Checklist For z/OS Performance Improvement That Every System Programmer Should Know 15789

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ISBANK

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#SHAREDIG

SHARE is an independent volunteer-run information technology association that provides education, professional networking and industry influence.

SHARE in Pittsburgh 2014

Who Is İŞBANK ?

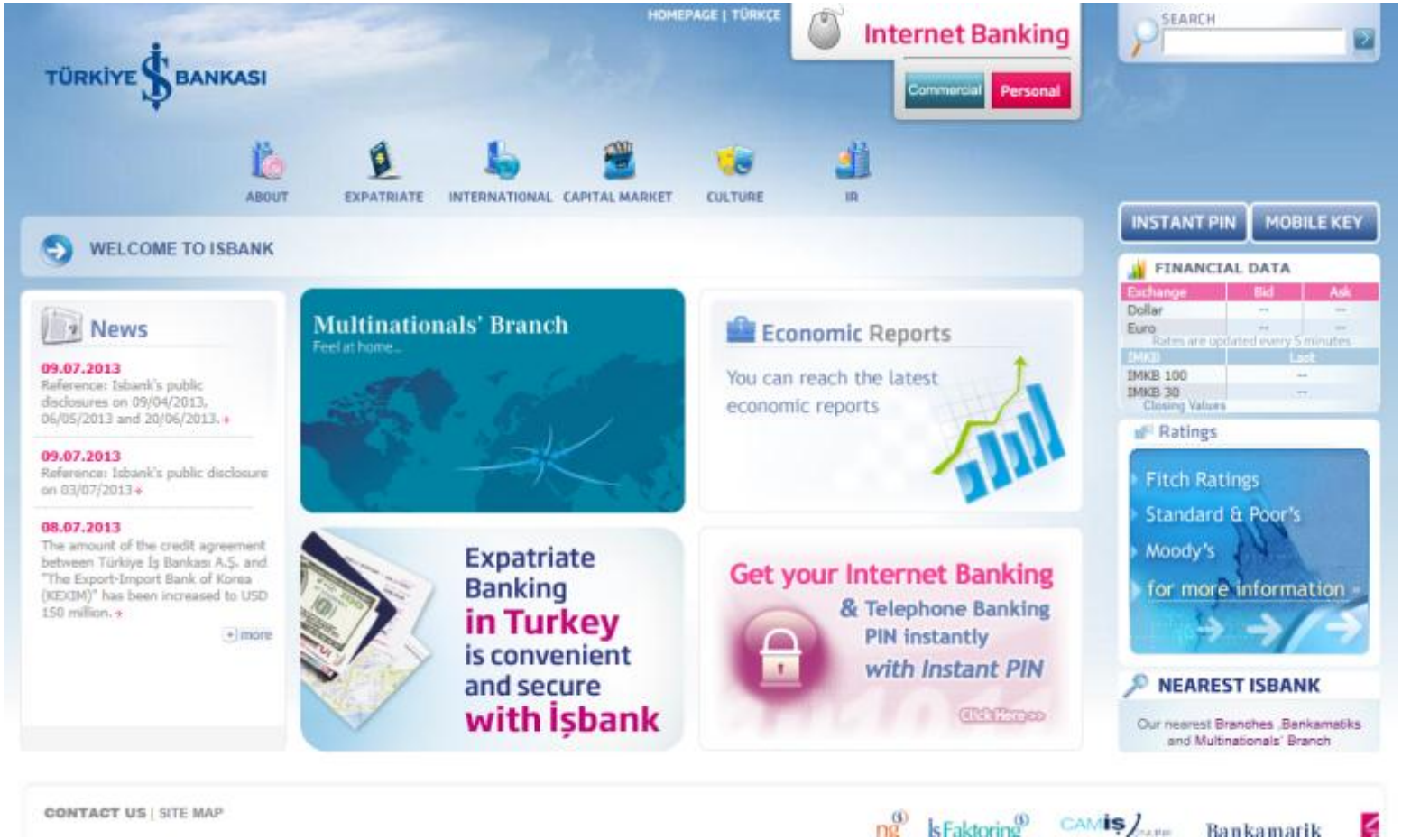
- The Biggest Bank Of Turkey
- 5521 ATMs
- 1296 Branches In Turkey, 20 Branches Outside Turkey
- Has The Highest Profit According To All Bank Announcements 2013
- Member Of SHARE Inc.

Who Is İŞBANK ?

BRANCHES

Who Is İŞBANK ?

INTERNET BANKING



Who Is İŞBANK ?

ATM

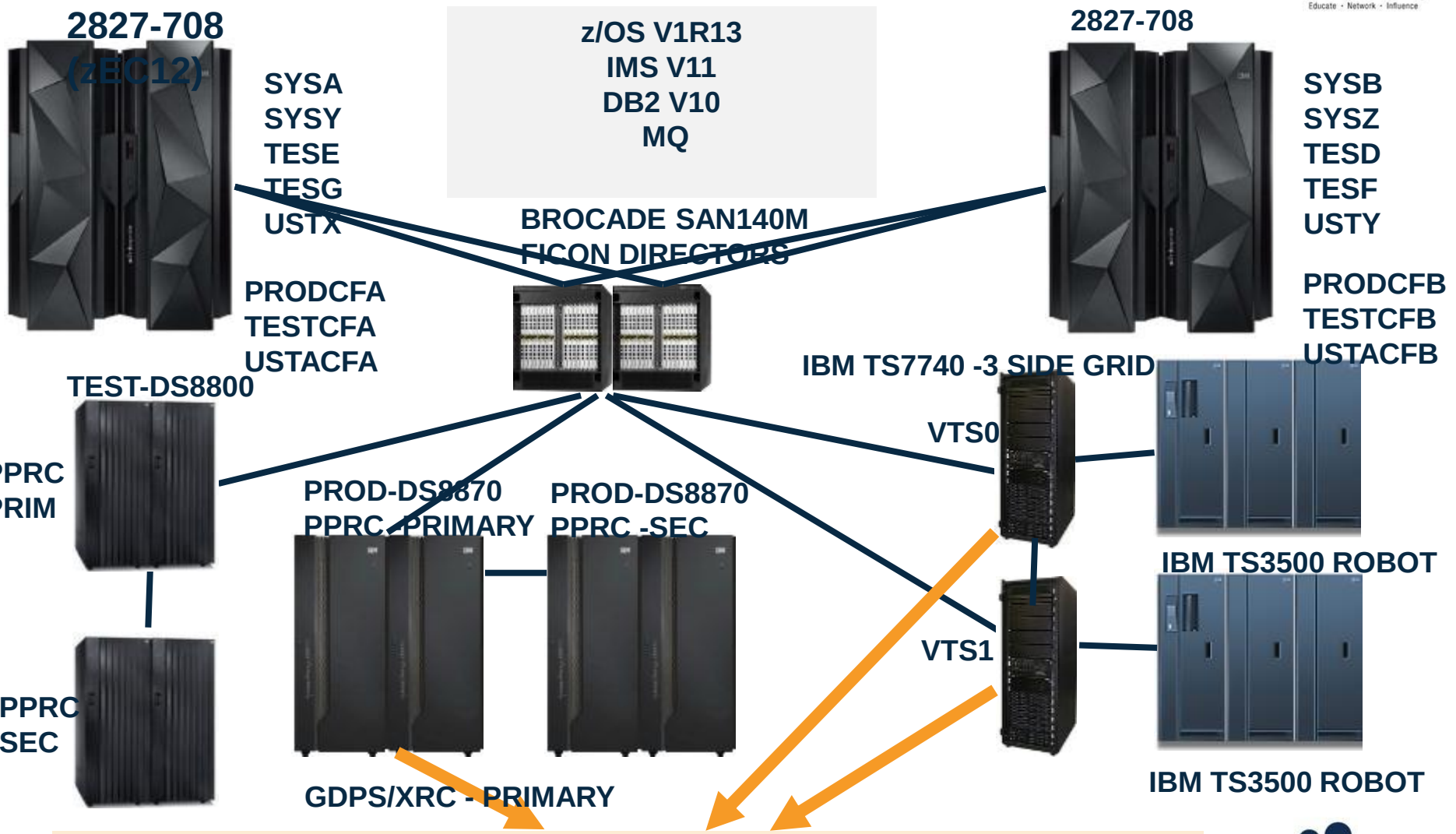
İŞCEP
Mobile Phone Application

İŞBANK IPAD FINANCE CENTER
Application

Who Is İŞBANK ?

Credit Cards

İşbank – Mainframe Configuration



z/OS System Programming & Performance

LOVE Dealing With Performance
LOVE! Dealing With z/OS From System Programming Perspective

- 1996- 2010 14 Years z/OS System Programming
  Last 4 Years Mainly Performance
- 2010- 2013 3 Years z/OS Performance Expert
- 2013 – Now 1,5 Years z/OS Team Leader

KEY JOINTS

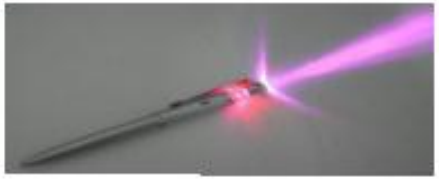
- ✓ Performance Troubleshooting
- ✓ Improving Performance Of Environment
- ✓ Improving Performance Management
  - ✓ DESIGN
  - ✓ ROTS
  - ✓ AWARENESS

Performance Troubleshooting

Probably , you heard of CSI miami, CSI NY, NCSI…

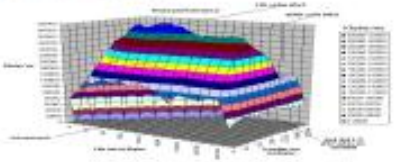
When we do performance troubleshooting, we work just like agents in CSI series

- desires much deaper knowledge
- knows where to look for the correct clue



- is aware of using latest methods is the way to success
- expected to know best way to use latest technologies

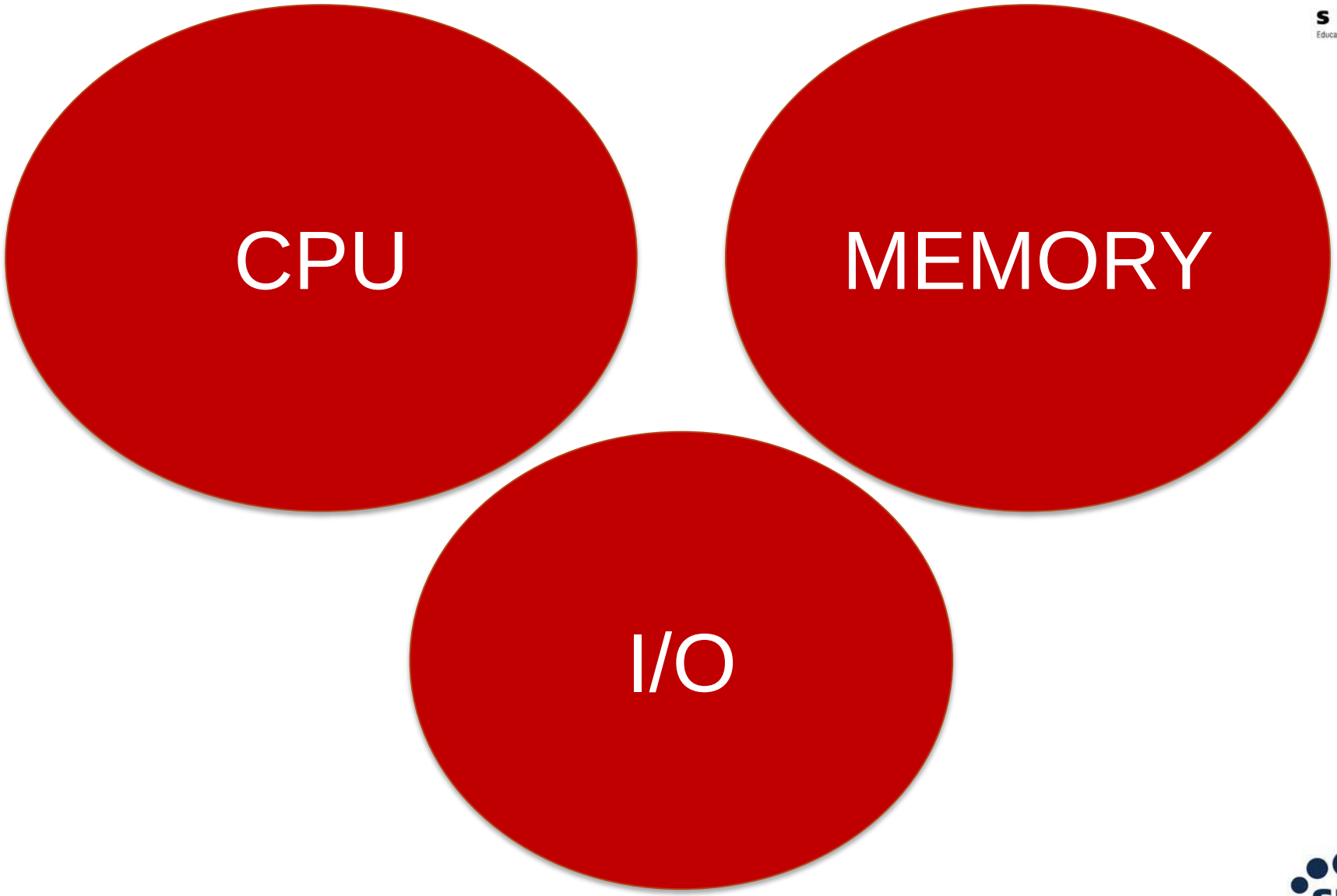
- expected to see the clues as soon as possible



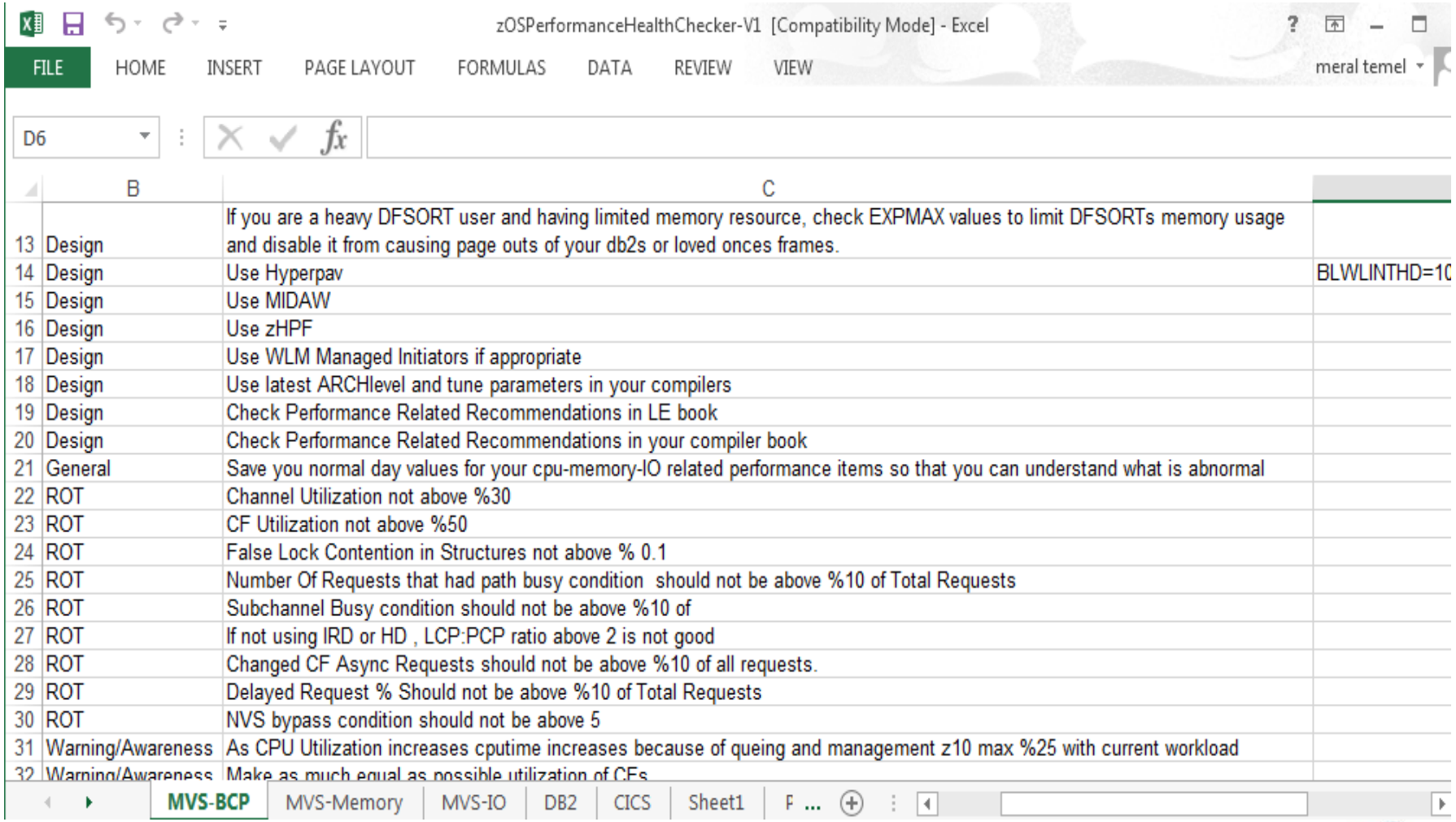
- expected to know well how to combine collected data

Improving Performance Management

z/OS Performance & RESOURCES



CHECKLIST


zOSPerformanceHealthChecker-V1 [Compatibility Mode] - Excel

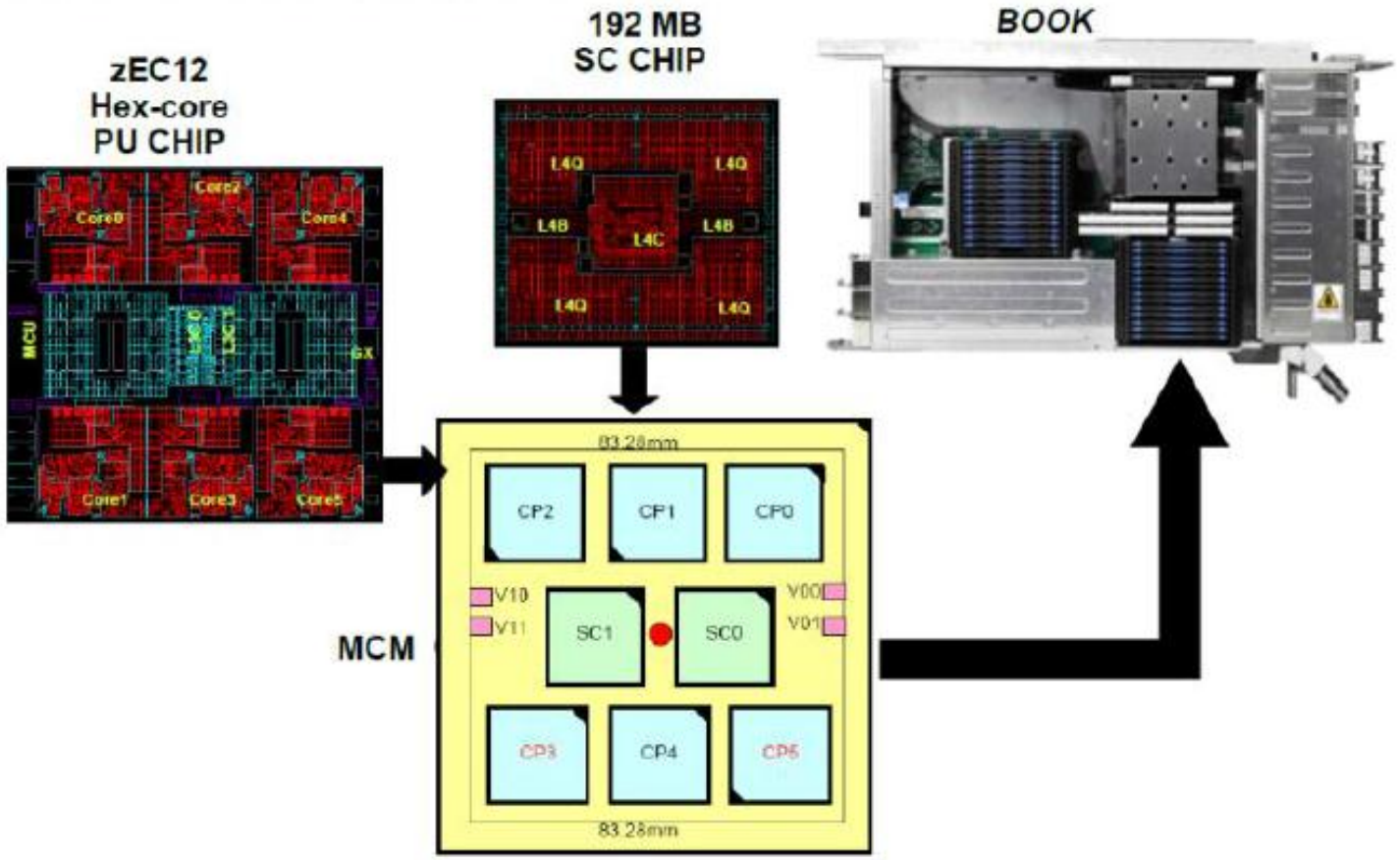
FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW meral temel

D6

	B	C	
13	Design	If you are a heavy DFSORT user and having limited memory resource, check EXPMAX values to limit DFSORTs memory usage and disable it from causing page outs of your db2s or loved onces frames.	
14	Design	Use Hyperpav	BLWLINTHD=10
15	Design	Use MIDAW	
16	Design	Use zHPF	
17	Design	Use WLM Managed Initiators if appropriate	
18	Design	Use latest ARCHlevel and tune parameters in your compilers	
19	Design	Check Performance Related Recommendations in LE book	
20	Design	Check Performance Related Recommendations in your compiler book	
21	General	Save you normal day values for your cpu-memory-IO related performance items so that you can understand what is abnormal	
22	ROT	Channel Utilization not above %30	
23	ROT	CF Utilization not above %50	
24	ROT	False Lock Contention in Structures not above % 0.1	
25	ROT	Number Of Requests that had path busy condition should not be above %10 of Total Requests	
26	ROT	Subchannel Busy condition should not be above %10 of	
27	ROT	If not using IRD or HD , LCP:PCP ratio above 2 is not good	
28	ROT	Changed CF Async Requests should not be above %10 of all requests.	
29	ROT	Delayed Request % Should not be above %10 of Total Requests	
30	ROT	NVS bypass condition should not be above 5	
31	Warning/Awareness	As CPU Utilization increases cputime increases because of queing and management z10 max %25 with current workload	
32	Warning/Awareness	Make as much equal as possible utilization of CEs	

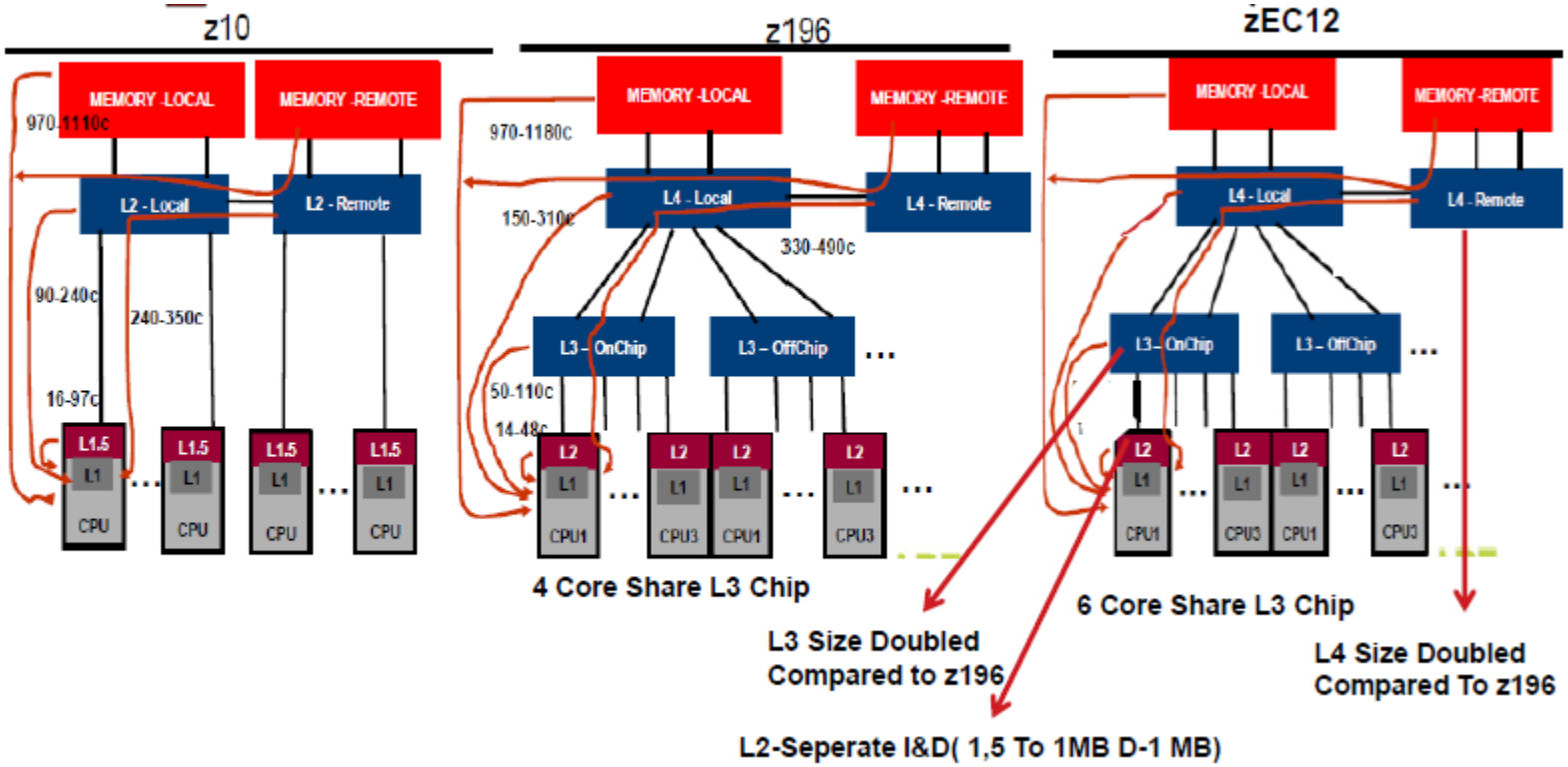
MVS-BCP | MVS-Memory | MVS-IO | DB2 | CICS | Sheet1 | F ...

CPU


zEC12
Hex-core
PU CHIP
Core0
Core2
Core4
Core1
Core3
Core5
MCU
GX
192 MB
SC CHIP
L4Q
L4B
L4C
BOOK
83.28mm
CP2
CP1
CP0
V10
V11
SC1
SC0
V00
V01
MCM
CP3
CP4
CP5
83.28mm

zEC12 & Previous HW Improvements

- Upgrade To Latest Machine (I have saved 15-18% MSU Decrease)
  zEC12 Has The Greatest Cache Algortihm & Instruction Support



- Enhanced OOO Execution

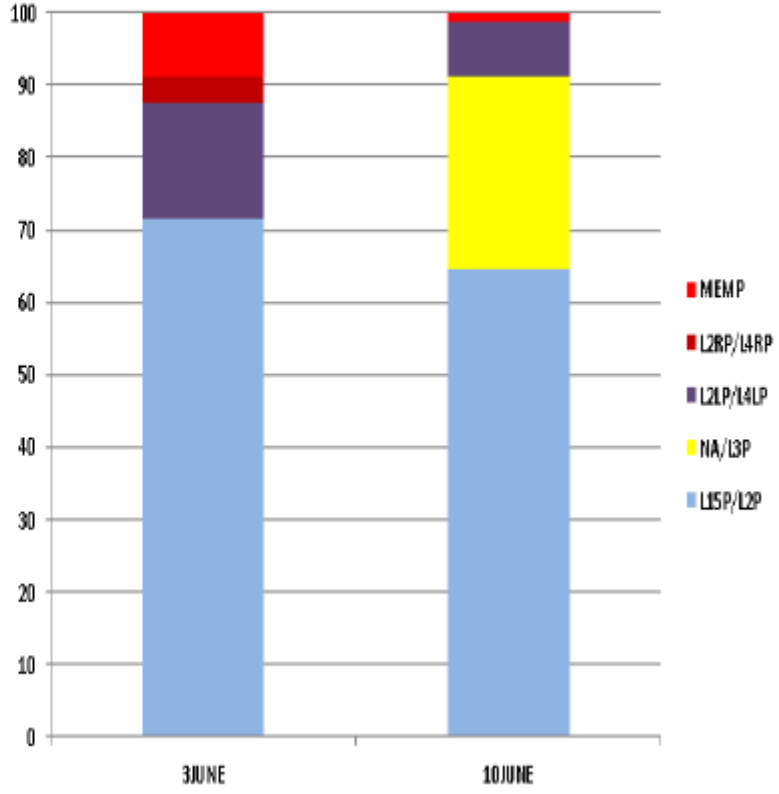
zEC12 & Previous HW Improvements

Other Then Cputimes,APPL%, MSU Fields In RMF……

- Collect SMF113s. Cycle Per Instruction Will Decrease

Cycle Per Instruction Decreased By %49

DATE	3JUNE	10JUNE	DECREASE%
CPI	7,46	3,81	49
L1MP	4,26	4,85	
L15P	71,58	NA	
L2P	NA	64,48	
L2LP	15,90	NA	
L2RP	3,84	NA	
L3P	NA	26,58	
L4LP	NA	7,74	
L4RP	NA	0,03	
LPARBUSY	7,89	54,67	
MEMP	8,68	1,16	87
MIPSEXEC	46,73	791,00	
ESTICCPI	3,07	2,10	32
ESTFINCP	4,40	1,71	61
ESTSCP1M	103,40	35,23	66
RNI	0,90	0,65	
EFFGHZ	4,40	5,50	
TLB1MISS	8,10	5,62	31
TLB1CYCL	79,49	27,28	66
PTEPCTMI	36,74	27,57	25



zEC12 & Previous HW Improvements

- Collect SMF113 all the time. Minimum overhead – Can not be realized

  Several SHARE Sessions About CPU MF.. This SHARE and the previous SHAREs

  SHARE 2013 Migration To zEC12 – A Journey In Performance –

  SHARE Using And Getting Benefit From SMF 113 Records - Customer Experience

- Use zPCR To Learn Your Real LSPR Workload Type

  (Uses SMF113 as input)

  SHARE 2012 :Usage Of zPCR Both In Performance Management And Capacity Planning Studies - Customer Experience

- Use zPCR Not Only For Capacity Planning But Also For LPAR Design

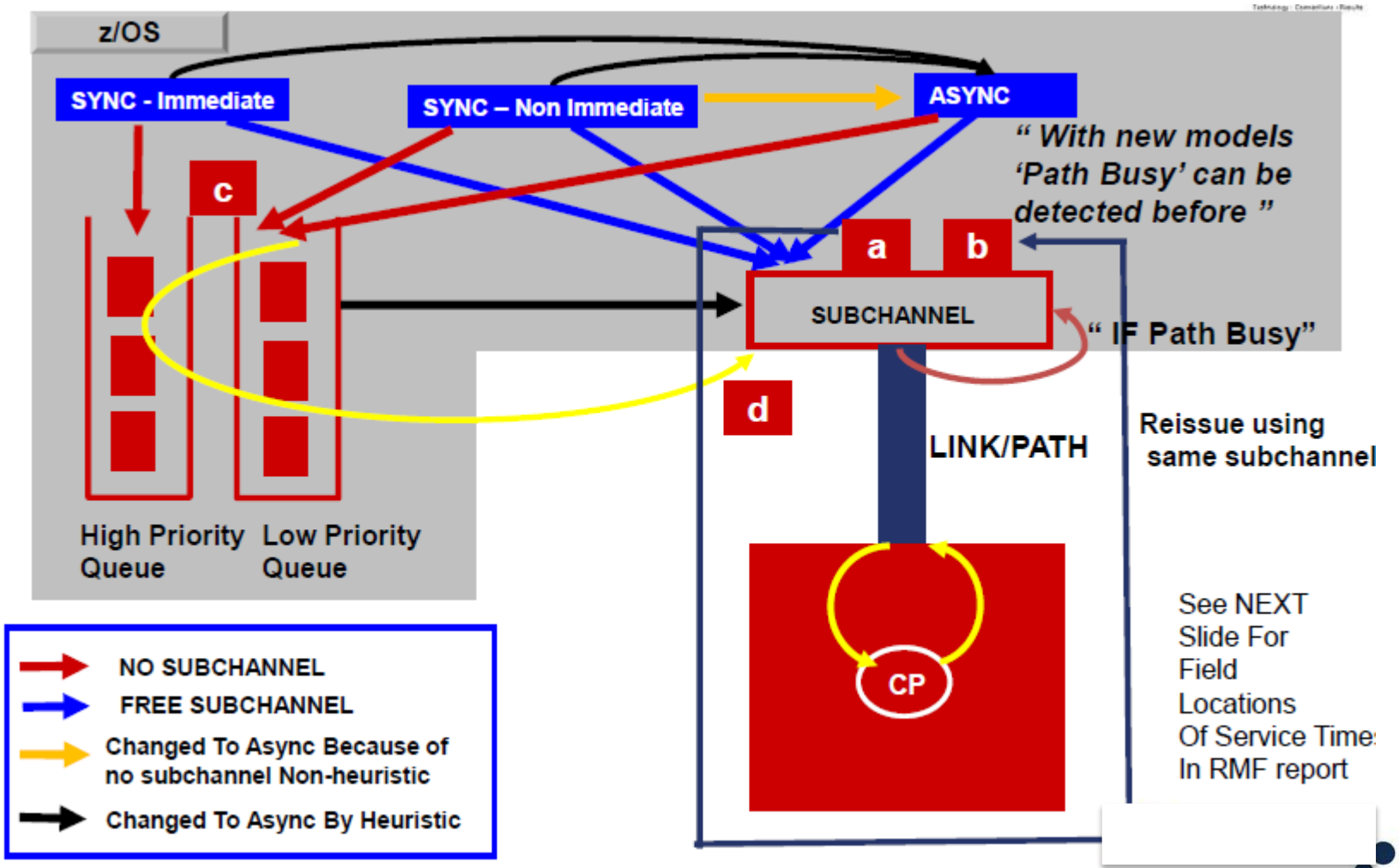
  SHARE 2012 :Usage Of zPCR Both In Performance Management And Capacity Planning Studies - Customer Experience

- Consider Using Absolute Capping

  I consider using it because I need both hardcap and softcap work together

CF Performance

CF Request Types & Cases



Sync/Async Conversion

NON-HEURISTIC

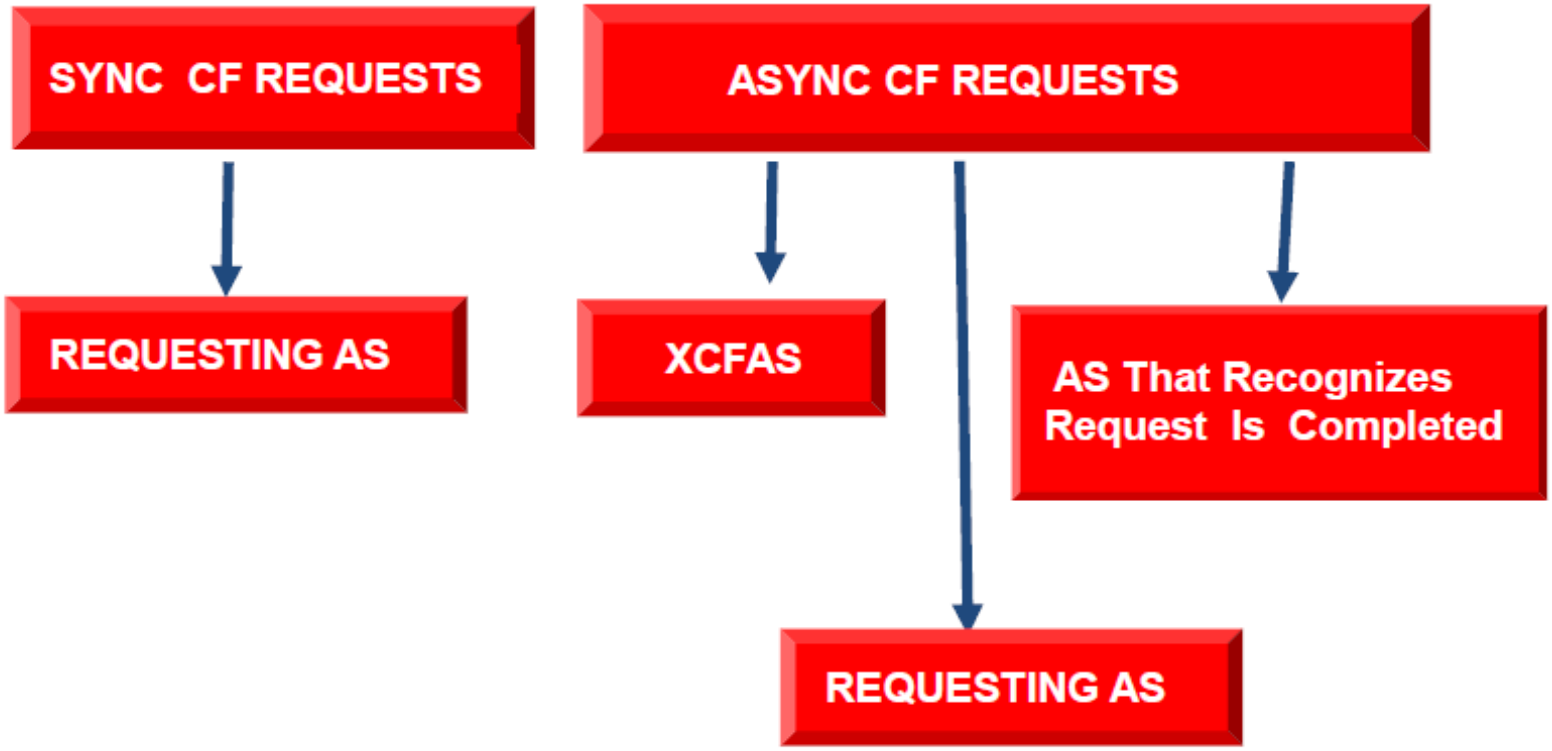
- Subchannel Busy Condition
- Path Busy Condition
- Serialized List or Lock Contention

HEURISTIC

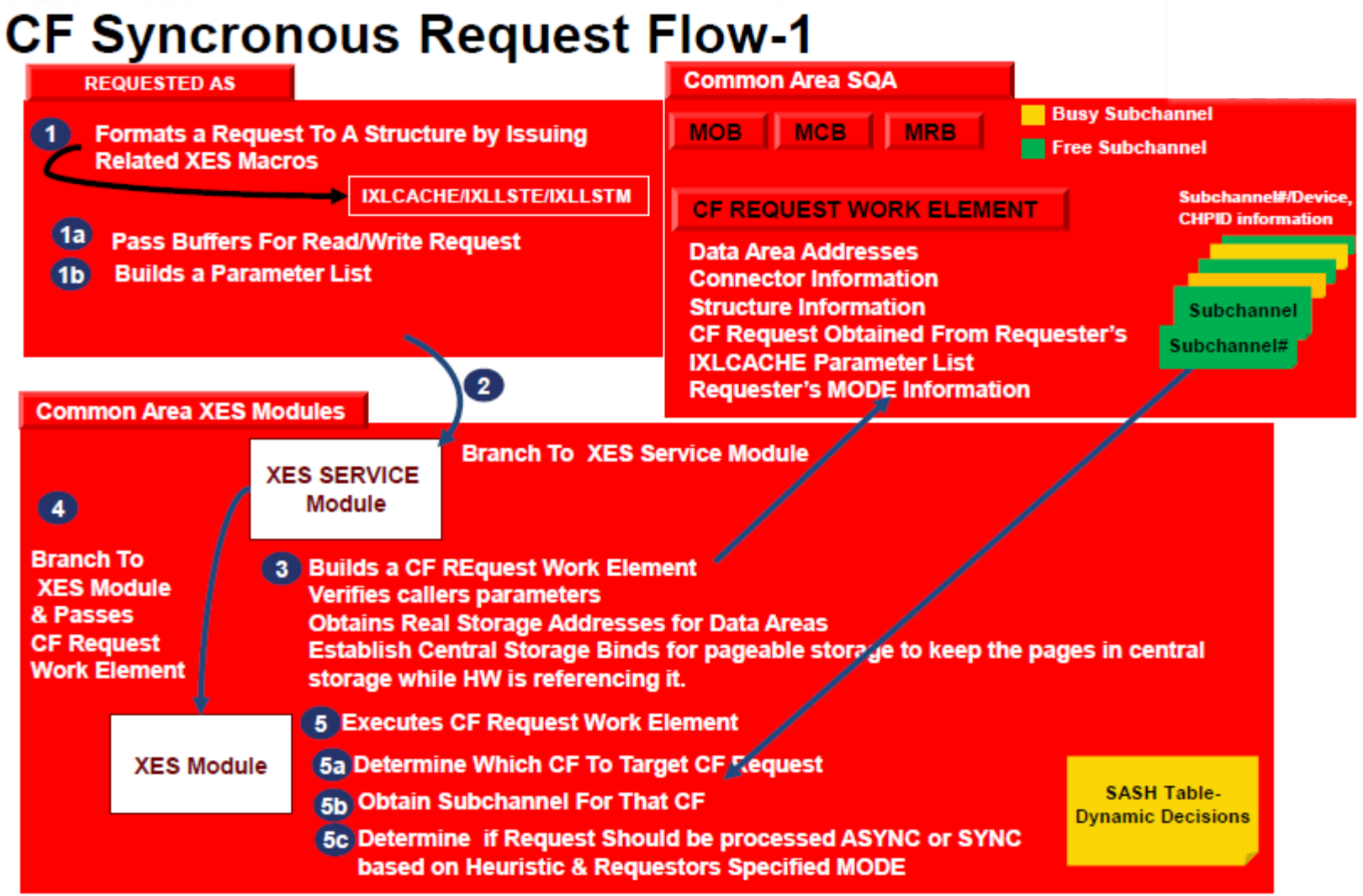
Introduced with z/OS v1r2...

- 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

CPU Cost Of CF Requests

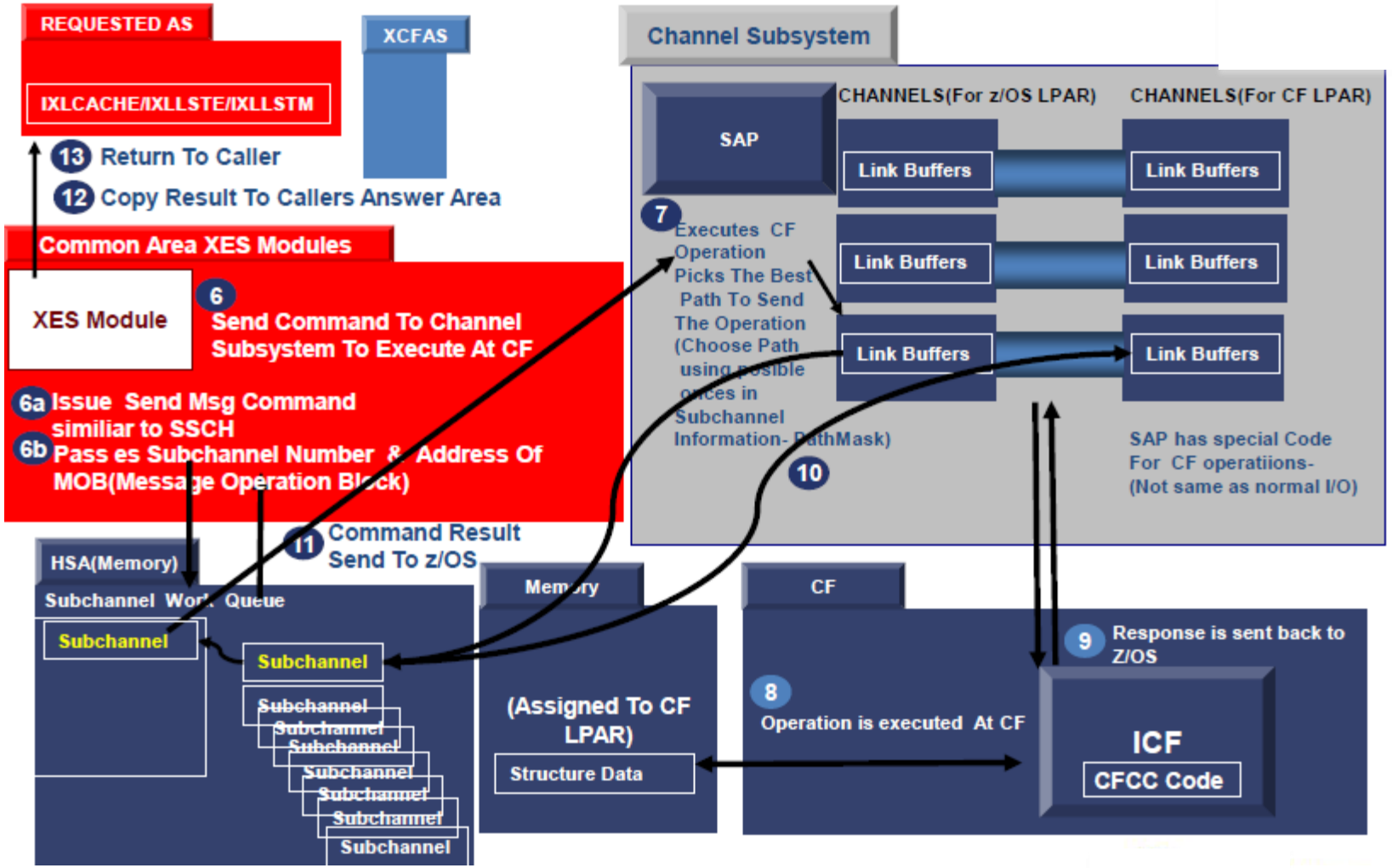


CF Performance



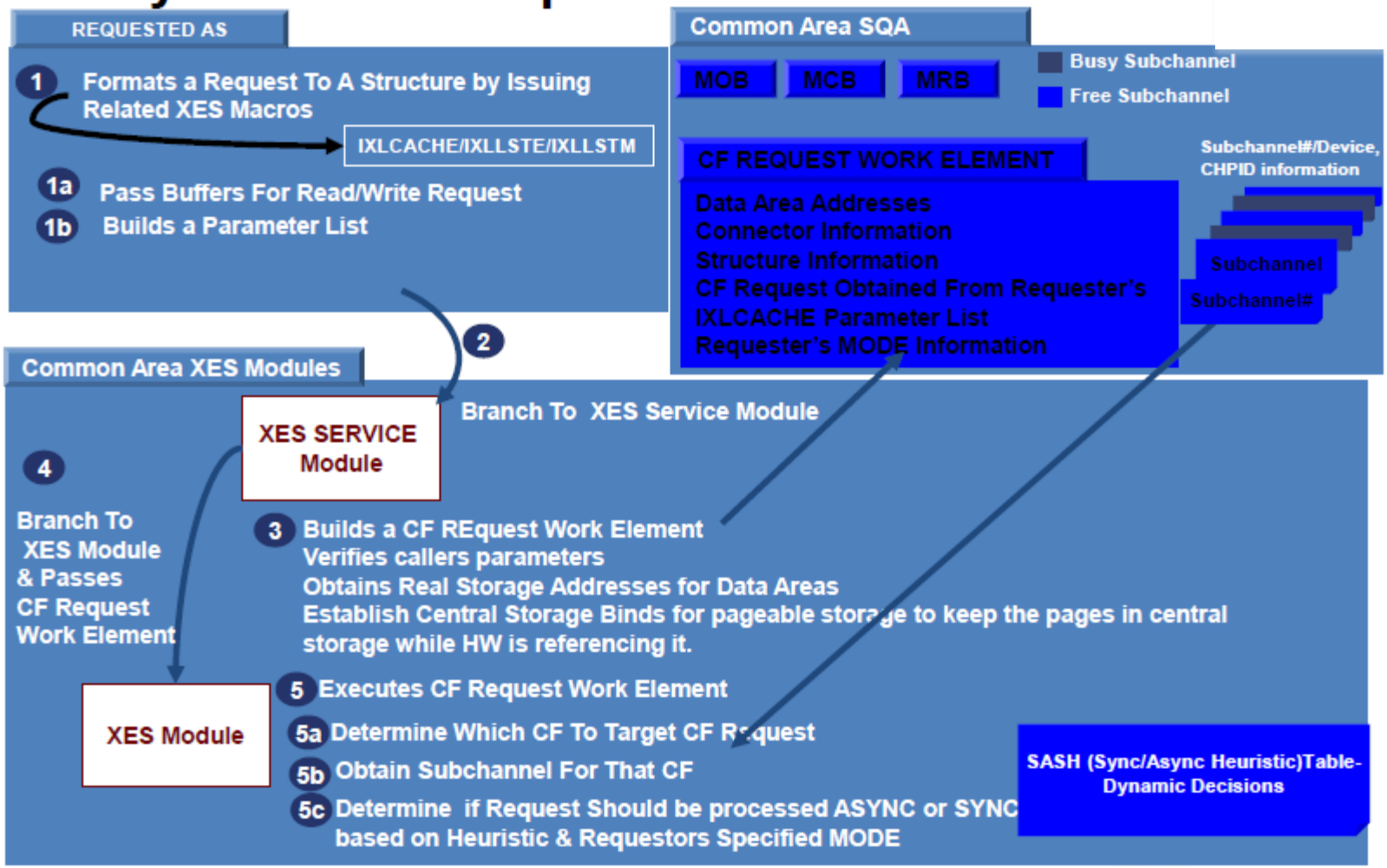
CF Performance

CF Syncronous Request Flow-2



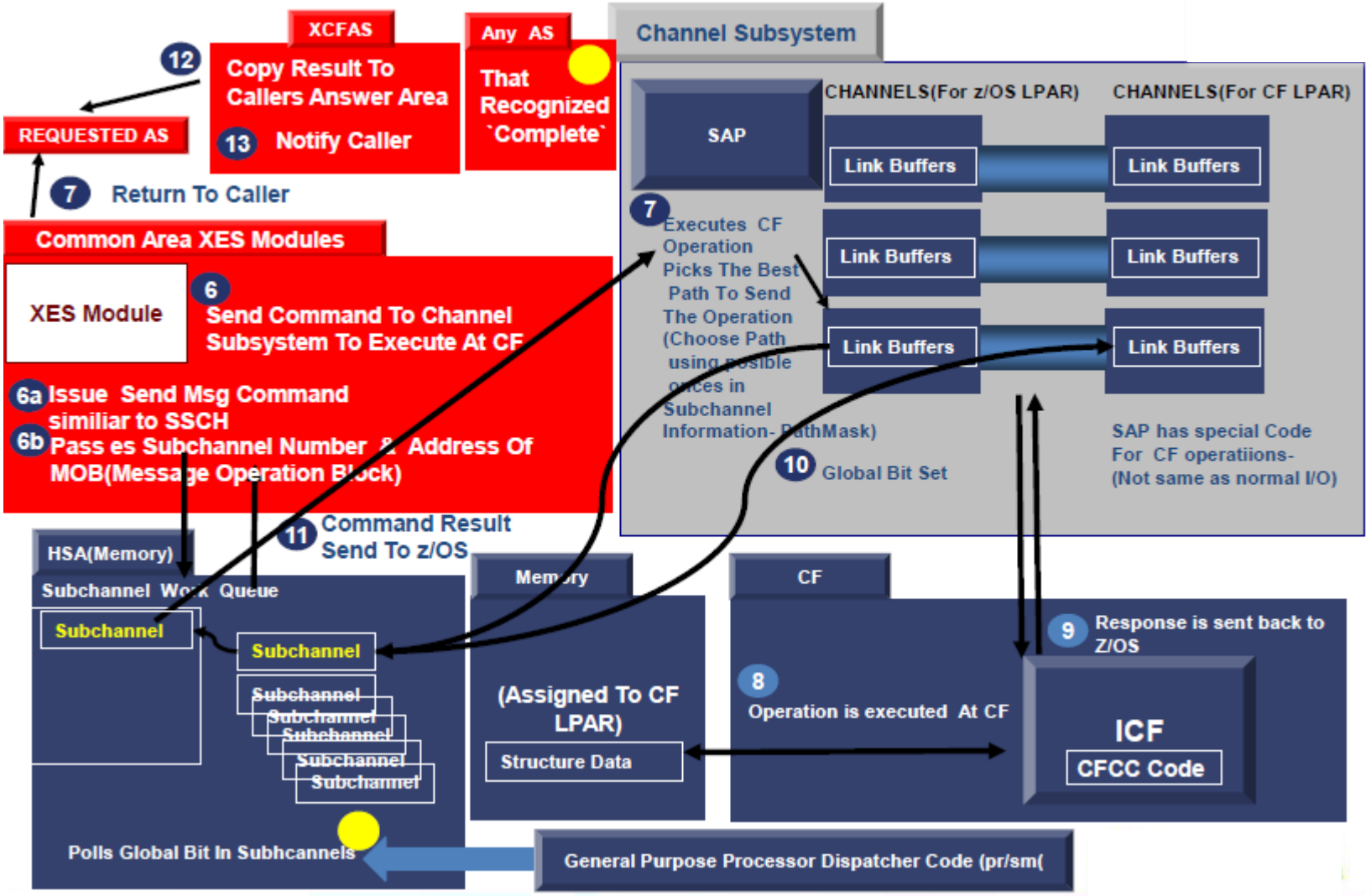
CF Performance

CF Asyncronous Request Flow -1



CF Performance

CF Asyncronous Request Flow -2



CF Performance

zEC12 & Previous HW CF Improvements

- CF Links- Infiniband Cards & Protokol Enhancements
- Latest Protokol IFB3 with HCA3-O Cards
- Improvements : Decrease In Service Times
  Decrease In Subchannel Busy Conditions
  Decrease In Sync/Async Conversion

For Details Of CF Performance Analysis: Using RMF & SMF

- Migrating from z10 ICBs to z196 Infiniband- a Detailed Performance Study and User Experience – SHARE Orlando 2011
- Migration To zEC12 – A Journey In Performance – SHARE Boston 2013

CF Performance

Check For Lock Structures Lock Contention

ROT : Not more than 0.1% Of Total CF Request For Structure

Check For Lock Structures False Lock Contention

ROT : Not more than 0.01% Of Total CF Request For Structure

Check For CF Utilization

ROT : Different ROTs….Not above 50% (I prefer 40%)

Check For Path Busy %

ROT : Different ROTs….Not above 10% Of Total Requests

Decide Whether To Increase # Of IC s or Infiniband CF links

CF Performance

Balance Your CF Request Rates Between CFs. - Design

Check Async /Sync Conversion % - Not Above 10% Of Total – ROT
Sample: Sync Service times 2-4 microseconds , Async 80-120 microseconds

CF Performance – Where To Look ?

- 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

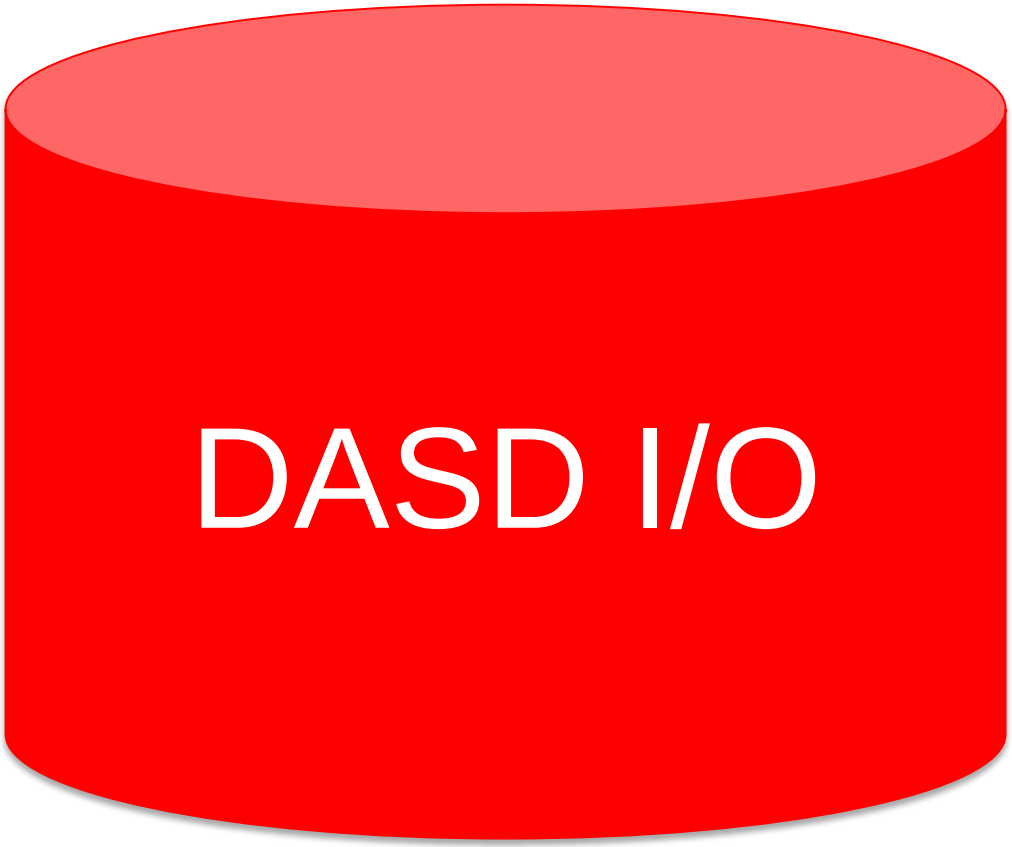
CF Performance – Where To Look ?

RMF Monitor I Reports

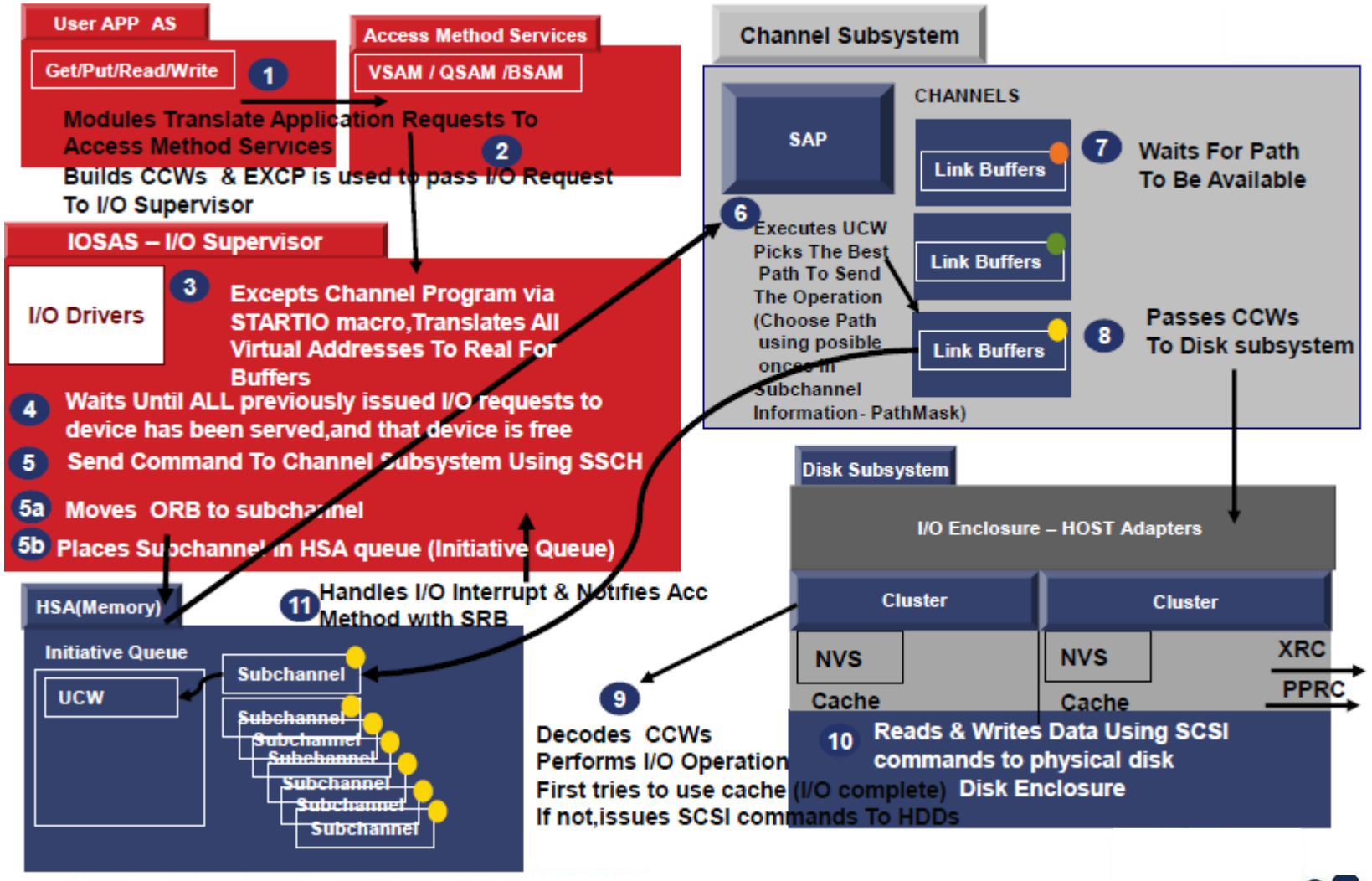
Postprocessor Statement – SYSRPTS(CF) - See sample JCL in backup slides

- Coupling Facility Usage Summary
- Coupling Facility Structure Activity
- Subchannel Activity

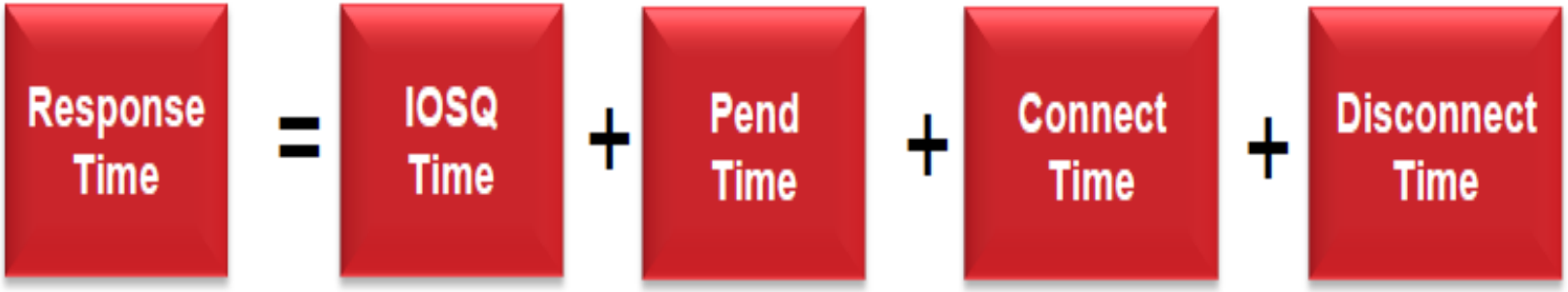
DASD I/O Performance



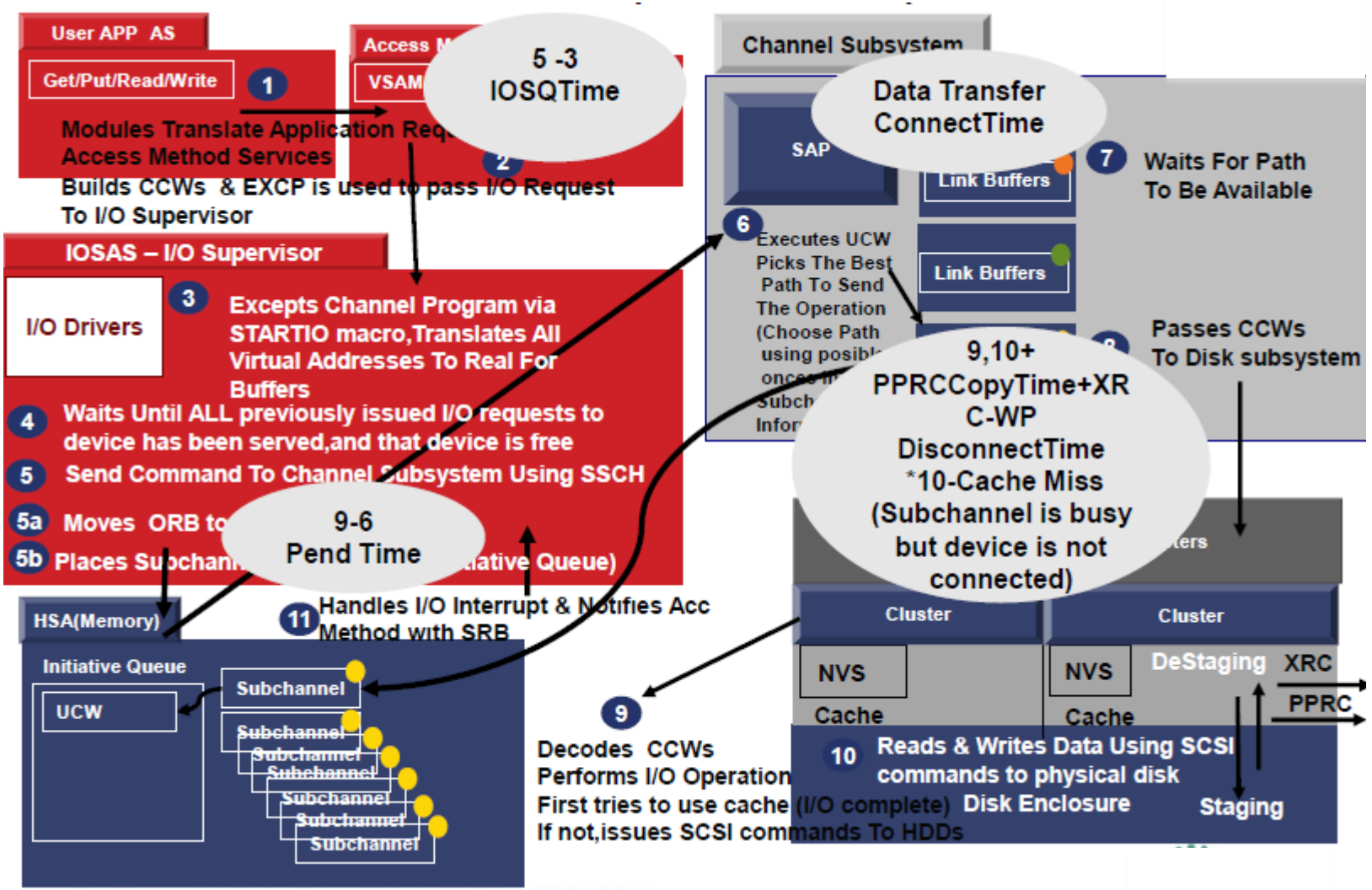
Life OF I/O


User APP AS
Get/Put/Read/Write
1
Access Method Services
VSAM / QSAM /BSAM
Modules Translate Application Requests To Access Method Services
2
Builds CCWs & EXCP is used to pass I/O Request To I/O Supervisor
IOSAS – I/O Supervisor
I/O Drivers
3
Excepts Channel Program via STARTIO macro,Translates All Virtual Addresses To Real For Buffers
4
Waits Until ALL previously issued I/O requests to device has been served,and that device is free
5
Send Command To Channel Subsystem Using SSCH
5a
Moves ORB to subchannel
5b
Places Subchannel in HSA queue (Initiative Queue)
HSA(Memory)
Initiative Queue
UCW
Subchannel
Subchannel
Subchannel
Subchannel
Subchannel
Subchannel
Subchannel
11
Handles I/O Interrupt & Notifies Acc Method with SRB
Channel Subsystem
SAP
CHANNELS
Link Buffers
Link Buffers
Link Buffers
6
Executes UCW
Picks The Best Path To Send The Operation
(Choose Path using posible onces in Subchannel Information- PathMask)
7
Waits For Path To Be Available
8
Passes CCWs To Disk subsystem
Disk Subsystem
I/O Enclosure – HOST Adapters
Cluster
Cluster
NVS
Cache
NVS
Cache
XRC
PPRC
9
Decodes CCWs
Performs I/O Operation
First tries to use cache (I/O complete)
If not,issues SCSI commands To HDDs
10
Reads & Writes Data Using SCSI commands to physical disk
Disk Enclosure

DASD I/O Response Time Components

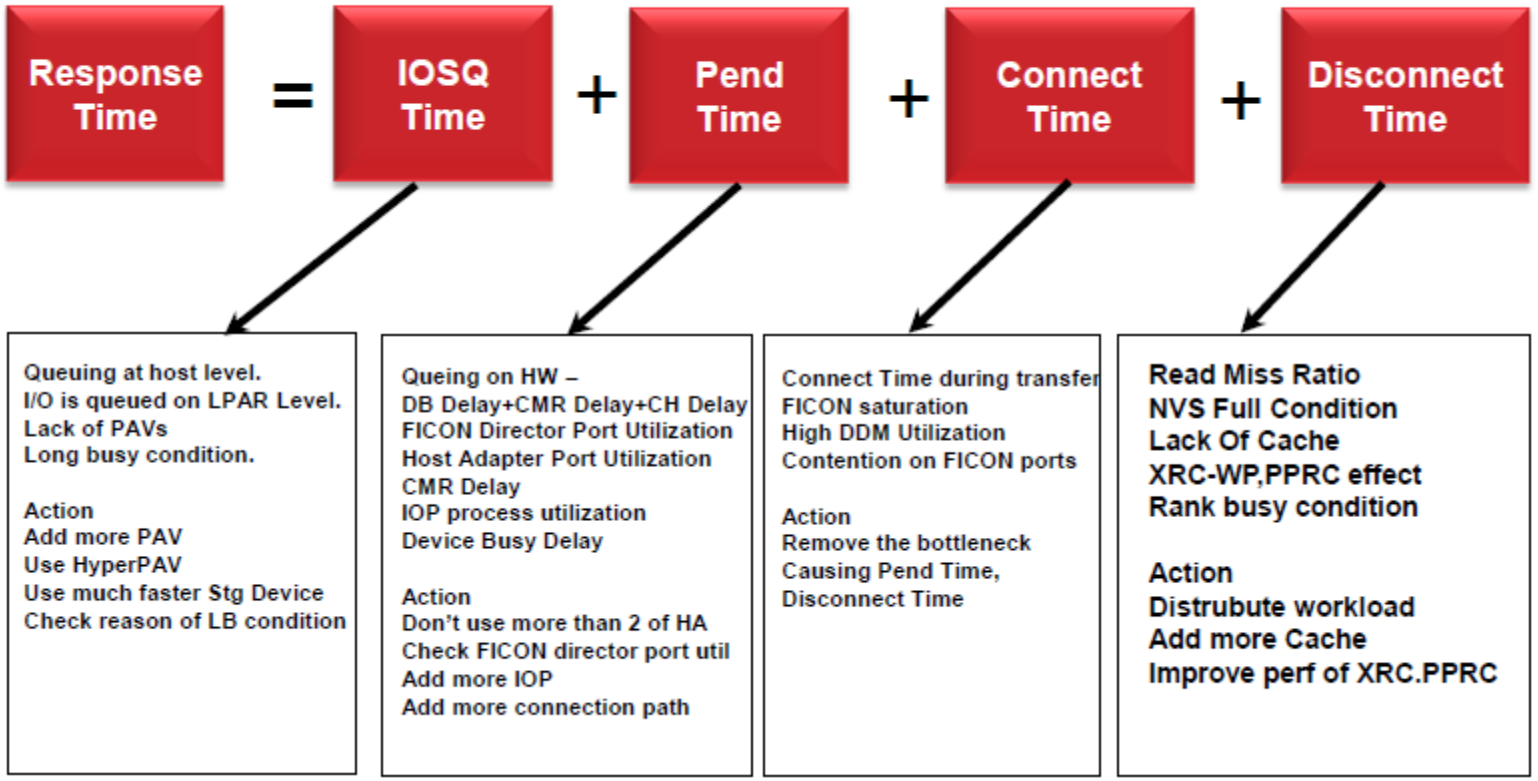


Life Of I/O & Response Time Components



DASD I/O Response Time Components

What Are The Possible Reasons? Where To Look ? What To Do ?



DASD I/O Performance

- Use Hyperpav - (Check IOSQtime Decrease) DESIGN
- Check I/O Intterupt Time (New Field) Awareness
- Use MIDAW - DESIGN
- Use zHPF – (Check PendTime Decrease) DESIGN
  Previous microcodes had some fixes for zHPF
  Modes: Basic Mode , Sequential Dataset Support Mode
- Channel Utilization not above 40% (I prefer 30%) - (Check Pendtime) ROT
- Use Enough HostAdapter Ports In The Box (Check Pendtime – CMR Delay) - Design
- Check NVS ByPass Conditions - (Check Disconnect Time) Awareness
- Use Top/Down Approach - Average IS Average ! - Awareness
- Know Your Normal Values For Response Times - Awareness

DASD I/O Performance

- Separate DB2 Work Datasets To Volumes (IOSQTime) - Awareness
- Don’t put Loved Onces & Other Batch Datasets In Same Volume – Awareness
- Becareful About XRC write pacing - (Disconnect Time) – Awareness
- Becareful About # Of PPRC Links – (Disconnect Time) – Awareness
- Check Dataset BlockSize – Basic But Often Forgotten – SMS Dataclass – DESIGN
- Use Buffers whenever you can – Saves Elapse Time & CPU – DESIGN
- Tape: Use LBI Suppport – Saves CPU - DESIGN

I/O Performance

- USE!!! IBM Tape Tool !... Free SW.
  SHARE 2012 : Analizing/Monitoring Performance Of z/OS I/O Operations: DASD and Tape - Performance View

- Analyze SMF42 Dataset I/O Performance Records
  SHARE 2013 : Hints And Tips of Data Set I/O Performance

- Know Your Highest I/O Intensitive Volumes – (RespTime*I/ORate)
  SHARE 2012 : Analizing/Monitoring Performance Of z/OS I/O Operations: DASD and Tape - Performance View
- Know Your Highest Queing Intensitive Volumes- ((RespTime- ConTime)*I/Orate)
  SHARE 2012 : Analizing/Monitoring Performance Of z/OS I/O Operations: DASD and Tape - Performance View

- Consider Using SSDs – Analyze – Free FlashDA program (Using SAS)
  Checks SMF42s and looks for ReadOnlyDisconnectTime
  SHARE 2013 : Hints And Tips of Data Set I/O Performance

General Z/OS DESIGN RELATED ITEMS

z/OS

z/OS General DESIGN

- Check Catalog Caching – `f catalog,report,cache ` & Several Other Commands
  Use RMF montitor III ENQ report to check whether you have any ENQs on these…
  Use VLF For Catalogs (Put only loved onces)
  Check size of VLF definition for Catalogs (CofvlfXX member)
  Separate Catalogs To Remove ENQs
  Don't put more than one catalog to same volume
  Use Enhanced Catalog Sharing (VVDS data read CF Request Instead Of DASD I/0)
  Use RLS type catalog – Planned!.

- Use zEDC If Possible- CPU consumption Of Compression Can be Very Significant
  Check your Compressed /Uncompressed Cpu Usage
  Decide Between I/O Count Cost – CPU Cost
  Use zBNA To Decide On Planning Of zEDC Cards

- USE!!!! zBNA Tool For Batch Analysis

  This SHARE : **System z Batch Network Analyzer (zBNA) User Experience**
  System z Batch Network Analyzer (zBNA) Tool Hands-on Lab – Thursday 4:15 PM
  System z Batch Network Analyzer (zBNA) Tool – Because Batch is Back!

z/OS General DESIGN

- Create Your Own PDB Database
  Merged Information Is something you can not get from elsewhere
  Automated Reports- Alerts
  SHARE 2010 Performance Management Hints Using RMF Data

- Amazing actions you can do with enough performance Data in Hand.
  Use products Alerts & Thresholds
  Create your own alerts using your own PDB

- Run z/OS HealthChecker All The Time.
  Not only for availability but there are several checks related to performance items

z/OS General DESIGN

- WLM Service Classes – don't use too many –
  Velocity Goals' value difference less than 5 does not make sense

- Use WLM BlockWorkload Support
  SHARE EWCP Hot Topics

- Use Hiperdispatch

- Check Your RMPTTOM Value
  IBM Techdoc flashes… Can decrease your cputime

- Check Your CPENABLE Value
  IBM Techdoc flashes

- Check Your COBOL Optime Parameter - Use Optimize(FULL)

- Use Latest ArchLevel Parameter In Compilers

z/OS General DESIGN

- Help PR/SM do its job much easier ….Check LCP/PCP ratios
- Use 3 digits for LPAR Weights . More granularity will be achieved
- Becareful About Short Engine Effect
- Don’t DO PAGING!!!.... Memory is much cheaper now
- Check DFSORT parameters – EXPMAX – EXPOLD not to cause it steal your loved onces pages
- Check Region Parameters
  Increase it if necessary … Some utilities parallelism is based on amount of memory that can be used
- Use zFlash – If you are being hurt by uncontrollable paging.

More Resources

www.share.org - Several Great Sessions

ResourceLink Website – zEC12 Books
https://www-304.ibm.com/servers/resourcelink/svc03100.nsf?Opendatabase

WSC TecDocs
http://www-03.ibm.com/support/techdocs/atsmastr.nsf/Web/TechDocs

IBM website for Several Tools (FlashDA, IBM Tapetool….)

ResourceLink Website - PR/SM Book

www.redbooks.ibm.com

THANK YOU!

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