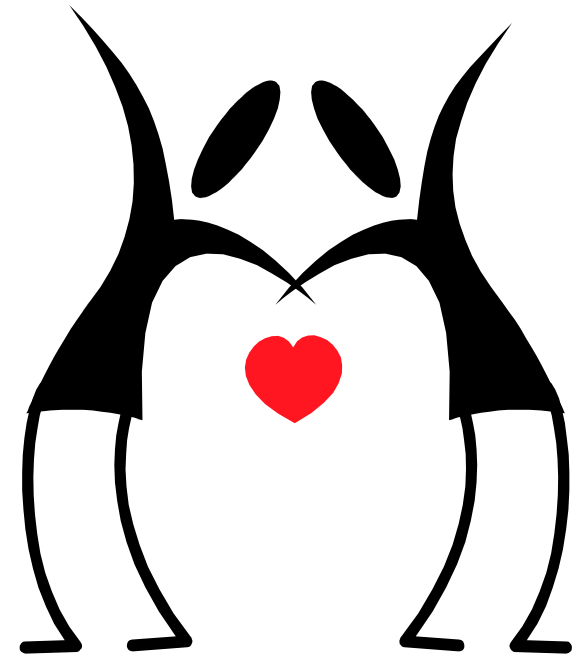




SHARE – Anaheim, March 1st, 2011



# CICS Performance Analysis Essentials

By Ivan Gelb

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# Agenda

- Your Questions @Anytime
- V4.1 Performance
- Performance Analysis
- Processor Performance
- I/O Performance



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# V4.1 Performance - 1

- Throughput improved via more efficient workload management with Sysplex optimized workload routing enabled at the z/OS Coupling Facility (CF)
  - **Most** effective if routing and target regions managed by different CMASs in a **single** Sysplex
  - Monitor distribution of dynamic workloads through CICSplex via **new CPSM WUI views**
  - Load value, including all tasks, and health status for a CICS region is broadcast with basic health status
  - CICSplex SM uses data in CF to make dynamic routing decisions
  - Target regions refresh interval for their data in CF is between 1 ms and up to 2 seconds. Default = 200ms
  - **Smaller refresh values increase CF utilization**

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# V4.1 Performance - 2

- New support for z/OS Workload Manager (WLM) service policy specified percentile goals
  - Addition to average response time goals support
  - CICSplex SM optimizes response times by routing to region it deems most likely to meet goals
  - Router and target regions managed by same CMAS
  - Percentile goal example: 95% of transactions need response time of less than 1 second
  - Average response time goal example: Average response time < 0.75 seconds
    - Average response time goals subject to WLM “over-reactions” due to effects a few long tasks ending in the interval’s workload mix

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## V4.1 Performance - 3

- CICS XML parsing improved via new z/OS XML System Services (XMLSS) parser which CICS can access directly
  - XMLSS can offload parsing to zSeries Application Assist Processor (zAAP)
  - Parsing offload can improve response time for all transactions because CPU time is moved to zAAP
  - zAAP CPU time cost is **at least 80% lower** than general purpose CPU cost!
  - XMLSS parser uses above-the-bar storage

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## V4.1 Performance - 4

- Improvements in CICS monitoring
  - New performance data metrics for Web and Web service applications
  - New transaction resource class monitoring data for distributed program link (DPL) requests
  - DPLLIMIT, FILELIMIT and TSQUEUELIMIT options limit the number of DPL requests, files, and Temp Storage queues for which CICS will perform transaction resource monitoring
  - New default is to compress monitor records

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# Performance Analysis - 1

## Top 5 reasons for performance analysis:

1. Meet or exceed Service Level Agreements.
2. Manage and control costs.
3. Assure scalability of business systems.
4. Insure that computer resources are aligned with the business priorities.
5. Reduce computer resource requirements.

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# Performance Analysis - 2

## Top 5 performance tuning recommendations:

1. Insure that PR/SM and Workload Manager (WLM) Service Policy provide proper priority for processor access.
2. Minimize the number of production CICS regions.
3. Turn off all CICS traces.
4. Tune Temporary Storage and Transient Data to reduce/eliminate physical I/Os.
5. Tune file I/Os via data-in-memory techniques and use data tables (CICS or User maintained).

Note: For additional detailed recommendations, please see SHARE Proceedings for “CICS Performance Management Best Practices” and “Mining Performance Gold From CICS Statistics”

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# Performance Analysis - 3

## An Ongoing Analysis Outline / Critical Success Factors:

- Service Level requirements are documented
- Short and long term performance data collected
- All system components (z/OS, CICS, MQ, DB2,...) are customized to maintain / protect performance of business critical applications
- Performance management and capacity management – are coordinated symbiotic functions

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# Performance Analysis - 4

## Performance Hierarchy

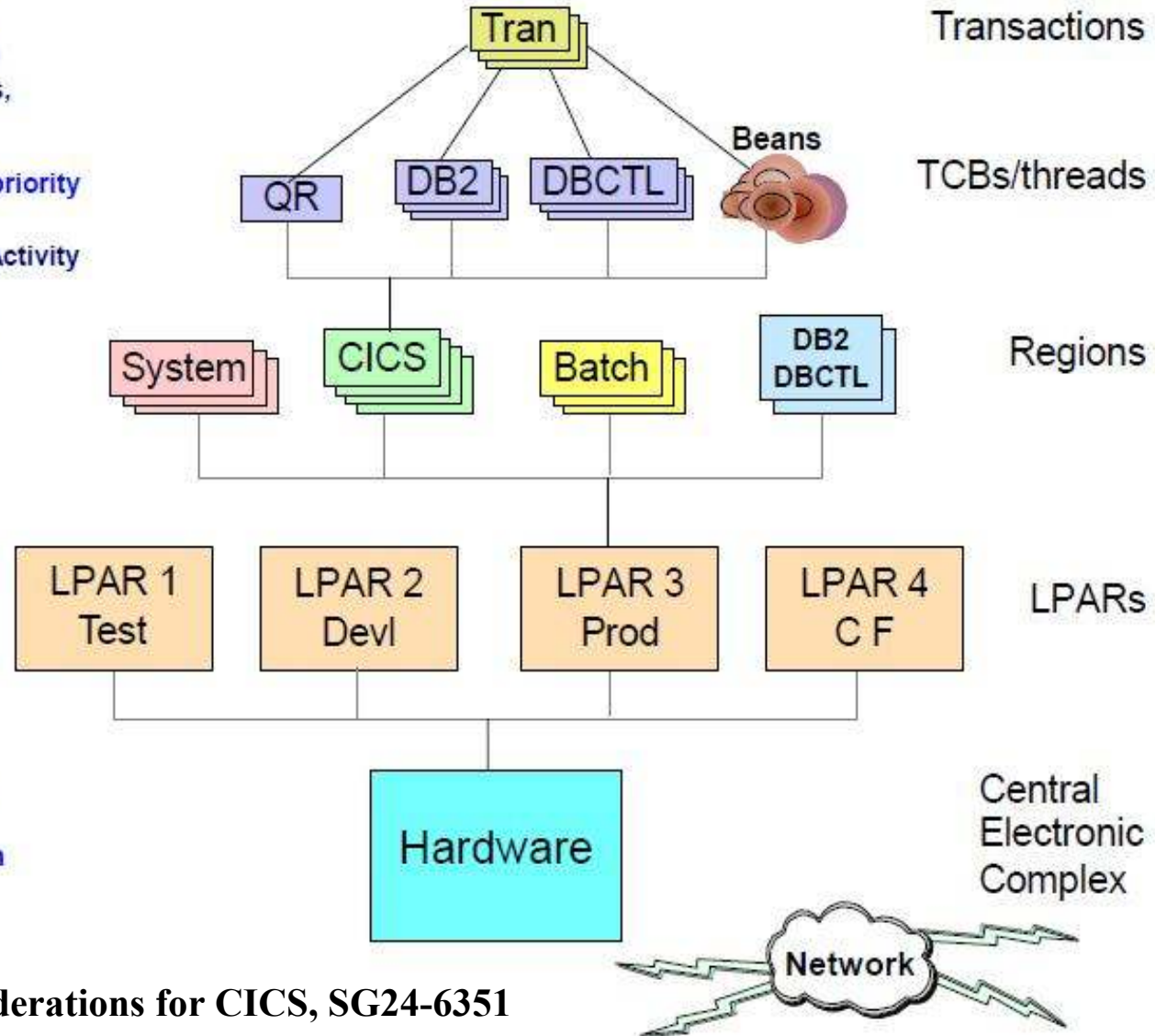
CICS dispatching and tuning; resource usage  
Tools: SMF 110 records, statistics

TCB/thread execution priority and contention  
Tools: RMF Workload Activity Reports

MVS dispatching and tuning; SRM/WLM  
Tools: RMF Reports, SMF Type 30 records

LPAR Mgmt (weights and fair share)  
Tools: RMF CPU and Partition data reports

CPU cycles - Engines, Memory, Devices, Hardware configuration  
Tools: RMF



Source: Threadsafe Considerations for CICS, SG24-6351

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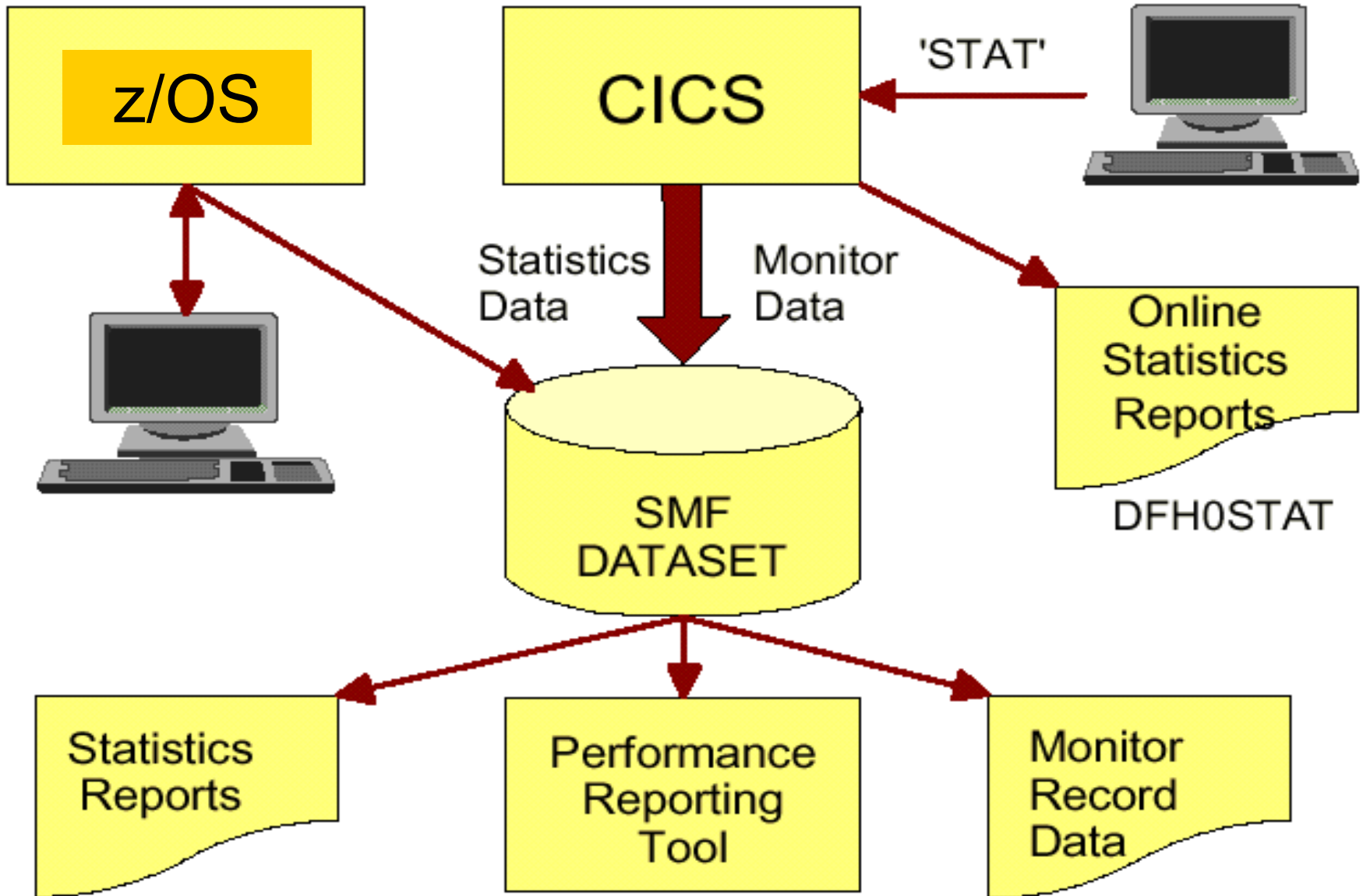


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# Performance Monitoring



Source: Chris Baker, IBM Hursley, UK

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# Measurement Data Sources

- **Resource Measurement Facility (RMF)**
  - System wide resource level details: CPU disks, storage, workload performance, and summary
- **System Management Facility (SMF)**
  - Address space level details for: batch, STC, CICS, etc. + resource level details/address space
  - VSAM file and DB2 object level activity details
- **CICS end-of-day and interval statistics**
  - CICS Region level statistics and resource counters for: CPU, IO, storage, transactions, connections, etc...
- **CICS Monitoring Facility (CMF)**
  - Transaction level details. **All** the details!

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# Processor Utilization Governors

- **Three** dispatchers involved in making physical processor time available to a CICS task:
  - PR/SM dispatches ready tasks of LPARs
    - LPAR weights based shares are enforced by PR/SM only when the processor is at or near 100% busy or LPAR is capped
  - z/OS dispatches tasks within LPAR,
    - z/OS Workload Manager (WLM) Service Policy governs which tasks get highest dispatching priority based on a workload's importance
  - CICS dispatches tasks within each CICS region
    - CICS' Dispatcher handles tasks in their specified priority order while being possibly constrained by various performance and capacity control parameters

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# CEC Level Processor Analysis

- LPAR weight and the guaranteed CPU share

LPAR	Weight	% Share	<b>Guaranteed # of CPs</b>
PRODHOT1	225	45%	<b>7.2</b>
PRODHOT2	225	45%	<b>7.2</b>
PRODWARM	50	10%	<b>1.6</b>
<b>Totals</b>	<b>500</b>	<b>100%</b>	<b>16</b>

- Effective Dispatch Time from PR/SM view
- Partition Dispatch Time from z/OS view
- **Short CPUs** = task only gets a **fraction** of one CP

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# RMF Partition Data Report

## PARTITION DATA REPORT

PAGE

z/OS V1R10

SYSTEM ID S59  
RPT VERSION V1R10 RMF

DATE 07/28/2009  
TIME 17.00.00

INTERVAL 15.00.010  
CYCLE 1.000 SECONDS

MVS PARTITION NAME	S59	NUMBER OF PHYSICAL PROCESSORS	26	GROUP NAME	N/A
IMAGE CAPACITY	1127	CP	20	LIMIT	N/A
NUMBER OF CONFIGURED PARTITIONS	12	AAP	2		
WAIT COMPLETION	NO	IFL	0		
DISPATCH INTERVAL	DYNAMIC	ICF	2		
		IIP	2		

----- PARTITION DATA -----							-- LOGICAL PARTITION PROCESSOR DATA --				-- AVERAGE PROCESSOR UTILIZATION PERCENTAGES --				
-----MSU-----							--DISPATCH TIME DATA--				LOGICAL PROCESSORS		--- PHYSICAL PROCESSORS ---		
NAME	S	WGT	DEF	ACT	DEF	WLM%	NUM	TYPE	EFFECTIVE	TOTAL	EFFECTIVE	TOTAL	LPAR MGMT	EFFECTIVE	TOTAL
S59	A	801	0	502	NO	0.0	20.0	CP	02.13.34.022	02.13.34.604	44.52	44.53	0.00	44.52	44.53
S50	A	500	0	0	NO	0.0	20.0	CP	00.00.00.000	00.00.00.000	0.00	0.00	0.00	0.00	0.00
S51	A	100	0	53	NO	0.0	3.0	CP	00.13.58.918	00.14.00.016	31.07	31.11	0.01	4.66	4.67
S55	A	101	0	68	NO	0.0	20.0	CP	00.18.01.114	00.18.01.538	6.01	6.01	0.00	6.01	6.01
S58	A	999	0	493	NO	0.0	20.0	CP	02.11.06.315	02.11.06.763	43.70	43.70	0.00	43.70	43.70
*PHYSICAL*										00.00.04.264		0.02		0.02	
TOTAL									04.56.40.370	04.56.47.186			0.04	98.89	98.93
S59	A	150					2	AAP	00.00.00.373	00.00.00.419	0.02	0.02	0.00	0.02	0.02
S50	A	150					2	AAP	00.00.00.000	00.00.00.000	0.00	0.00	0.00	0.00	0.00
S51	A	150					2	AAP	00.00.00.737	00.00.00.770	0.04	0.04	0.00	0.04	0.04
S55	A	150					2	AAP	00.00.00.283	00.00.00.327	0.02	0.02	0.00	0.02	0.02
S58	A	150					2	AAP	00.00.00.317	00.00.00.359	0.02	0.02	0.00	0.02	0.02
*PHYSICAL*										00.00.00.993		0.06		0.06	
TOTAL									00.00.01.713	00.00.02.870			0.06	0.10	0.16

Source: RMF V1R10 Report Analysis

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# RMF CPU Activity Report

CPU ACTIVITY

z/OS V1R10                      SYSTEM ID S59                      DATE 07/28/2009                      INTERVAL 14.  
RPT VERSION V1R10 RMF                      TIME 16.45.00                      CYCLE 1.000

CPU 2097    MODEL 720    H/W MODEL E26    SEQUENCE CODE 0000    00005C34F    HIPERDISPATCH=YES

CPU NUM	TYPE	TIME %				LOG PROC SHARE %	--I/O INTERRUPTS--	
		ONLINE	LPAR BUSY	MVS BUSY	PARKED		RATE	% VIA TPI
0	CP	100.00	99.96	100.0	0.00	100.0	95.31	0.03
1	CP	100.00	99.60	100.0	0.00	100.0	0.00	0.00
2	CP	100.00	99.58	99.97	0.00	100.0	0.00	0.00
3	CP	100.00	99.58	99.97	0.00	100.0	0.00	0.00
4	CP	100.00	99.58	99.98	0.00	100.0	0.00	0.00
5	CP	100.00	78.17	100.0	0.00	70.3	0.00	0.00
6	CP	100.00	78.10	100.0	0.00	70.3	0.00	0.00
7	CP	100.00	0.01	0.00	100.00	0.0	0.00	0.00
8	CP	100.00	0.01	0.00	100.00	0.0	0.00	0.00
9	CP	100.00	0.01	0.00	100.00	0.0	0.00	0.00
A	CP	100.00	0.01	0.00	100.00	0.0	0.00	0.00
B	CP	100.00	0.01	0.00	100.00	0.0	0.00	0.00
C	CP	100.00	0.01	0.00	100.00	0.0	0.00	0.00
D	CP	100.00	0.01	0.00	100.00	0.0	0.00	0.00
E	CP	100.00	0.01	0.00	100.00	0.0	0.00	0.00
F	CP	100.00	0.01	0.00	100.00	0.0	0.00	0.00
10	CP	100.00	0.01	0.00	100.00	0.0	0.00	0.00
11	CP	100.00	0.00	0.00	100.00	0.0	0.00	0.00
12	CP	100.00	0.00	0.00	100.00	0.0	0.00	0.00
13	CP	100.00	0.00	0.00	100.00	0.0	0.00	0.00
TOTAL/AVERAGE			32.76	34.99		640.6	95.31	0.03
16	AAP	100.00	0.03	0.03	0.00	40.0		
17	AAP	100.00	0.01	0.00	100.00	0.0		
TOTAL/AVERAGE			0.02	0.03		40.0		
14	IIP	100.00	0.02	0.02	0.00	40.0		
15	IIP	100.00	0.01	0.00	100.00	0.0		
TOTAL/AVERAGE			0.02	0.01		40.0		

Source: RMF V1R10 Report Analysis

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# RMF Monitor III Processor Delays - 1

RMF V1R8 Processor Delays Line 1 of 138  
Scroll ==> HALF

Command ==>

Samples: 60      System: MVS1    Date: 10/31/06    Time: 09.10.00    Range: 60 Sec

Jobname	CX	Service Class	CPU Type	DLY %	USG %	EApp1 %	Holding Job(s)					
							%	Name	%	Name	%	Name
WSWS7	O	OMVS	CP	11	46	59.4	9	*ENCLAVE	7	DBS3DIST	7	WSP1S2F
WSP1S2FS	SO	WASCR	CP	4	4	42.5	2	DBS3DIST	2	WSWS7	2	VTAM44
			AAP	6	0	98.4	6	*ENCLAVE				
WSP1S6FS	SO	WASCR	CP	0	0	5.3						
			AAP	6	0	7.7	6	*ENCLAVE				
DBS3DBM1	S	DB2HIGH	CP	2	6	0.8	2	XCFAS	2	DBS3DIST	2	WSP1S2F
WSP1S6F	SO	WASCR	CP	0	2	1.9						
			AAP	2	2	0.7	2	*ENCLAVE				
U078069	O	OMVS	CP	2	4	1.2	2	WSWS7	2	DBS3DIST	2	U078069
WSP1S4F	SO	WASCR	CP	0	0	0.1						
			AAP	2	0	0.4	2	WSP1S6F				
U078068	O	OMVS	CP	2	0	0.2	2	XCFAS	2	WSWS7	2	*ENCLAVE
DBS3DIST	SO	DB2HIGH	CP	0	78	111.0						
			IIP	0	2	21.3						
XCFAS	S	SYSTEM	CP	0	28	24.1						

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# RMF Monitor III Processor Delays - 1

## NOTES

Processor delays report identifies who is delayed and by ABOUT how much.

1.  $DLY \% = (\# \text{ of Delay Samples} / \# \text{ of Samples}) * 100$  is % of time task is delayed from getting CPU time
2.  $USG \% = (\# \text{ Using Samples} / \# \text{ Samples}) * 100$  is % of time the task is receiving CPU service
3. Holding Job(s) – up to three tasks that most contributed to delay

**Note that delays are collected via statistical sampling!**

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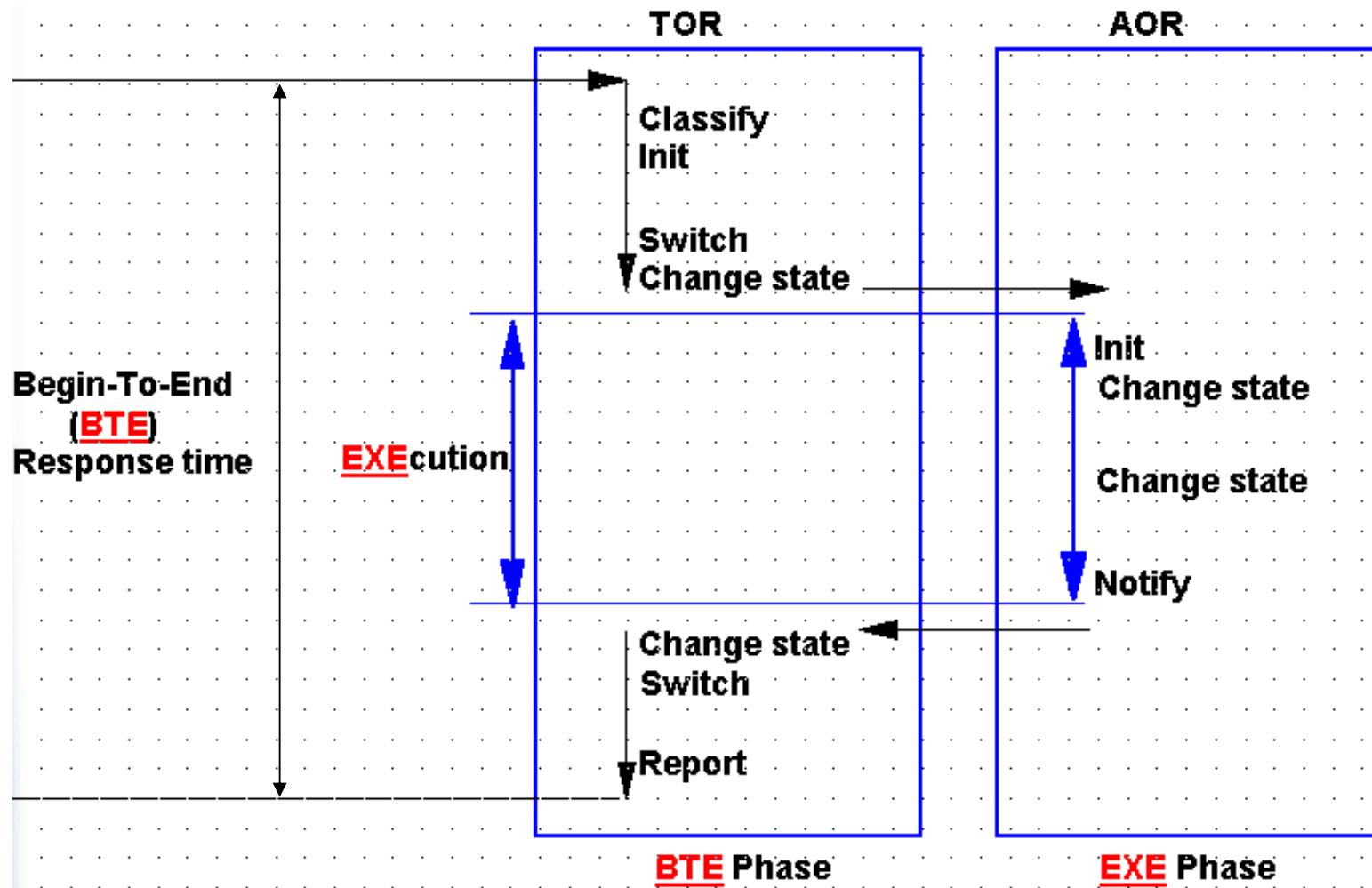


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# RMF CICS Measurements



Source: Chris Baker, IBM Hursley, UK

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# RMF Workload Activity

## WORKLOAD ACTIVITY

PAGE 1

z/OS V1R10

SYSPLEX SVPLEX3  
RPT VERSION V1R10 RMF

DATE 07/28/2009  
TIME 12.00.00

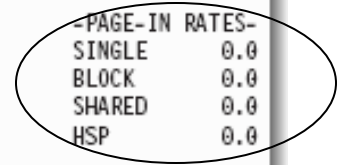
INTERVAL 14.59.995 MODE = GOAL

POLICY ACTIVATION DATE/TIME 11/01/2007 10.12.11  
- WORKLOAD & SERVICE CLASS PERIODS -

----- SERVICE CLASS(ES)

REPORT BY: POLICY=BASEPOL WORKLOAD=STC\_WLD SERVICE CLASS=STCHIGH RESOURCE GROUP=\*NONE  
CRITICAL =NONE  
DESCRIPTION =High priority for STC workloads

-TRANSACTIONS-	TRANS-TIME	HHH.MM.SS.TTT	--DASD	I/O--	---	SERVICE---	SERVICE TIME	---	APPL %---	---	PROMOTED--	---	STORAGE----		
AVG	0.00	ACTUAL	62	SSCHRT	0.0	IOC	0	CPU	0.000	CP	0.00	BLK	0.000	AVG	695.77
MPL	0.00	EXECUTION	62	RESP	0.0	CPU	0	SRB	0.015	AAPCP	0.00	ENQ	0.000	TOTAL	1.49
ENDED	62	QUEUED	0	CONN	0.0	MSO	0	RCT	0.009	IIPCP	0.00	CRM	0.000	SHARED	0.00
END/S	0.03	R/S AFFIN	0	DISC	0.0	SRB	2933	IIT	0.000						
#SWAPS	62	INELIGIBLE	0	Q+PEND	0.0	TOT	2933	HST	0.000	AAP	0.00				
EXCTD	0	CONVERSION	0	IOSQ	0.0	/SEC	2	AAP	0.000	IIP	0.00				
AVG ENC	0.00	STD DEV	482					IIP	0.000						
REM ENC	0.00							ABSRPTN	759						
MS ENC	0.00							TRX SERV	757						



PER	IMPORTANCE	PERF	INDX	--TRANSACTIONS--	---	RESPONSE TIME-----	---	EX VEL%	TOTAL	---	EXE--
1	1	0.5		-NUMBER-	-%	-----GOAL-----	---	GOAL	ACT	USING%	DELAY%
				62	100	00.00.00.500	80%	98.4%	98.4%	0.0	0.0
		N/A		0	0	00.00.05.000	80%	0.0%	N/A	0.0	0.0
		N/A		0	0	00.00.15.000	AVG	00.00.00.000	N/A	0.0	0.0
TOTAL				62	100						

REPORT BY: POLICY=BASEPOL WORKLOAD=STC\_WLD SERVICE CLASS=STCLOW RESOURCE GROUP=\*NONE  
CRITICAL =NONE  
DESCRIPTION =Low priority for STC workloads

-TRANSACTIONS-	TRANS-TIME	HHH.MM.SS.TTT	--DASD	I/O--	---	SERVICE---	SERVICE TIME	---	APPL %---	---	PROMOTED--	---	STORAGE----		
AVG	0.12	ACTUAL	5.341	SSCHRT	0.1	IOC	250903	CPU	14.636	CP	0.82	BLK	0.000	AVG	679.09
MPL	0.12	EXECUTION	5.341	RESP	2.7	CPU	2046K	SRB	0.032	AAPCP	0.00	ENQ	0.000	TOTAL	81.44

Source: RMF V1R10 Report Analysis

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# Notes- RMF Workload Activity

**CP** Percentage of CPU time used by transactions running on standard CPs in the service or report class period.

The calculation is:

$$\text{APPL\% CP} = \frac{\text{CPU} + \text{SRB} + \text{RCT} + \text{IIT} + \text{HST} - \text{AAP} - \text{IIP}}{\text{Interval length}} * 100$$

**Notes:**

1. The interval length in a sysplex is the common interval length.
2. The AAP and IIP times may be normalized from a faster zAAP or zIIP.

## **AAPCP**

Percentage of CPU time used by zAAP eligible transactions running on standard CPs. This is a subset of APPL% CP.

**IIPCP** Percentage of CPU time used by zIIP eligible transactions running on standard CPs. This is a subset of APPL% CP.

**AAP** Percentage of CPU time used by transactions executed on zAAPs in the service or report class period.

**IIP** Percentage of CPU time used by transactions executed on zIIPs in the service or report class period.

Source: RMF V1R10 Report Analysis

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**AAPCP and IIPCP will forecast ZAAP and ZIIP potential utilization with PROJECTCPU option specified in IEAOPT member of PARMLIB**

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# RMF Workload Activity - 2

REPORT BY: POLICY=HPTSPOL1 WORKLOAD=PRODWKLD SERVICE CLASS=CICSHR RESOURCE GROUP=\*NONE PERIOD=1  
IMPORTANCE=HIGH

-TRANSACTIONS--	TRANSACTION TIME	HHH.MM.SS.TTT	Response time
AVG	0.00	ACTUAL	000.00.00.114
MPL	0.00	QUEUED	000.00.00.036
ENDED	216	EXECUTION	000.00.00.078
END/SEC	0.24	STANDARD DEVIATION	000.00.00.270
#SWAPS	0		
EXECUTD	216		

-----RESPONSE TIME BREAKDOWN IN PERCENTAGE-----															-----STATE-----			
SUB	P	TOTAL	ACTIVE	READY	IDLE	-----WAITING FOR-----										SWITCHED TIME (%)		
TYPE						LOCK	I/O	CONV	DIST	LOCAL	SYSPL	REMOT	TIMER	PROD	MISC	LOCAL	SYSPL	REMOT
CICS	BTE	93.4	10.2	0.0	0.0	0.0	0.0	83.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	83.3	0.0	0.0
CICS	EXE	67.0	13.2	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.7	0.0	0.0	0.0	0.0

Time in DB2 or  
IMS or MQ

This is a sample RMF post processor (ERBRMFPP) output with option SYSRPTS(WLMGL(SCPER))

Source: Chris Baker, IBM Hursley, UK

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# CICS Statistics

- Data written to SMF files
- Control via:  
CEMT SET STATISTICS  
INTERVAL(hhmmss) **default = 3 hrs.**  
ENDOFDAY(hhmmss) **default = 000000**
- Can be requested via CEMT for any one of the over 20 specific areas of CICS
- Reports via DFHSTUP and DFH0STAT

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# CICS Statistics - 2

- **Recommendation for detailed performance analysis:**  
INTERVAL(hhmmss) Make the interval **match** the RMF – SMF data collection interval's duration.  
Same use as DFHSIT STATINT.
- Enables most effective analysis of resource utilization statistics collected by SMF- RMF in conjunction with the CICS statistics.

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# CICS Dispatcher Domain -1

- Statistics to watch:
  - Current MXT limit
  - ☠ Nr. Of Times MXT reached
  - Peak tasks??
  - TRANCLASS limit by class
  - ☠ TRANCLASS limit reached by class

**NOTE:** Limits should only be hit intentionally, and watch out for excessive (about 25% above HWM) MXT as cause of increased WLM /SRM CPU needs!





# CICS Dispatcher Domain –2

## Processor timings by modes of TCB in CICS V4.1:

QR = Quasi-reentrant (system & **applications**)

CO = Concurrent (VSAM) mode TCB if SUBTSKS is 1

FO = File Owning (VSAM)

RO = Resource Owning

D2 = Used to stop DB2 protected threads

SZ = Used by FEPI interface

RP = Used to make ONC/RPC calls

**EP = Runs event processing (new in v4.1)**

J8 = Run JVM in CICS key

J9 = Run JVM in user key

JM = Shared class cache management

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# CICS Dispatcher Domain – 3

## Processor timings by modes of TCB in CICS V4.1:

L8 = OPENAPI option and EXECKEY=CICS programs

L9 = OPENAPI option and EXECKEY=USER programs

SO = Used for calls to TCP/IP sockets interface

SL = Used to wait for activity on a set of listening sockets

S8 = Secure Sockets Layer (SSL) or LDAP request

SP = Used for socket pthread owning task

**T8 = Used by tasks to perform system processing in JVM server (new in v4.1)**

**TP = Owns and manages the LE enclave, JVM, THRD TCB pool, and T8 TCB of JVM server (new in v4.1)**

X8 = Used by tasks which call C or C++ program compiled with XPLINK option and defined with EXECKEY=CICS

X9 = Used by tasks which call C or C++ program compiled with XPLINK option and defined with EXECKEY=USER

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# CICS Dispatcher Domain -4

- Number of MVS waits /TCB
- Accum. time in MVS wait /TCB
- Accum. Time dispatched /TCB
- Accum. CPU time /TCB
- **Track & Note:**
  - Total CPU & consumption rate of region
  - Wait-for-dispatch (incl. measurement distortions) = 3 – 4 (w/o capture ratio)

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# Dispatcher Statistics – Summary

## DISPATCHER STATISTICS

Dispatcher Start Date and Time. . . . .	: 11/24/2002 09:22:44.7563
Address Space CPU Time. . . . .	: 02:11:34.1901
Address Space SRB Time. . . . .	: 00:02:24.3700
Peak number of dispatcher tasks . . . . .	: 149
Peak ICV time (msec). . . . .	: 1000
Peak ICVR time (msec) . . . . .	: 150000
Peak ICVTS time (msec) . . . . .	: 250
Peak PRTYAGE time (msec). . . . .	: 0
Peak MRO (QR) Batching (MROBTCH) value. . . . .	: 1
Number of Excess TCB Scans. . . . .	: 1030792M ☹
Excess TCB Scans - No TCB Detached. . . . .	: 901943M ☹
Number of Excess TCBs Detached. . . . .	: 222681M ☹
Average Excess TCBs Detached per Scan . . . . .	: 0

.....

## Notes/Recommendations:

- Excess TCB scans and detaches increase unproductive overhead.
- Tune number of TCB-s allocated to minimize overhead.

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# Dispatcher Statistics – V4.1 Summary

## DISPATCHER STATISTICS

<u>Dispatcher Start Date and Time. . . . .</u>	<u>: 08/23/2009 06:03:32.6499</u>
<u>Address Space CPU Time. . . . .</u>	<u>00:05:27.182061</u>
<u>Address Space SRB Time. . . . .</u>	<u>00:00:06.130045</u>
<u>Peak number of dispatcher tasks . . . . .</u>	<u>69</u>
<u>Peak ICV time (msec). . . . .</u>	<u>1000</u>
<u>Peak ICVR time (msec) . . . . .</u>	<u>2500</u>
<u>Peak ICVTS time (msec) . . . . .</u>	<u>500</u>
<u>Peak PRTYAGE time (msec). . . . .</u>	<u>0</u>
<u>Peak MRO (QR) Batching (MROBTCH) value. . . . .</u>	<u>1</u>
<u>Number of Excess TCB Scans. . . . .</u>	<u>239</u>
<u>Excess TCB Scans - No TCB Detached. . . . .</u>	<u>231</u>
<u>Number of Excess TCBs Detached. . . . .</u>	<u>12</u>
<u>Average Excess TCBs Detached per Scan . . . . .</u>	<u>0</u>
<u>Number of CICS TCB MODEs. . . . .</u>	<u>21</u> 
<u>Number of CICS TCB POOLs. . . . .</u>	<u>5</u>

**Note: Three new TCB modes in V4.1: EP, T8, TP**

**Report Source: Steve Ware, from UFL Test Region**

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# Dispatcher Statistics – Time by TCB Mode

DISPATCHER STATISTICS (Note: Columns 2 - 5 deleted to improve legibility)

TCB Mode	MVS Waits	Total Time in MVS wait	Total Time Dispatched	Total CPU Time / TCB
QR	13051397	000-18:18:33.24	000-01:49:46.74	000-01:12:02.27
RO	48658	000-20:05:12.28	000-00:02:46.27	000-00:01:00.80
CO	0	000-00:00:00.00	000-00:00:00.00	000-00:00:00.00
SZ	0	000-00:00:00.00	000-00:00:00.00	000-00:00:00.00
RP	0	000-00:00:00.00	000-00:00:00.00	000-00:00:00.00
FO	800	000-19:00:52.61	000-00:00:44.05	000-00:00:06.50
SL	1	000-00:00:00.00	000-00:00:00.00	000-00:00:00.00
SO	2	000-00:00:00.00	000-00:00:00.00	000-00:00:00.00
S8	0	000-00:00:00.00	000-00:00:00.00	000-00:00:00.00
D2	2419	000-20:18:01.28	000-00:00:03.26	000-00:00:00.43
L8	16952578	007-03:07:31.31	000-05:36:18.48	000-01:13:35.37
H8	0	000-00:00:00.00	000-00:00:00.00	000-00:00:00.00
J8	0	000-00:00:00.00	000-00:00:00.00	000-00:00:00.00

**Recommendation:** If QR TCB “Total Time Dispatched” is more than 1.25 times “Total CPU Time/TCB,” determine response time degradation and seek increased importance in WLM Service Policy if degradation is significant.

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# I/O Performance Analysis

- Read I/O Performance
- Write I/O Performance
- RMF Device Activity Reports
- CICS I/O Activity Statistics

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# READ I/O Performance

Performance factors:

- IOS queuing
- Channel utilization
- Amount of cache
- Device utilization
- Intra-file contention
- Inter-file contention
- Path utilization
- I/O pend request handling by CPU

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# WRITE I/O Performance

Performance factors:

- IOS queuing
- Channel utilization
- Amount of NVS cache
- Contention with other writers
- Disk device utilization
- Intra-file contention
- Inter-file contention
- I/O path utilization
- I/O pend request handling by CPU.

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# I/O Device Activity (RMF PP Report)

## DIRECT ACCESS DEVICE ACTIVITY

z/OS V1R8

SYSTEM ID SYS1  
RPT VERSION V1R8 RMF

DATE 11/28/2006  
TIME 16.30.00

INTERVAL 14.59.946  
CYCLE 1.000 SECONDS

TOTAL SAMPLES = 900 IODF = A3 CR-DATE: 07/21/2006 CR-TIME: 07.42.20 ACT: POR

STORAGE GROUP	DEV NUM	DEVICE TYPE	VOLUME SERIAL	PAV	LCU	DEVI- ACTIVITY RATE	AVG RESP TIME	AVG IOSQ TIME	AVG CMR DLY	AVG DB DLY	AVG PEND TIME	AVG DISC TIME	AVG CONN TIME	% DEV CONN	% DEV UTIL	% DEV RESV	AVG NUMBER ALLOC	% ANY ALLOC	% MT PEND
	0401	3380K	SYSLIB		0032	1.246	4.6	0.0	0.0	2.2	2.5	0.1	2.0	0.25	0.26	0.0	89.6	100.0	0.0
	0402	3380K	SYSUSR		0032	0.250	1.4	0.0	0.0	0.1	0.3	0.0	1.0	0.03	0.03	0.1	14.0	100.0	0.0
	040F	3380K	SCL338		0032	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.0	0.0	100.0	0.0
			LCU		0032	1.496	4.1	0.0	0.0	1.0	2.1	0.1	1.8	0.07	0.07	0.0	104	100.0	0.0
	044F	3380K	MVSPG1		0033	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.0	0.0	100.0	0.0
	0460	3380K	RMFLIB		0033	0.036	6.1	0.0	0.0	0.3	1.5	0.0	4.6	0.02	0.02	0.0	0.0	100.0	0.0
	047F	3380K	MVSPLX		0033	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.0	0.0	100.0	0.0
			LCU		0033	0.036	6.1	0.0	0.0	0.3	1.5	0.0	4.6	0.00	0.00	0.0	4.0	100.0	0.0
	0500	33903	MVSLIB		0034	0.082	22.6	0.0	0.0	13.0	16.2	0.3	6.1	0.05	0.05	0.0	20.4	100.0	0.0
	0501	33903	MVSSCF		0034	0.012	1.6	0.0	0.0	0.0	0.5	0.0	1.0	0.00	0.00	0.0	4.6	100.0	0.0
	0502	33903	MVSCI2		0034	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.0	0.0	100.0	0.0
OMVSSYS	0503	33903	MVSOP2		0034	0.008	19.2	0.0	0.0	0.0	0.8	0.0	18.4	0.01	0.01	0.0	0.0	100.0	0.0
	0705	33909	15CY09		0035	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.0	0.0	100.0	0.0
	0707	33909	16RJ02		0035	0.036	55.2	0.0	0.0	36.7	44.6	0.0	10.6	0.04	0.04	0.0	0.0	100.0	0.0
	0708	33909	15CYX9		0035	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.0	0.0	100.0	0.0

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# RMF Monitor III- Device Delays

RMF V1R8 Device Delays

Line 1 of 57  
Scroll ==> HALF

Command ==>

Samples: 100 System: MVS1 Date: 10/31/06 Time: 10.03.20 Range: 100 Sec

Jobname	Service C Class	DLY %	USG %	CON %	Main Delay Volume(s)					
					% VOLSER	% VOLSER	% VOLSER	% VOLSER	% VOLSER	% VOLSER
MARYPATM	B NRPRIME	70	51	54	70 TSOL11	1 DUMP00				
MICHAELL	B NRPRIME	39	15	14	39 BPXLK1					
MCPDUMP	S SYSSTC	36	18	20	36 D24PK2					
CHARLESR	B NRPRIME	33	13	13	28 BPXLK1	3 HSML02	2 BPXSSK			
DFHSM	S SYSSTC	30	83	35	10 HSML17	5 SMS026	4 HSMOCD	4 HSMBCD		
SHUMA3	T TSOPRIME	18	52	53	13 D83ID0	5 HSML02				
DAVEP	T TSOPRIME	16	9	10	4 HSM009	3 HSM005	2 HSML06	1 SMS013		
CATALOG	S SYSTEM	9	15	21	2 CLR007	1 HSM036	1 HSM018	1 HSM011		
DB2MDBM1	S SYSSTC	9	7	5	7 DB2MS2	1 DB2MD0	1 DB2MS0			
GINNI	T TSOPRIME	8	10	9	3 HSML17	2 CLR010	1 HSM032	1 NATPK1		
TREVORJ	T TSOPRIME	6	10	11	2 HSM022	1 HSM001	1 RESPK1	1 HSM024		
RHANSON	T TSOPRIME	6	9	8	4 HSML17	1 RESPK1	1 NATPK1			
KOCH	T TSOPRIME	6	3	3	2 HSML17	1 CLR010	1 HSM018	1 HSM043		

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# M3- File I/O Tuning – VSAM RLS

RMF VIR8 VSAM RLS Activity - SYSPLEX Line 1 of 20  
Command ==> Scroll == => HALF

Samples: 120 Systems: 2 Date: 10/31/06 Time: 13.25.00 Range: 120 Sec

< 2GB / > 2GB  
LRU Status : Good / Accel  
Contention % : 0.0 / 0.0  
False Cont % : 0.0 / 0.0

**VSAM RLS activity by data set.**  
**Also available by Storage Class.**

Sphere/DS	Access	Resp Time	----- Read Rate	BMF%	CF%	DASD%	----- Valid%	BMF False	----- Inv%	Write Rate
BMAI.VSAMIN.MEGA										
BMAI.VSAMIN.MEGA.AIX.DATA										
Below 2GB	DIR	0.003	0.01	0.0	0.0	100	0.0	0.00		0.00
	SEQ	0.000	0.00	0.0	0.0	0.0	0.0	0.00		0.00
Above 2GB	DIR	0.003	0.01	0.0	0.0	100	0.0	0.00		0.00
	SEQ	0.000	0.00	0.0	0.0	0.0	0.0	0.00		0.00
BMAI.VSAMIN.MEGA.AIX.INDEX										
Below 2GB	DIR	0.003	0.03	50.0	0.0	50.0	100	0.00		0.00
	SEQ	0.000	0.00	0.0	0.0	0.0	0.0	0.00		0.00
Above 2GB	DIR	0.003	0.03	50.0	0.0	50.0	100	0.00		0.00
	SEQ	0.000	0.00	0.0	0.0	0.0	0.0	0.00		0.00
BMAI.VSAMIN.MEGA.DATA										
Below 2GB	DIR	0.000	7.45	83.2	0.0	16.8	100	0.00		0.00
	SEQ	0.000	0.00	0.0	0.0	0.0	0.0	0.00		0.00

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# NOTES: File I/O Tuning – VSAM RLS

- “**LRU Status**” status of local buffers under Buffer Manager Facility (BMF) control
  - 😊 GOOD = BMF at or below goal
  - 😞 ACCELERATED = buffer aging algorithms accelerated because BMF is over goal
  - 😞😞 RECLAIMED = buffer aging bypassed accelerated because BMF is over goal
- “**BMF Valid %**” percent of BMF reads that were valid  
NOTE: BMF read hits are sum of valid and invalid hits. Buffers can be invalid because (A) data altered, or (B) CF lost track of buffer status
  - $\text{BMF READ HIT\%} = \text{BMF READ\%} / \text{BMF VALID\%} * 100$
  - $\text{BMF INVALID READ HIT\%} = \text{BMF READ HIT\%} - \text{BMF READ\%}$





# CICS File Control Statistics

- FC Calls total by the 7 types: Get, Get Upd, Browse, Update, Add, Delete, Brws Upd
- VSAM Data component physical I/Os
- VSAM Index component physical I/Os

**Recommendation:** Tuning Objective is to Maximize ratio of:

**$\Sigma$ FC Calls / (Data + Index I/Os)**

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# CICS VSAM File Control Statistics

File Name	Get Requests	Get Upd Requests	Browse Requests	Update Requests	Add Requests	Delete Requests	Brws Upd Requests	VSAM EXCP Data	Requests Index	RLS req Timeouts
AAAB2SP	34238	0	0	0	0	0	0	22	1	0
BBBACTV	0	27	0	27	376636	0	0	382501	0	0
CCCFNDD	65928	0	0	0	0	0	0	15089	6228	0
DDDIAFD	4767	0	25159	0	0	0	0	12609	148	0
EEEINTX	27088	0	8124	0	0	0	0	3	2	0 ☺
FFFPNDD	17969	5310	0	5310	166	0	0	9905	799	0
GGGSCRX	488	0	0	0	0	0	0	18	59	0
HHHSEGH	33043	43	1712	43	43	0	0	1597	841	0 ☺
IIISEG1	48931	6925	531	2810	6739	4115	0	15537	2862	0
JJJSEG2	23634	745	0	205	745	540	0	1291	1	0
KKKTBLs	537	0	75997	0	0	0	0	525	26	0 ☺
LLLTEST	0	0	0	0	41741	0	0	43761	0	0
MMMULHD	54891	43	0	43	0	0	0	806	453	0 ☺
NNNUNLD	32679	1640	0	1586	53	0	0	7319	2670	0
OOOPCFIL	37752	0	0	0	0	0	0	21	1	0 ☺
*TOTALS*	427489	18626	155690	13864	459660	4655	0	536868	15546	0

## Notes & Recommendations:

1. Totals are greater than all files shown because many files deleted from sample.
2. Focus your tuning to minimize/eliminate VSAM EXCP Requests.
3. ☺ shown next to files with superior performance (least EXCP-s/Request).
4. BBB tuning options: faster IO service, application changes, file attributes,...
5. CCC, DDD, III, NNN appear to be good candidates for data in memory tuning.

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# CICS LSR Buffer Pools

- Buffer size
- Number of buffers
- Look-aside hits (This = saved I/Os)
- Buffer reads (I/Os required)
- User-initiated buffer writes (bad for LSR!)
- ☠ Number of requests waited for strings

**Recommendation:** Maximize 3 & minimize 4 by adding buffers; isolate 5s; minimize 6s!!!

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# CICS LSR Pools Statistics

## LSRPOOLS

Total number of pools built : 17  
Peak requests that waited for string : 2  
Total requests that waited for string : 125 ☹️ ☠️  
Peak concurrently active strings : 6

## Shared Buffers

<u>Pool Number</u>	<u>Look- asides</u>	<u>Reads</u>	<u>User writes</u>	<u>Non-user writes</u>
1	644389	48039	4596	0
2	53249	824	0	0 ☺️
3	234800	2568	139	0 ☺️
4	83125	5164	5620	0
5	187335	21327	1658	0
6	23980	10	24460	0
7	397988	7033	12882	0 ☺️
8	86917	1443	1507	0
<b>*TOTALS*</b>	<b>1711783</b>	<b>86408</b>	<b>50862</b>	<b>0</b>

**Recommendations:** (1) Minimize/eliminate waits for strings. (2) Add buffers until reads are being reduced significantly. (3) Use multiple LSR pools to separate data from index, and good from poor buffer candidates.

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# References

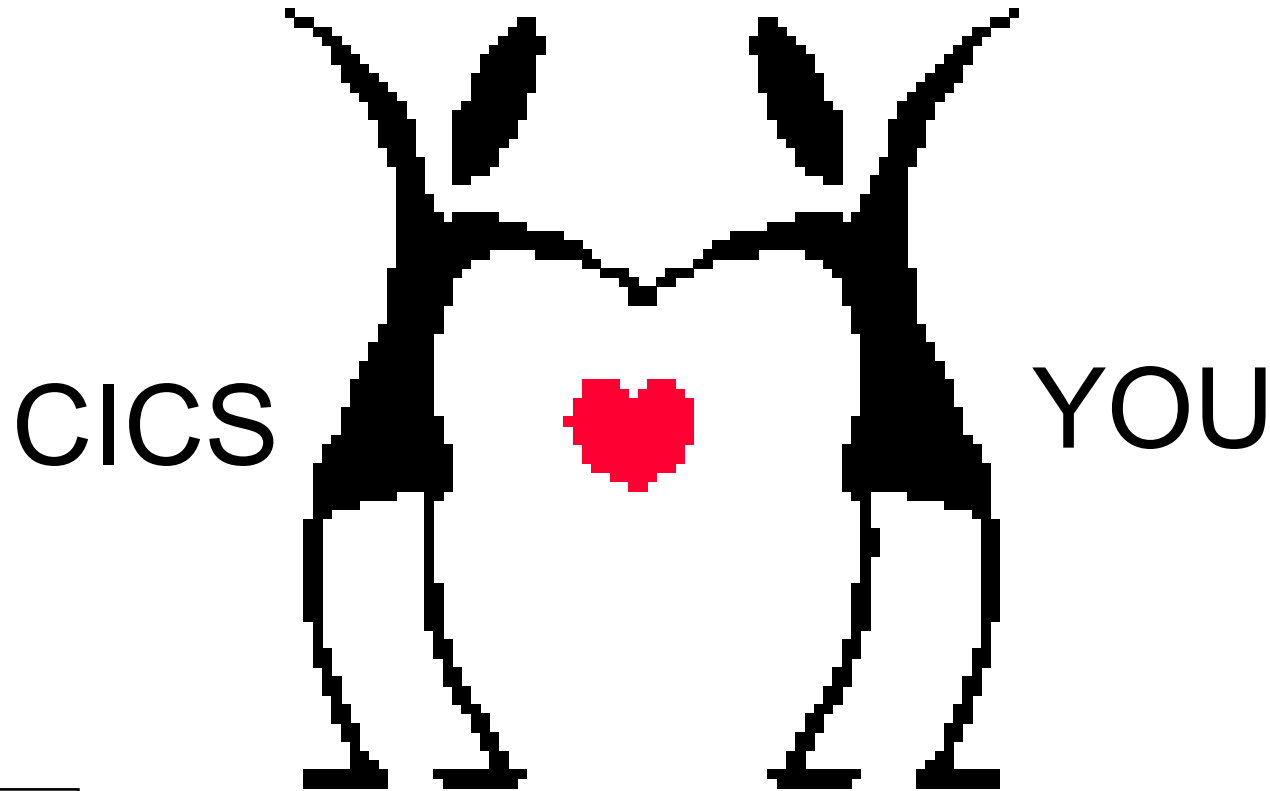
- CICS Information Center – IBM CICS Transaction Server for z/OS Version 4.1
- CICS Performance Guide, SC34-6009
- CICS Performance Management Guide, SC33-1699
- Videos On YouTube (follow CICSfluff):
  - Performance comparison between CICS TS V3.2 and CICS TS V4.1 and CICS TS V4.1 with WLM
  - Threadsafe Analysis with the CICS Explorer and CICS Tools





# Be @Next SHARE / Any Questions?

Join us at the next SHARE in Orlando, Summer of 2011.



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