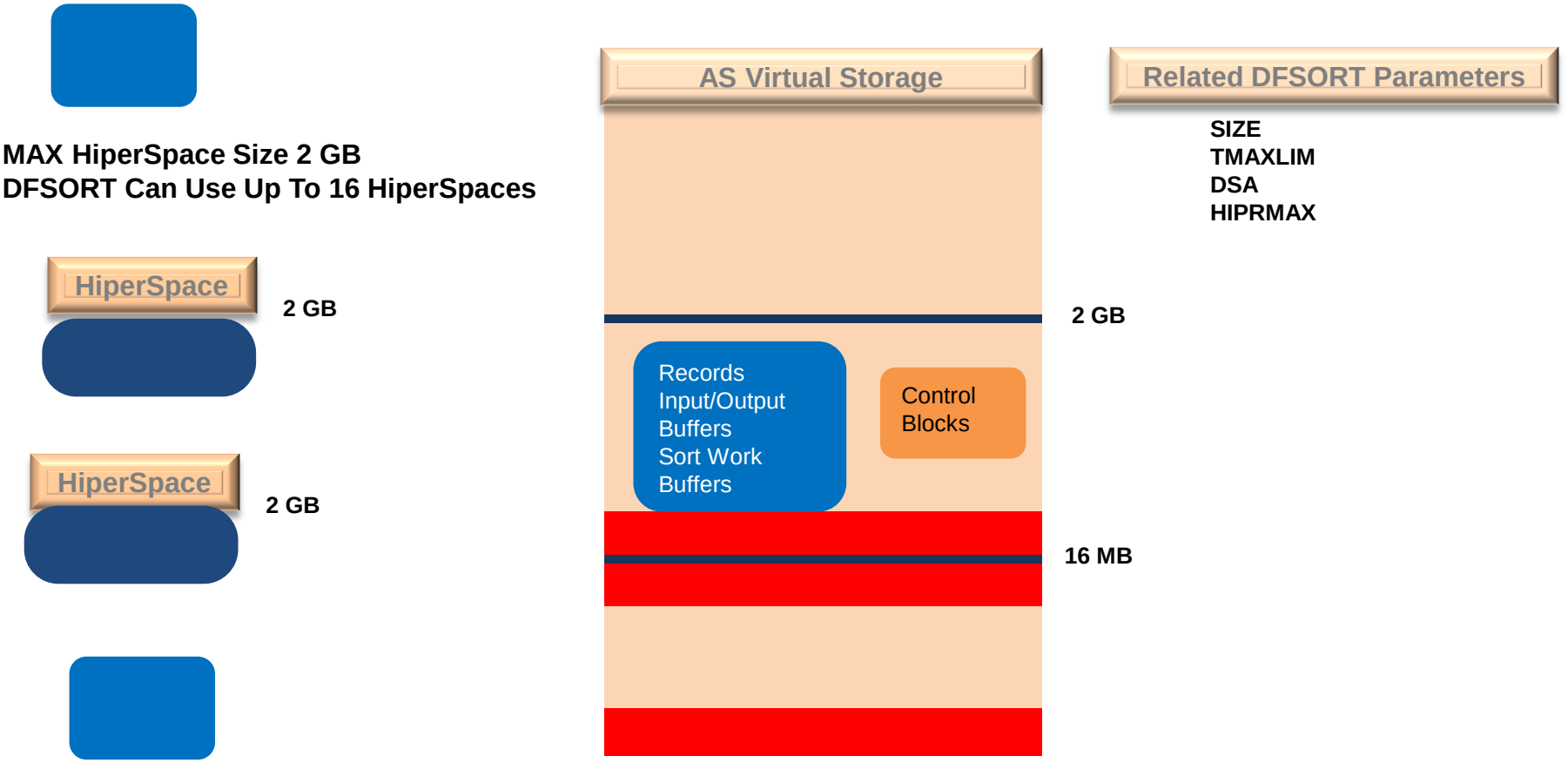
MVS –REGION Parameter
MVS-MEMLIMIT Parameter

This works much the same as Hiperspace sorting.
Max of 16 memory object work files.

Beginning with DFSORT V1R12, memory objects can also be used as intermediate work space.

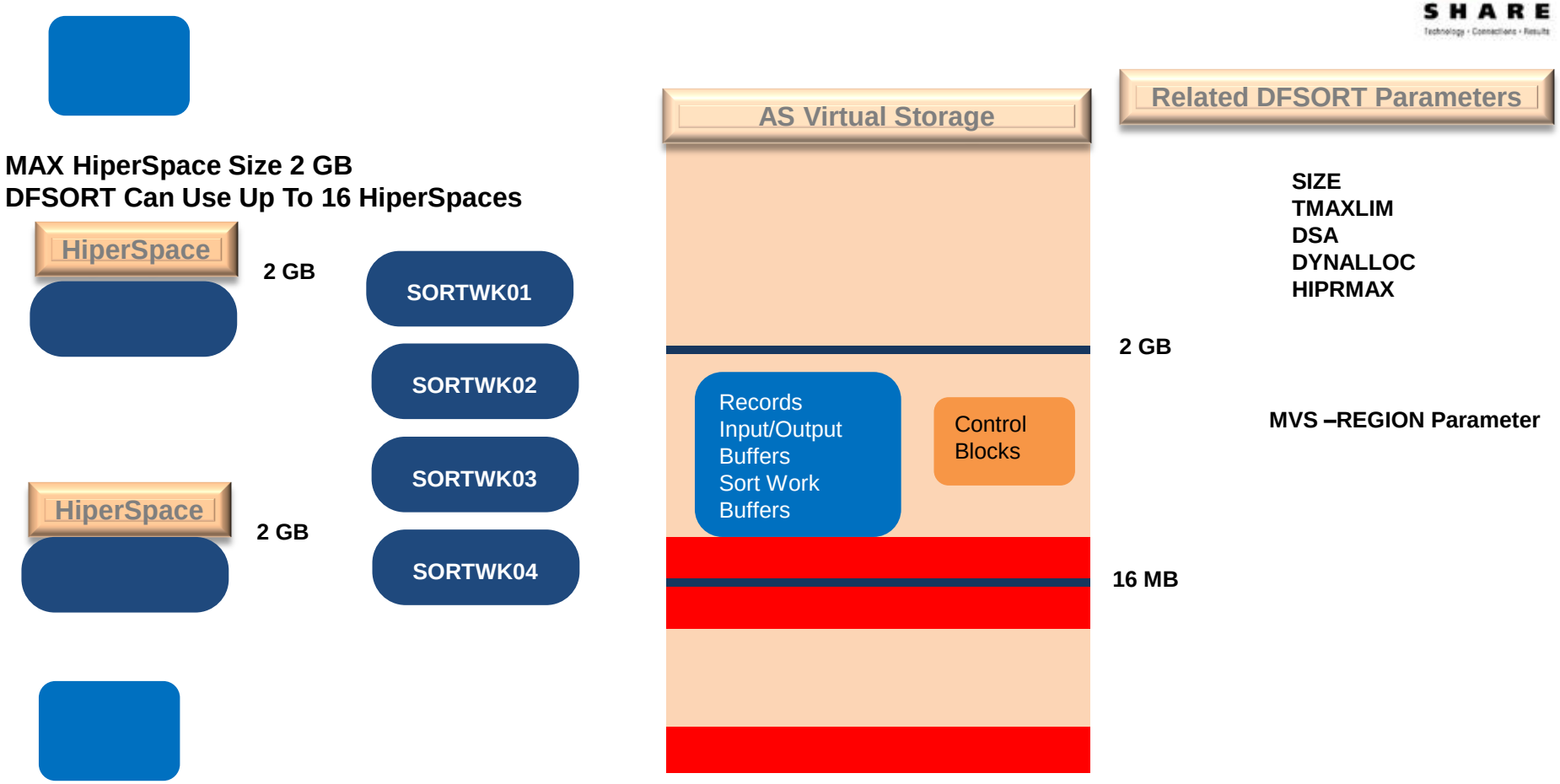
Sort Memory Usage – HiperSpace Only Sort

MAX HiperSpace Size 2 GB
DFSORT Can Use Up To 16 HiperSpaces



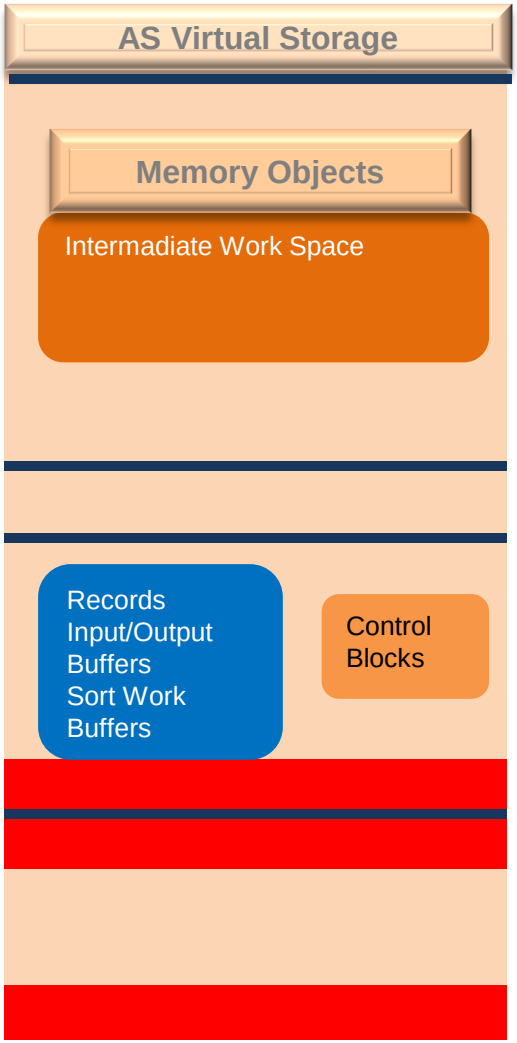
- Hiperspace is used as intermediate work space, <u>not as an extension of main storage</u>
- Data is sorted in main storage, similar to a Disk work sort.
- DFSORT Still writes the same amount of data to intermediate work space
- But now all of the data can be written to Hiperspace instead of Disk SORT WORK

Sort Memory Usage – HiperSpace/Disk Sort



- Hiperspace is used as intermediate work space, <u>not as an extension of main storage</u>
- Data is sorted in main storage, similar to a Disk work sort.
- DFSORT Still writes the same amount of data to intermediate work space
- But now some of the data can be written to Hiperspace instead of Disk SORT WORK

Sort Memory Usage – Memory Object Work Only Sort



4 GB

2 GB

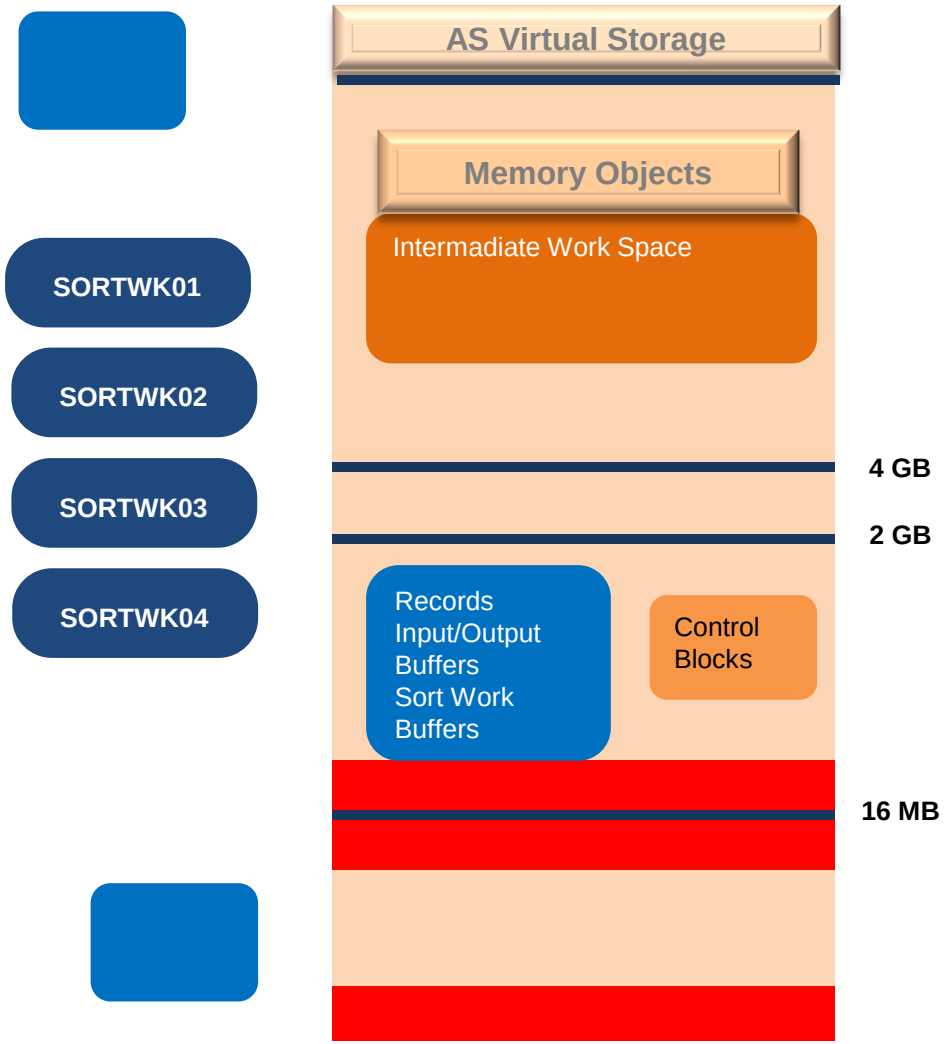
16 MB

Related DFSORT Parameters

SIZE
TMAXLIM
DSA
MOSIZE
MOWRK YES

MVS –REGION Parameter
MVS-MEMLIMIT Parameter

Sort Memory Usage – Memory Object Work /Disk Sort



Related DFSORT Parameters

SIZE
TMAXLIM
DSA
DYNALLOC
MOSIZE
MOWRK YES

MVS –REGION Parameter
MVS-MEMLIMIT Parameter

DFSORT Parameters Summary

DEFAULTS OVERWRITTEN BY ICEPRMXX PAMRLIB member

```
     SYS1.PARMLIB(ICEPRMPF)
**************************
    JCL
      SMF=SHORT
      EXPOLD=0
      EXPMAX=25000
      CFW=NO
      DYNALOC=(SYSDA,8)
    INV
      SMF=SHORT
      EXPOLD=0
      EXPMAX=25000
      CFW=NO
      GNPAD=IEB
      GNTRUNC=IEB
      DYNALOC=(SYSDA,8)
```

SAME INFORMATION IN SMF16 RECORDS
OR
USING ICETOOL- DEFAULTS LIST- Statement

SOME IMPORTANT PARAMETERS & VALUES LEFT DEFAULT

TMAXLIM 6MB
SIZE MAX
HIPRMAX Optimal
MOSIZE MAX
MOWRK YES
DSA 64
DSPSIZE MAX

References

- z/OS V1R8,V1R9,V1R10,V1R11,V1R12,V1R13 Implementation Redbook
- z/OS V1R12 Initialization And Tunning Guide
- IBM Research Papers z196 & LargePage Support
- RMF Books
- DFSORT Books
- SHARE Prezentations*** – Elpida Tzortzatos

Thanks To …

ELPHIDA TZORTZATOS

CHERYL WATSON – WATSON&WALKER

DAVID BETTEN - DFSORT DEVELOPMENT PERFORMANCE

CHRISTIAN MICHEAL – DB2 UTIILITIES DEVELOPMENT

JERRY KENYON – DB2 DEVELOPMENT

JUERGEN KUHN – RMF DEVELOPMENT

DIETER WELLERDICK – WLM DEVELOPMENT

CHRIS BAKER – CICS DEVELOPMENT

BARRY MERRILL – Merrill Consultant

THANK YOU !

Backup-VSM Storage Management Rules

- ✓ MVS manages storage through the use of subpools designed to accommodate a variety of storage needs
- ✓ Storage is allocated or assigned to a subpool in one page (4K) multiples
- ✓ Storage belonging to different **subpools** cannot occupy the same page
- ✓ Storage with different storage **keys** cannot occupy the same page
- ✓ Storage belonging to different **TCBs** cannot occupy the same page
- ✓ When there is not enough storage above the line to fulfill an above the line storage request, VSM will attempt to honor the request from below the line instead
- ✓ LSQA / SWA / high private pages may not intermix with user region pages
- ✓ Unless otherwise directed on the GETMAIN request, VSM will give out storage at the high end of the page first ??

Backup-Subpools

Private Subpool Attributes

- **Subpool numbers** 0 - 255
- **Storage protection** Keys 0 - 15

- **User Region** subpools
  - 0 - 132, 250 - 252
  - TCB-related
  - Keyed storage
  - **Un**authorized
  - General purpose subpools

- **High Private** subpools
  - 229, 230, 249
  - TCB-related
  - Keyed storage
  - Authorized
  - Special authorized application storage needs

- **LSQA**
  - 255 (mainly)
  - Fixed, key0 storage
  - Address space-related, not TCB-related

* See MVS Diagnosis: Reference, Chapter 8, for additional subpool information.