Migrating from z10 ICBs to z196 Infiniband- a Detailed Performance Study and User Experience

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Garanti Technology

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Agenda

- Who is GT?
- GT-Parallel Sysplex Configuration
- General Information About PSIFB
- General Information About CF Request
  - Life Cycle Of CF Requests
  - How Does Sync/Async Heuristic Algorithm Work?
- Effect Of Upgrade To Performance Items
- RMF Mon III,I panels That Are Used and Key Fields
- More Information & Backup Slides
Who is GT?

- 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

- 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
Our Customers
Who is GT?

Number of Transactions / Day (mio.)

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Average daily txs.: 205 million
Peak daily txs.: 281 million
Average response time: 0.045 sec.

Average Login / Day ('000)

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Internet Average logins /day: 849,000
Internet Logins/day on peak days: 1,209,000
Internet Average response time: 22 msec.
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.
GT Is A Member Of …

- SHARE
- CMG
- GDPS Design Council
- zBLC
GT Parallel Sysplex Configuration
GT Parallel Sysplex Configuration - Hardware

**IBM zEnterprise Z96**
- 2817 M32-717
- 15076 MIPS/1816 MSU
- 2 x ICF
- 2 x zIIP
- 192 GB memory
- 2 x Crypto Express® cards
- 3 x OSA Express® GbE cards
- 5 x OSA Express® 1GbE
- 32 x FICON Express® adapters
- 1560 MSU CAP

**TS740 Virtual Tape (2)**
- 6 TB native capacity
- 256 virtual drive

**TS3500 Tape Library**
- 10 x TS1130 drive
- 25 x TS1120 drive
- 700GB and 1TB uncompressed media
- 2550 cartridge slots
- 5 frames

**Production Disk Subsystems**
- 4 x DS8700, 12.8 TB per box
- 4 x DS8300 Turbo 12.8 TB per box
- 2 x DS8300 Turbo, 6.4 TB per box
- GPDSPPRC, GPDPSXRC, HyperPAV zHPF
- 128GB (4), 256GB (6) cache per box
- 24 (4) and 32 (4) FICON adapters per box

**Archive and TEST Disk Subsystems**
- 3 x DS8300, 6.4 TB per box
- 1 x DS8700, 85 TB
- GPDSPPRC, GPDPSXRC, PAV
- 256GB (1), 128GB (2), 64GB (1) cache per box
- 24 FICON adapters per box

240 TB
GT Parallel Sysplex Configuration - LPARS

Production Sysplex

z/OS 1.12
DB2 V9
CICS TS 3.2
GT Parallel Sysplex Configuration - ICFs & CF Links z10

2 ICB4 physical links For Each LPAR

TOTAL 14 Subchannel – IC
14 Subchannel – ICB4
For Each LPAR- CF Connection

2 ICB4 physical links For Each LPAR
GT Parallel Sysplex Configuration - ICFs & CF Links z196

2 IC links Per each LPAR

3 PSIFB physical links For Each LPAR

TOTAL 14 Subchannel – IC
21 Subchannel – PSIFB
For Each LPAR - CF Connection

3 PSIFB physical links For Each LPAR
z196 Infiniband Adapters & Chpids

GAR1

6 Infiniband Adapters
12 Physical Ports/Links

GAR2

6 Infiniband Adapters
12 Physical Ports/Links
z196 Infiniband Adapters & Chpids

3 PSFIB Adapters + 3 PSFIB Adapters

Infiniband Also But For CPU- I/O CAGE Interface
z196 Infiniband Links - CHPIDs

In one Infiniband adapter card, there are 2 ports.

Port 1:
- One physical connection (link)
- One cable (Transmit/Receive)

Port 2:
- One physical connection (link)
- One cable (Transmit/Receive)

Figure 2-10: Optical InfiniBand cable, including TX and RX labels.
More subchannels per physical link BY HAVING A CHANCE TO DEFINE MORE THAN ONE CHPID FOR SAME PHYSICALLY CONNECTION!

Subchannel Limit For One CHPID Is Still 7

Up To 16 CHPIDs Across The Two Ports Of Single InfiniBand Coupling HCA (Adapter)
z196 Infiniband Cables & CHPIDs

GAR1 CHPID 00-0D For z/OS, 90-9D For CF

CHPID 00
CHPID 01
CHPID 02
CHPID 03
CHPID 04
CHPID 05
CHPID 06

Port 1
Port 2
R T R T

CHPID 90
CHPID 91
CHPID 92
CHPID 93
CHPID 94
CHPID 95
CHPID 96

PRDD
PRDB
PRDG

GAR2 CHPID 00-0D For CF, 90-9D For z/OS

CHPID 00
CHPID 01
CHPID 02
CHPID 03
CHPID 04
CHPID 05
CHPID 06

Port 1
Port 2
R T R T

CHPID 90
CHPID 91
CHPID 92
CHPID 93
CHPID 94
CHPID 95
CHPID 96

PRDD
PRDB
PRDG

PRDA
PRDC
PRDE
z196 Where Are My ICFs?

GAR1

---

**Book01** 14 CPU 2 zIIPs 3 SAPs

---

**Book03** 3 CPU 2 ICFs 3 SAPs
### z196 Where Are My ICFs?

**GAR2**

- **Node Number (Phys):** 03 03 03 03 03 03 03 03 03 03 03 03 03 03 03 03
- **Core Number:** 24 14 15 25 17 18 19 1A 1B 1C 1D 1E 1F 20 21 22 23 24 25
- **IPU Number:** 300 301 302 303 304 305 306 307 308 309 30A 30B 30C 30E 30F 310 311 312 313 314
- **EPR Number:** 00 14 15 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

**Operation Mode CPU:**

- **ICF:** 14 15
- **SAP:** 00
- **XAP:** 00
- **IFL:** 00
- **ZAAP:** 00
- **ZTIE:** 00

**Dedicated:**

- **Operation:** Y Y Y Y Y Y Y Y Y Y Y Y Y Y
- **Clock Stopped:** Y Y Y Y Y Y Y Y

---

**Book01 15 CPU 1 zILP 3 SAPs**

**Book03 2 CPU 2 ICFs 3 SAPs**
GT Parallel Sysplex Configuration - Structures

- DSNPD01_GBP0
- DSNPD01_GBP1
- DSNPD01_GBP16K0
- DSNPD01_GBP16K1
- DSNPD01_GBP2
- DSNPD01_GBP21
- DSNPD01_GBP22
- DSNPD01_GBP23
- DSNPD01_GBP24
- DSNPD01_GBP31
- DSNPD01_GBP32
- DSNPD01_GBP32K
- DSNPD01_GBP33
- DSNPD01_GBP34
- DSNPD01_GBP5
- DSNPD01_GBP6
- DSNPD01_GBP7
- DSNPD01_GBP8K0
- DSNPD01_LOCK1
- DSNPD01_SCA

- DSNPDRM_GBP0
- DSNPDRM_GBP1
- DSNPDRM_GBP2
- DSNPDRM_GBP8K0
- DSNPDRM_LOCK1
- DSNPDRM_SCA

- EZBEPORT
- EZBEPORT0111
- EZBEPORT0113
- ISTGENERIC

- DFHNCLS_PRODNC1
- DFHXQLS_PRODTSQ1
- LOG_DFHLOG_WUI
- LOG_DFHSHUNT_WUI

- PQS1APPLSTR
- PQS1CSQ_ADMIN
- PQS1FFMCSTR
- PQS1FFMDSTR
- PQS1LOGOSTR
- PQS1OLASTR
- PQS1OTPSTR
- PQS1SMSSTR
- PQS1SYSPSTR
- PQS1UTLSTR

- IXCSIG1
- IXCSIG11
- IXCSIG2
- IXCSIG21
- IXCSIG3
- IXCSIG31
- IXCSIG4
- IXCSIG5
- IXCSIG6
- IXCSIG7

- CKPT1
- RLS_APL1
- RLS_APL2
- RRSSTR1
- SYSARC_HSMPP_RCL
- SYSIGGCAS_ECS
- SYSTEM_OPERLOG
- SYSZWLM_0E162817
- SYSZWLM_0E262817
- HSA_LOG
- HZS_HEALTHCHKLOG
- IBMBDG
- IGWLOCK00
- ISGLOCK

- TOPSTR1
GT-CF Configuration – z196

- 179 Structures Defined In CFRM Policy
- 27205 MB Storage In Each CF

Average CF Request Rate / Workload

20-06-2011

- System: $24,573,947 - 11.68%
- MQ Series: 275,730,417 - 3.54%
- DB2 Lock & SCA: 3,022,089,968 - 38.85%
- DB2 Group BufferPool: 3,424,755,173 - 44.03%
- CICS: 131,558,946 - 1.69%
General Information About PSIFB
Infiniband Technology - Drivings Of Innovation (WHY?)

Problem

Efficient Systems Must Provide Balance Between
• CPU Performance
• Memory Bandwidth
• I/O Capabilities

Semiconductor Technology Evolves Much Faster Than I/O Interconnect Speed.
New Technology is needed to keep up with the speed of processors

Solution

In 1999 Two Competing I/O Standards called
• Future I/O (Developed By Compaq, IBM, HP)
• NextGeneration I/O (Developed By Intel, Microsoft, Sun)
Merged Into Unified I/O Standard Called INFINIBAND

InfiniBand offers a powerful interconnect architecture that by its nature is better able to scale with increasing processor speeds. Up to 120 Gbps

http://www.infinibandta.org/itinfo/IL
Infiniband Technology - Advantages

✓ Superior Performance – Up To 120 Gbps
✓ Reduced Complexity
✓ Highest Interconnect Efficiency
✓ Reliable & Stable Connection

☐ First Used As Connection Between Books & I/O Cage, starting with z10.
☐ With z10 and supported by z9 also, it started to be used as CF link.

BUT!
Infiniband As Coupling Link Choice - PSIFB

Coupling Link Choices - Overview

- ISC (Inter-System Channel)
  - Fiber optics
  - I/O Adapter card
  - 10km and longer distances with qualified WDM solutions

- ICB (Integrated Cluster Bus)
  - Copper cable plugs close to memory bus
  - 10 meter max length
  - Not available on z196

- IC (Internal Coupling Channel)
  - Microcode - no external connection
  - Only between partitions on same processor

- PSIFB (12x IB)
  - 150 meter max distance optical cabling
  - Supports multiple CHPIPs per physical link
  - Multiple CF partitions can share physical link

Relative Performance
Based on avg data xfer size

3x
2.2x
4x
1x
PSIFB Configuration Advantages

- Pure Capacity
  - 1 12x PSIFB replaces 1 ICB4
  - 1 12x PSIFB replaces 4 ISC3s
- Eliminating subchannel and path delays
  - Often >2 ICB4s configured not for capacity but for extra subchannels/paths to eliminate delays
  - 2 12x PSIFB links with multiple CHPIDs can replace >2 ICB4s in this case
- Multiple sysplexes sharing hardware
  - Production, development, test sysplexes may share hardware – each needs own ICB4 or ISC3 links
  - 2 PSIFB links with multiple CHPIDs can replace >2 ICB4s or ISC3s in this case
- Multiple CHPID recommendations
  - Max 16 per HCA (2 ports per HCA)
    - Use up to all 16 for lightly loaded connectivity
    - Limit to use up to 8 per HCA for heavy loads
PSIFB Configuration Disadvantages

In Every Document – There Is One NOTE

Note: The InfiniBand link data rates of 6 GBps, 3 GBps, 2.5 Gbps, or 5 Gbps do not represent the performance of the link. The actual performance is dependent upon many factors including latency through the adapters, cable lengths, and the type of workload. With InfiniBand coupling links, while the link data rate may be higher than that of ICB (12x IB-SDR or 12x IB-DDR) or ISC-3 (1x IB-SDR or 1x IB-DDR), the service times of coupling operations are greater, and the actual throughput may be less than with ICB links or ISC-3 links.

So As Expected IBM, Recently Created A New Adapter & Protocol
New PSIFB Protocol & Infiniband Fanout Cards

New 12x InfiniBand fanout cards, exclusive to z196 and z114

Two protocols (IFB & IFB3)
1. 12x IFB = HCA3-O to HCA2-O
2. 12x IFB3 = HCA3-O to HCA3-O (see below)
   • Improved service times, 12x IFB3 service times are designed to be 40% faster than 12x IFB

12x IFB3 protocol activation requirements
- Maximum of four CHPIDs per HCA3-O port
  • If more than four CHPIDs are defined per port, links will run at normal 12x IFB service times
  • IFB3 protocol activated as long as 4 CHPIDs or less are defined. No configuration settings required.
  • Performance considerations may reduce the number of CHPIDs per port

Note: The InfiniBand link data rates of 6 GBps, 3 GBps, 2.5 Gbps, or 5 Gbps do not represent the performance of the link. The actual performance is dependent upon many factors including latency through the adapters, cable lengths, and the type of workload.

Thanks To Riaz Ahmad For This Slide
Life Of A CF Request
CF Syncronous Request Flow -1

1. Formats a Request To A Structure by Issuing Related XES Macros
   - IXLCACHE/IXLLSTE/IXLLSTM
   1a. Pass Buffers For Read/Write Request
   1b. Builds a Parameter List

2. Branch To XES Service Module

3. Builds a CF REquest Work Element
   - Verifies callers parameters
   - Obtains Real Storage Addresses for Data Areas
   - Establish Central Storage Binds for pageable storage to keep the pages in central storage while HW is referencing it.
   
4. Branch To XES Module & Passes CF Request Work Element

5. Executes CF Request Work Element
   5a. Determine Which CF To Target CF Request
   5b. Obtain Subchannel For That CF
   5c. Determine if Request Should be processed ASYNC or SYNC based on Heuristic & Requestors Specified MODE
CF Sycronous Request Flow-2

**REQUESTED AS**
- IXLCACHE/IXLSTE/IXLLSTM

**XCFAS**
- Executes CF Operation
- Picks The Best Path To Send The Operation (Choose Path using possible ones in Subchannel CHANNELS)

**Common Area XES Modules**
- XES Module
  - Send Command To Channel Subsystem To Execute At CF
  - SAP
    - CHANNLES(For z/OS LPAR)
    - Link Buffers
    - SAP has special Code For CF operations- (Not same as normal I/O)

**IXLCACHE/IXLSTE/IXLLSTM**
- HSA(Memory)
  - Subchannel Work Queue
  - Command Result Send To z/OS
  - CFCC Code
  - ICF

**IXLCACHE/IXLSTE/IXLLSTM**
- Subchannel Work Queue
- Memory
- (Assigned To CF LPAR)
- Structure Data
- Subchannel
- Subchannel
- Subchannel
- Subchannel
- Subchannel
- Subchannel
- Subchannel
- Subchannel
- Subchannel
- Subchannel
- Subchannel
- Subchannel

**IXLCACHE/IXLSTE/IXLLSTM**
- Link Buffers
- SAP
  - CHANNLES(For z/OS LPAR)
  - Link Buffers
  - Link Buffers
  - Link Buffers

**IXLCACHE/IXLSTE/IXLLSTM**
- Copy Result To Callers Answer Area
- Return To Caller

**IXLCACHE/IXLSTE/IXLLSTM**
- IXLCACHE/IXLSTE/IXLLSTM
- Copy Result To Callers Answer Area
- Return To Caller

**IXLCACHE/IXLSTE/IXLLSTM**
- IXLCACHE/IXLSTE/IXLLSTM
- Copy Result To Callers Answer Area
- Return To Caller
**CF Asynchronous Request Flow -1**

**1. Formats a Request To A Structure by Issuing Related XES Macros**
   - **1a.** Pass Buffers For Read/Write Request
   - **1b.** Builds a Parameter List

**2. Branch To XES Service Module**
   - Data Area Addresses
   - Connector Information
   - Structure Information
   - CF Request Obtained From Requester’s IXLCACHE Parameter List
   - Requester’s MODE Information

**3. Builds a CF REquest Work Element**
   - Verifies callers parameters
   - Obtains Real Storage Addresses for Data Areas
   - Establish Central Storage Binds for pageable storage to keep the pages in central storage while HW is referencing it.

**4. Branch To XES Module & Passes CF Request Work Element**

**5. Executes CF Request Work Element**
   - **5a.** Determine Which CF To Target CF Request
   - **5b.** Obtain Subchannel For That CF
   - **5c.** Determine If Request Should be processed ASYNC or SYNC based on Heuristic & Requestors Specified MODE

**Common Area SQA**
- **MOB**
- **MCB**
- **MRB**
- Busy Subchannel
- Free Subchannel

**SASH (Sync/Async Heuristic) Table**
- Dynamic Decisions

**Subchannel# Device, CHPID information**
CF Asynchronous Request Flow - 2

1. REQUESTED AS
2. Executes CF Operation
3. Picks the Best Path to Send the Operation (Choose Path using possible ones in Subchannel Channels (For z/OS LPAR))
4. SAP
5. Link Buffers
6. Send Command to Channel Subsystem to Execute at CF
7. Response is sent back to Z/OS
8. Operation is executed at CF
9. CFCC Code
10. Global Bit Set
11. Command Result Sent to z/OS
12. Copy Result to Callers Answer Area
13. Notify Caller

Common Area XES Modules

XES Module

6a. Issue Send Msg Command similar to SSCH
6b. Passes Subchannel Number & Address of MOB (Message Operation Block)

ICF

SAP

Channels (For z/OS LPAR)

Channels (For CF LPAR)

General Purpose Processor Dispatcher Code (pr/sm)
CF Request Types & Cases

- **SYNC - Immediate**
- **SYNC – Non Immediate**
- **ASYNC**

- **High Priority Queue**
- **Low Priority Queue**

- **IF Path Busy**
  - With new models ‘Path Busy’ can be detected before

- **SUBCHANNEL**
  - Changed To Async Because of no subchannel Non-heuristic
  - Changed To Async By Heuristic

- **LINK/PATH**
  - Reissue using same subchannel

- **CP**

- **NO SUBCHANNEL**
- **FREE SUBCHANNEL**

See NEXT Slide For
Field Locations
Of Service Times
In RMF report
Service Time is calculated as

\[ \text{Service Time} = \frac{\text{Delayed Time}}{\text{Utilization}} \]

Delayed Time is calculated as

\[ \text{Delayed Time} = \text{Service Time} \times (1 - \text{Utilization}) \]

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CPU COST OF CF REQUESTS

**Sync CF Requests**
- Requesting AS

**Async CF Requests**
- XCFAS
  - AS That Recognizes Request Is Completed

REQUESTING AS
Sync/Async Conversion
Sync/Async Conversion

- Subchannel Busy Condition
- Path Busy Condition
- Serialized List or Lock Contention

HEURISTIC

- Introduced with z/OS v1r2...
- CF Link Technology
- Types Of Workload – Variable Workload Amount
- Range Of CF Utilization, Shared CP or not, ...
- Actual Observed Sync Request Service Time
- Amount Of Data That Needs To Be Transfered
- Other items that effect CF response ex: Distance
- Moving Weighted Averages Of Actual CF Requests
- Every 1 of N Request not converted and send as Sync
How To Display sync/async Conversion Threshold Value
With z/OS V1R11 (APAR OA28603 for z/OS v1r8 and above)

PRDA D XCF,C
IXC357I 15.21.03 DISPLAY XCF 494
SYSTEM PRDA DATA
INTERVAL OPMETHOD MAXMSG CLEANUP RETRY CLASSLEN
165 165 2000 15 10 956
SSUM ACTION SSM INTERVAL SSM LIMIT WEIGHT MEMSTALLTIME
ISOLATE 0 60 100 0
CFSTRHANGTIME
NO
PARMLIB USER INTERVAL: 85
DERIVED SPIN INTERVAL: 165
PARMLIB USER OPMETHOD: 87
MAX SUPPORTED CFLEVEL: 17
MAX SUPPORTED SYSTEM-MANAGED PROCESS LEVEL: 17
SIMPLEX SYNC/ASYNC THRESHOLD: 26
DUPLEX SYNC/ASYNC THRESHOLD: 26
SIMPLEX LOCK SYNC/ASYNC THRESHOLD: 26
DUPLEX LOCK SYNC/ASYNC THRESHOLD: 26
CF REQUEST TIME ORDERING FUNCTION: INSTALLED
SYSTEM STATUS DETECTION PARTITIONING PROTOCOL ELIGIBILITY:
SYSTEM CANNOT TARGET OTHER SYSTEMS.
REASON: SYSPLEX COUPLE DATA SET NOT FORMATTED FOR THE PROTOCOL
SYSTEM IS NOT ELIGIBLE TO BE TARGETED BY OTHER SYSTEMS.
REASON: SYSPLEX COUPLE DATA SET NOT FORMATTED FOR THE PROTOCOL

Related To Heuristic Decision
How To Display sync/async Conversion Threshold Value

PRDE D XCF,C
IXC357I 15.22.57 DISPLAY XCF 859
SYSTEM PRDE DATA
INTERVAL OPNOTIFY MAXMSG CLEANUP RETRY CLASSLEN
165 165 2000 15 10 956
SSUM ACTION SSM LIMIT WEIGHT MEMSTALLTIME
ISOLATE 0 60 1 NO
CFSTRHANGTIME
NO
PARMLIB USER INTERVAL: 85
DERIVED SPIN INTERVAL: 165
PARMLIB USER OPNOTIFY: 87

MAX SUPPORTED CFLEVEL: 17
MAX SUPPORTED SYSTEM-MANAGED PROCESS LEVEL: 17
SIMPLEX SYNC/ASYNC THRESHOLD: 26
DUPLEx SYNC/ASYNC THRESHOLD: 26
SIMPLEX LOCK SYNC/ASYNC THRESHOLD: 26
DUPLEx LOCK SYNC/ASYNC THRESHOLD: 27
CF REQUEST TIME ORDERING FUNCTION: INSTALLED

SYSTEM STATUS DETECTION PARTITIONING PROTOCOL ELIGIBILITY:
SYSTEM CANNOT TARGET OTHER SYSTEMS.
REASON: SYSPLEX COUPLE DATA SET NOT FORMATTED FOR THE PROTOCOL
SYSTEM IS NOT ELIGIBLE TO BE TARGETED BY OTHER SYSTEMS.
REASON: SYSPLEX COUPLE DATA SET NOT FORMATTED FOR THE PROTOCOL
Performance Differences
### IBM - Sync Service Times For Different CF Link Types

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IBM POK CF Performance Group

IBM POK CF Performance Group Have Not Published Values For New 12XIFB3 Protocol Yet.
Z10 ICFs To z196 ICFs Utilization Change

Utilization Decreased by 40%
Z10 ICFs To z196 ICFs Utilization Change

Utilization Decreased by 30%.

CF Utilization - WeekDays Only - 00:00-03:00 Batch Period

Z10 To Z196 Upgrade

AVG % 14 Utilization

AVG % 20 Utilization

SHARE in Orlando 2011
Z10 ICFs To z196 ICFs MAX Utilization Change

Utilization Decreased by %34-%23

Online Time 8-12 14-18     29 To 19
Batch Period 0-8 & 18-24    36 To 28
Z10 & z196 CF Request Rates Online
Between 90.000 – 110.000 During 14:00 – 17:00 For Each Week-Day

Z10 To Z196 Upgrade

30-11-2010 To 7-3-2011
Average 96000 To 107300 CF Request Rate increased by %12
Z10 & z196 CF Request Rates Online

Range is wider than online 80,000 – 120,000 During 00:00 – 03:00 For Each Week-Day

Z10 To Z196 Upgrade
Asyncronous Request %

Async Request Percentage For DB2 GBP Structures 09:00-18:00 – Weekdays Only

Stacked Area Graph

18% Decreased In ASYNC %
Number Of Asynchronous Requests Converted by Non-Heuristic

Requests Changed To async by Non-heuristic Method For DB2 GBP Structures
09:00-18:00 – Weekdays Only - Stacked Area Graph

CHANGED Request Fields in RMF Report- `No subchannel` reason

Z10 – z196 Upgrade
~70% Decrease
Configuration Change Effect on # Of Async Requests For DB2 Lock Structure

Average # Of Async Requests For DB2 Lock Structure 09:00-18:00 – Weekdays

Z10 – z196 Upgrade

Probability of CF utilization decrease being main reason of this decrease is high
Configuration Change Effect on % Of Async Requests For DB2 Lock Structure

Async Request % For DB2 Lock Structures 09:00-18:00 – Weekdays

% 0.5 - % 2

Graph showing the percentage of async requests for DB2 lock structures over a specified period.
ASYNC Requests CPU USAGE CHARGED TO XCFAS Address Space

XCFAS CPU Usage APPL% - 20 sec interval avg of Each Weekday Online Time period - 09:00-12:00 & 14:00-18:00 Lunch Time Excluded

Without Normalization

AVG 3.03 APPL% z10
AVG 1.92 APPL% z196
SYNC Requests CPU USAGE CHARGED TO Requested AS: Sample IRLM

IRLM Address Spaces' CPU Usage(°CP/100) WeekDay OnlineTime Period

Without Normalization
ASync Requests Daily Online Period Average Service Times
Rule Of Thumb Path Busy < %10 Of Total Req

PCF1GAR1 Path Busy %

PCF2GAR2 Path Busy %
Rule Of Thump Delayed Request % < %10 Of Total Req

% Of Delay Requests - Daily Based Average
For Each Structure For Each System
Average( (#DelayedReq/#TotalReq)*100)
Rule Of Thumb: Delayed Request % < %10 Of Total Req

Max(Delayed Request %) Of Each Structure For Each Day, For Each System
### Host Cost (Data Sharing Cost)

Assumes 9 CF requests / MI

---

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<thead>
<tr>
<th>Host</th>
<th>z890 ISC</th>
<th>z990 ISC</th>
<th>z9 BC ISC</th>
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The table does not take into consideration any extended distance effects or system managed duplexing.

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Thanks To Gary King
Calculating Host Cost (Data Sharing Cost)

One can calculate the coupling intensity by simply summing the total req/sec of the CFs and dividing by the used MIPS of the attached systems (MIPS rating times CPU busy). Then, the values in the table would be linearly scaled. For example, if the workload was processing 4.5 CF operations per million instructions (or 4.5 CF ops/second/MIPS), then all the values in the table would be cut in half.
Calculating Host Cost (Data Sharing Cost)
Host Cost Before & After Upgrade – One LPAR

- **z10 – z196 Upgrade**
  - **ACTUAL** 43% Increase In Host Cost
  - **AFTER** Average 133 MIPS
  - **BEFORE** Average 93.3 MIPS
  - 10% Table
  - 14% Table
## Host Cost With New IFB3 Protocol

### Thanks To Riaz Ahmad For This Information

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CF SUBCHANNEL UTILIZATION

Calculate Yourself Using SMF Records

\[
\text{Utilization} \% = \frac{(((\text{Sync} \#\text{Req} \times \text{Sync service time}) + (\text{Async} \#\text{Req} \times \text{Async service time}))}{\text{Interval time} \times \#\text{Subchannels in use}} \times 100
\]

OR

Using RMF Overview Report

\[
\text{OVERVIEW(REPORT)}
\]

\[
\text{OVW(CF1P(SUBCHBP(PCF1GAR1)))}
\]

\[
\text{OVW(CF2P(SUBCHBP(PCF2GAR2)))}
\]

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<th>cfname</th>
<th>R744S$SRC</th>
<th>R744S$STM</th>
<th>R744S$ARC</th>
<th>R744S$ATM</th>
<th>R744F$SCU</th>
<th>((R744S$SRC \times R744S$STM) + (R744S$ARC \times R744S$ATM)) \times 100 / \text{Interval} \times R744F$SCU</th>
<th>$</th>
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</table>

| | | | | | | | | | | |
CF SUBCHANNEL UTILIZATION – ONE DAY

01.02.2011

PRDA  PRDB  PRDC  PRDD  PRDE  PRDF  PRDG  PRDW

01.02.2011

PCF1GAR1  PCF2GAR2

SHARE in Orlando 2011
Pivotor Product of Peter Enrico

http://www.epstrategies.com/sitex/index.php

CF Response Time Analysis - Average Sync Times by Lock Structure

SHARE in Orlando 2011
Understanding Data Types In Reports

- RMF Monitor I Post Processor Report Fields
- RMF Monitor I Overview/Exception Report Fields
- RMF Monitor III Report Fields
- SMF Record Fields (RMF Related Records 70-79)

If explanation in books is not clear,
- Cross Check Related Fields in Other Types Of Data
- Google It – For APARs, Redbooks, WSC Documents
- Ask IBM – Open PMR For Information Request
Sample: Path Busy Condition

SMF Record R744FPBC = 203

Output of RMF Post Processor Report With Statement “SYSRPTS(CF)”

| SYSTEM NAME | TOTAL | -- CF LINKS -- | PTH NAME | AVG/SEC | TYPE | GEN | USE | BUSY | -- SERVICE TIME (MIC) -- | REQUESTS |
|-------------|-------|----------------|---------|---------|------|-----|-----|-----|---------|----------------------|----------|
| PRDA        | 2116K | ICP            | 4       | 4       | 203  |     |     |     | SYNC    | 1402K                | 6.7      |
|             | 2351.3| SUBCH          | 56      | 28      |      |     |     |     | ASYNC   | 691604               | 80.6     |
|             |       |                |         |         |      |     |     |     | CHANGED | 212                  | 631.1     |
|             |       |                |         |         |      |     |     |     | UNSUCC   | 0                    | 0.0       |

Output of RMF Post Processor Overview/Exception Report With Statements

OVERVIEW(REPORT)
OVW(PTHBUS1(PBSY(PCF1GAR1)))
OVW(PTHBUS2(PBSY(PCF2GAR2)))

R744FBC/Interval = 203/(900 secs) = 0.22
RMF Mon I Post Processor Reports – CF Reports

Postprocessor Statement – SYSRPTS(CF) - See sample JCL in backup slides

- Coupling Facility Usage Summary
- Coupling Facility Structure Activity
- Subchannel Activity
**RMF Subchannel Activity Section**

Service Times Do NOT include Delay Times

---

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>TOTAL</th>
<th>CF LINKS</th>
<th>PTH</th>
<th>AVG/SEC</th>
<th>TYPE</th>
<th>GEN</th>
<th>USE</th>
<th>BUSY</th>
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## COUPLING FACILITY USAGE SUMMARY

### STRUCTURE SUMMARY

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<tr>
<th>TYPE</th>
<th>STRUCTURE NAME</th>
<th>STATUS</th>
<th>CHG</th>
<th>ALLOC SIZE</th>
<th>% OF CF</th>
<th>% OF ALL STOR</th>
<th>% OF UTIL</th>
<th>AVG REQ/SEC</th>
<th>LST/DIR ENTRIES TOT/CUR</th>
<th>DATA ELEMENTS TOT/CUR</th>
<th>LOCK ENTRIES TOT/CUR</th>
<th>DIR REC TOT/CUR</th>
<th>DIR REC XI'S</th>
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<tr>
<td>LIST</td>
<td>DSNPDAM_SCA</td>
<td>ACTIVE</td>
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<td>0.0</td>
<td>2400</td>
<td>0.0</td>
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<td>2.67</td>
<td>11K</td>
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<td>159K</td>
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<td>HSA_LOG</td>
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<td>14M</td>
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<td>0.00</td>
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### RMF CF Usage Summary Section

At the end of this section, Summary part exists

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<th>STRUCTURE TOTALS</th>
<th>136</th>
<th>47.5</th>
<th>47169K</th>
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#### STORAGE SUMMARY

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<tr>
<th></th>
<th>ALLOC SIZE</th>
<th>% OF CF STORAGE</th>
<th>% IN USE</th>
<th>MAX % REQUESTED</th>
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<tr>
<td>TOTAL CF STORAGE USED BY STRUCTURES</td>
<td>12929M</td>
<td>47.5</td>
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<tr>
<td>TOTAL CF DUMP STORAGE</td>
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<td>TOTAL CF STORAGE AVAILABLE</td>
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#### TOTAL CF STORAGE SIZE

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<th>% ALLOCATED</th>
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<td>TOTAL CONTROL STORAGE DEFINED</td>
<td>27205M</td>
<td>47.7</td>
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<td>TOTAL DATA STORAGE DEFINED</td>
<td>0K</td>
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</table>

#### PROCESSOR SUMMARY

- COUPLING FACILITY: 2017, MODEL M32, CFLEVEL 17, DYNDISP OFF
- AVERAGE CF UTILIZATION (% BUSY): 14.0
- LOGICAL PROCESSORS: DEFINED 2, EFFECTIVE 2.0, SHARED 0, AVG WEIGHT 0.0
<table>
<thead>
<tr>
<th>SYSTEM NAME</th>
<th>AVG/SEC</th>
<th>TYPE</th>
<th>STATUS</th>
<th>REQUESTS</th>
<th>DELAYED REQUESTS</th>
<th>EXTERNAL REQUEST</th>
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<td>PRDA</td>
<td>992K</td>
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<td>1102</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>False cont 5615</td>
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<td>PRDB</td>
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<td>NO SCH 13</td>
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<td>Cont 25K</td>
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<td>False cont 9839</td>
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### RMF Structure Activity Section

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<th>STATUS = ACTIVE PRIMARY</th>
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<td>SYSTEM NAME</td>
<td>TOTAL AVG/SEC</td>
<td>REQUESTS</td>
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<tr>
<td>SYSTEM NAME</td>
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### Important SMF Fields Analyzed in SMF 74(4)

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<th>Field</th>
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<td>R744SARC</td>
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<tr>
<td>AVERAGE SERVICE TIME PER ASYNC</td>
<td>Average service time</td>
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<tr>
<td>SYNC REQUESTS</td>
<td>Requests</td>
<td>R744SSRC</td>
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<tr>
<td>AVERAGE SERVICE TIME PER SYNC</td>
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<td>REQUESTS CHANGED FROM SYNC TO ASYNC</td>
<td>Requests changed</td>
<td>R744SSTA</td>
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<td>REQUESTS QUEUED</td>
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<td>REQUESTS WAITING ON HI PRTY QUEUE</td>
<td>Requests waiting</td>
<td>R744SHTO</td>
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<td>REQUESTS WAITING ON LO PRTY QUEUE</td>
<td>Requests waiting</td>
<td>R744SLTO</td>
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<td>TIMES CF REQUEST FAILED DUE TO PATH BUSY</td>
<td>Times failed</td>
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<td>TOTAL REQUESTS FROM THIS SYSTEM</td>
<td>Total requests</td>
<td>R744FTOR</td>
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</table>
Special THANKS TO ..... 

GEORGETTE KURDT – IBM
Very Special Thanks to Georgette for her many help

GARY KING - IBM

CHERYL WATSON – Watson & Walker

PETER ENRICO - EPS Strategies

MARIANNE HAMMER – IBM

BARBARA WEILER – IBM
REFERENCES

- z/OS 1.12 Setting Up Sysplex
- IBM z/OS Parallel Sysplex Operational Senarios
- System z Parallel Sysplex Best Practices
- Coupling Facility Performance : A Real World Perspective
- z196 PR/SM Guide, z196 Technical Guide
- Previous SHARE presentations – Parallel Sysplex Update and many more...
- IBM WSC Papers & Flashes
- System 390 Parallel Sysplex Performance
- www.research.ibm.com
- IBM XES Related APARs – Really Good Information in APARs.
- www.freepatentsonline.com - For Understanding Alternatives At Least
MORE INFORMATION & BACKUP SLIDES
RMF Report Sample JCL * CF report

//SMT1RMF JOB MSGCLASS=X,CLASS=S,NOTIFY=&SYSUID,
//DUMPSMF EXEC PGM=IFASMFDP,REGION=1M
//DUMPIN DD DSN=SYS3.SMF.PRDA.MVSARC2,DISP=SHR
//DUMPOUT DD DSN=&DO,DISP=(NEW,CATLG),
// SPACE=(CYL,(500,10)),DCB=(LRECL=137,RECFM=VBA,BLKSIZE=1693)
//SYSPRINT DD SYSOUT=* 
//SYSIN DD * 
//INDD(DUMPIN,OPTIONS(DUMP))
//OUTDD(DUMPOUT,TYPE(70:79))
//START(1000)
//END(1015)
*/

//SORTSMF EXEC PGM=SORT
//SORTIN DD DSN=&DO,DISP=(OLD,DELETE)
//SYSSOUT DD SYSOUT=* 
//SORTOUT DD DSN=&SO,DISP=(,PASS),UNIT=SYSDA,
// SPACE=(CYL,(5,10))
//SORTWK01 DD SPACE=(TRK,200),UNIT=SYSDA
//SORTWK02 DD SPACE=(TRK,200),UNIT=SYSDA
//SORTWK03 DD SPACE=(TRK,200),UNIT=SYSDA
//EXITLIB DD DSN=SYS1.SERBLINK,DISP=SHR
//SYSIN DD *
//SORT FIELDS=(11,4,CH,A,7,4,CH,A),EQUALS 
//MODS E15=(ERBPPE15,36000,,N),E35=(ERBPPE35,3000,,N)
/*

//POSTRMF EXEC PGM=ERBRMFP,REGION=32M
//MFPINPUT DD DSN=&SO,DISP=(OLD,DELETE)
//MFPMSGDS DD SYSOUT=* 
//PPRPTS DD SYSOUT=* 
//SYSIN DD DDNAME=SREP
//SREP DD *
//SYSRPTS(CF)
//RTOD(0000,2359)
//STOD(0000,2359)
//DINTV(0015)
//SYSOUT(X)
//SUMMARY(INT,TOT)
How To Find Out MWASDT Using IPCS
How To Find Out MWASDT Using IPCS

Select 0 ‘Defaults’ To Update Dump Dataset

```
OPTION ==> 0
0 DEFAULTS - Specify default dump and options
1 BROWSE - Browse dump data set
2 ANALYSIS - Analyze dump contents
3 UTILITY - Perform utility functions
4 INVENTORY - Inventory of problem data
5 SUBMIT - Submit problem analysis job to batch
6 COMMAND - Enter subcommand, CLIST or REXX exec
T TUTORIAL - Learn how to use the IPCS dialog
X EXIT - Terminate using log and list defaults

Enter END command to terminate IPCS dialog

Command ==> 

------------ IPCS Default Values --------------

You may change any of the defaults listed below. The defaults shown before any changes are LOCAL. Change scope to GLOBAL to display global defaults.

Scope ==> LOCAL (LOCAL, GLOBAL, or BOTH)

If you change the Source default, IPCS will display the current default Address Space for the new source and will ignore any data entered in the Address Space field.

Source ==> DSNAMES(‘SYSDMP,PRDA,OMASTER,DMP00001’)
Address Space ==> ASID(X’0@05’)
Message Routing ==> NOPRINT TERMINAL NOPDS
Message Control ==> CONFIRM VERIFY FLAG(WARNING)
Display Content ==> NOMICMACHINE REMARK REQUEST NOSTORAGE SYMBOL

Press ENTER to update defaults.

Use the END command to exit without an update.
```
How To Find Out MWASDT Using IPCS

Select 2 ‘Analysis’ And Then 6 ‘Component’

--- IPCS MVS ANALYSIS OF DUMP CONTENTS ---

To display information, specify the corresponding option number.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
<th>Value</th>
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</tr>
<tr>
<td>2</td>
<td>STATUS</td>
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<tr>
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<td>WORKSHEET</td>
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<td>SUMMARY</td>
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<td>5</td>
<td>CONTENTION</td>
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<td>6</td>
<td>COMPONENT</td>
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<tr>
<td>7</td>
<td>TRACES</td>
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</tbody>
</table>

Enter END command to terminate MVS dump analysis.

--- IPCS MVS DUMP COMPONENT DATA ANALYSIS ---

To display information, specify US option name or enter S to the left of the option name for help regarding the component support.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
<th>Value</th>
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<tbody>
<tr>
<td>S</td>
<td>Name</td>
<td>Abstract</td>
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<td>HNDMAP</td>
<td>Nucleus CSE/IT Map</td>
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<tr>
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<td>OAMDATA</td>
<td>OAM Control Block Analysis</td>
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<td>OMBPDATA</td>
<td>OpenMVS analysis</td>
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<td>REFGDATA</td>
<td>RACF control block analysis</td>
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<td>RESOLVER</td>
<td>TCP/IP Resolver Analysis</td>
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<td>RHMDATA</td>
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<td></td>
<td>RHMTPDA</td>
<td>RHM TPDA Trace Analysis</td>
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<td>RMSDATA</td>
<td>Real storage manager summary</td>
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<td>SBNMPSG</td>
<td>SBNMP console messages</td>
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<td>SHMSDATA</td>
<td>SHMS Control block analysis</td>
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<td>SMSXDATA</td>
<td>SMSX Control Block Formatter</td>
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<td></td>
<td>SMRDATA</td>
<td>SMR control block analysis</td>
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<tr>
<td></td>
<td>SSDATA</td>
<td>Subsystem Interface analysis</td>
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<td></td>
<td>STRDATA</td>
<td>Coupling Facility Structure Data</td>
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<td></td>
<td>SUNLOAD</td>
<td>Format summary Dump data</td>
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<td></td>
<td>SYDEF</td>
<td>Static Symbol Table Formatter</td>
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<td>SYMPTOMS</td>
<td>Format symptoms</td>
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<td>SYSTRACE</td>
<td>Format custom trace</td>
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<td></td>
<td>TCP/IP</td>
<td>Top/Ip Dump Analysis</td>
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<td>TOPICPS</td>
<td>TCP/IP Analysis</td>
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<td>TS0DATA</td>
<td>TS0 analysis</td>
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<tr>
<td></td>
<td>VLFDATA</td>
<td>Virtual Lockedside Facility data</td>
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<tr>
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<td>VLFTRACE</td>
<td>Virtual Lockedside Facility trace</td>
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<td>VSMDATA</td>
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<td>VTAM</td>
<td>VTAM Dump Analysis</td>
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<td>VTAMMAP</td>
<td>VTAM control block analysis</td>
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<td></td>
<td>WLMWORK</td>
<td>Work load manager data</td>
</tr>
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<td></td>
<td>XEDATA</td>
<td>XES analysis</td>
</tr>
</tbody>
</table>

END OF LIST
How To Find Out MWASDT Using IPCS

Select ‘Detail’ And Then ‘S’ Command

--- IPCS - XESDATA SUBCOMMAND ---

SELECT OPTION ==>  

Select zero or more levels of detail. Default is SUMMARY reporting.
- SUMMARY  - EXCEPTION  * DETAIL

Select zero or more report types. Default is ALL report types.
- CONNECTION  - FACILITY  - CACHE  - LOCKMGR
- XESSTACK  - LIST  - LOCKRESOURCE  - LOCK

Select zero or more filtering options. Default is NO filtering.
Additional filtering selection menus may be presented:
- ASID  - HASHVALUE  - SYSNAME  - REQUESTORCONID
- RNAME  - TARGETNAME  - STRNAME  - PEQID
- SOURCENAME  - CONNAME  - CFNAME  - LISTNUM
- JOBNAME  - LTENTRY  - LOCKMGRCONID  - LISTNUM

--- XESDATA DETAIL ---

S = START XESDATA subcommand.
R = Reset all panel variables.
END = Terminate XESDATA subcommand.

--- IPCS OUTPUT STREAM --- Line 0

********* XESDATA (CROSS-SYSTEM EXTENDED SERVICES) REPORT *********

Options list:
Report(s) .............. CONNECTION
                  XESSTACK
                  LOCKMGR
                  FACILITY
                  LIST
                  CACHE
                  LOCK

Level(s) of detail...... DETAIL
Filter(s) in use........ NONE

Sysplex name.............. PPLEX
System name.............. PRDA
Facility name............ PCFGAR1
Structure name........... IXCSIG1
                  ASID.............. X'0006'
Connection name.. SIGPATH_06000302
Structure name........... IXCSIG11
                  ASID.............. X'0006'
Connection name.. SIGPATH_06000302
How To Find Out MWASDT Using IPCS

Sample MWASDT 31 microseconds For PCF1GAR1

Queued Request Information:

Facility Name.................. PCF1GAR1
Low Priority Work Queue
Number of Queued Requests... 0  (decimal)
Total Number of Requests.... 305193  (decimal)
High Priority Work Queue
Number of Queued Requests... 0  (decimal)
Total Number of Requests.... 2429  (decimal)

Moving Weighted Average Subchannel Delay Time (MWASDT) Information:

Refresh Counter............... 2  (decimal)
Refresh Limit.................. 250  (decimal)
Queued Count................... 2777  (decimal)
Total Count.................... 2882  (decimal)
MWASDT (in microseconds)...... 31  (decimal)

Sync/Async Heuristics Data

Simplex Requests:

<table>
<thead>
<tr>
<th>OpCode</th>
<th>Acronym</th>
<th>Size</th>
<th>ReqCount</th>
<th>ConvReqCount</th>
<th>Avg Svc Time</th>
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<tbody>
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<td>ALST</td>
<td>0-0</td>
<td>0</td>
<td>0</td>
<td>41</td>
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<td>0303</td>
<td>RLSC</td>
<td>0-0</td>
<td>0</td>
<td>0</td>
<td>13</td>
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<tr>
<td>0303</td>
<td>RLSC</td>
<td>1-1</td>
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<td>0</td>
<td>13</td>
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<td>0304</td>
<td>RLC</td>
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<td>RLM</td>
<td>0-0</td>
<td>444777</td>
<td>391000</td>
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</table>
**How To Find Out MWASDT Using IPCS**

Sample MWASDT 6 microseconds For PCF1GAR1

<table>
<thead>
<tr>
<th>Queued Request Information:</th>
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<tbody>
<tr>
<td>Facility Name</td>
</tr>
<tr>
<td>Low Priority Work Queue</td>
</tr>
<tr>
<td>Number of Queued Requests</td>
</tr>
<tr>
<td>Total Number of Requests</td>
</tr>
<tr>
<td>High Priority Work Queue</td>
</tr>
<tr>
<td>Number of Queued Requests</td>
</tr>
<tr>
<td>Total Number of Requests</td>
</tr>
</tbody>
</table>

```
Facility Name................. PCF2CAR2
Low Priority Work Queue
Number of Queued Requests... 0
Total Number of Requests.... 115497
High Priority Work Queue
Number of Queued Requests... 0
Total Number of Requests.... 21
Time of Last Queued Request. 07/22/2011 07:43:06.658744
```

Moving Weighted Average Subchannel Delay Time (MWASDT) Information:

```
Refresh Counter.............. 0
Refresh Limit................ 250
Queued Count................ 0
Total Count................... 7
MWASDT (in microseconds)... 6
```

Sync/Async Heuristics Data

<table>
<thead>
<tr>
<th>Simplex Requests:</th>
</tr>
</thead>
<tbody>
<tr>
<td>OpCode</td>
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<tr>
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<tr>
<td>0301</td>
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<tr>
<td>0303</td>
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</table>
GT Structure Distribution – 2 CFs
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<tr>
<th>CF Name</th>
<th>Structure Name</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>DSNPD01_LOCK1</td>
<td>DSNPD01_GBP0</td>
<td>RLS_APL2</td>
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<tr>
<td>DSNPD01_SCA</td>
<td>DSNPD01_GBP1</td>
<td>RRSSTR1</td>
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<tr>
<td>DSNPDRM_GBP0</td>
<td>DSNPD01_GBP16K0</td>
<td>SYSTEM_OPERLOG</td>
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<td>DSNPDRM_GBP1</td>
<td>DSNPD01_GBP16K1</td>
<td>SYSZWLM_0E162817</td>
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<td>DSNPDRM_GBP2</td>
<td>DSNPD01_GBP2</td>
<td>LOG_DFHLOG_WUI</td>
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<td>DSNPDRM_GBP8K0</td>
<td>DSNPD01_GBP21</td>
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<td>PQS1OLASTR</td>
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<td>PQS1SMSSTR</td>
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<td>DSNPD01_GBP5</td>
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<td>DSNPD01_GBP32K</td>
<td>DSNPD01_GBP6</td>
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<td>IXCSIG21</td>
<td>IXCSIG4</td>
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<td>CF Name</td>
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