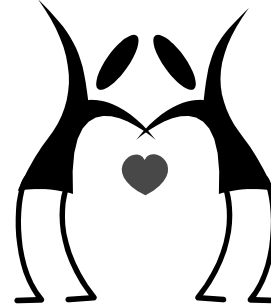




CICS Performance Management 2004

By Ivan Gelb



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Gelb Information Systems Corp.
10 Country Club Lane
Marlboro, NJ 07746
Phone: 732-303-1333
E-mail: ivan@gelbis.com

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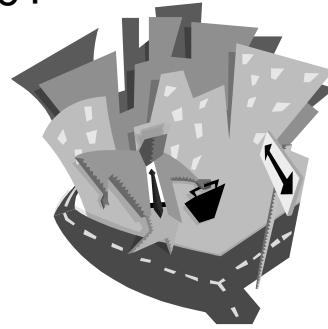


Contents

- Best Practices
- CICS TS 2.2 Performance
- CICS & WLM Release 2.10+
- Performance Reports

Key to symbols meanings:

- ☺ example of good performance
- ☹ example of poor performance
- ☠ bottleneck example
- < system “health” indicator + +



Best Practices



Begin With...

- Understanding of what is normal for your system's performance indicators
- Having a documented and traceable procedure for handling anomalies / complaints from clients
- Producing a record of each investigation
- Keeping early warning and/or "post mortem" performance reports

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Best Practices Summary

- List of questions
- Track processor delays
- Avoid CICS limit conditions
- Tune VSAM files
- Avoid PRTYAGE
- Use MROLRM
- Consider MROBATCH
- Limit TRACE use
- Evaluate MN use
- Storage violations?
- Use Log Manager
- DPMODE What?
- Tune MXT
- Use WLM Goal Mode
- Use response time goals
- Consider CPU critical?
- Consider Storage Critical?
- Tune Temp. Stor.

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Best Practice - 1

- Top 10 recommended questions while we handle performance issues:
 1. What is the complaint, and are any old complaints still around?
 2. When did this problem 1st occur and occur the last time?
 3. How many changes during period we study and what are they?
 4. How much the activity rate changed in any direction?
 5. How much did total workload change on this system?
 6. Was anything moved around (files, clients, regions,..)?
 7. If multiple LPARs under PR/SM, how much did the total load of all LPARs change?
 8. If multiple LPARs under PR/SM, did any weights or caps change (switched to uncapped)?
 9. Were any changes made to WLM service policy?
 10. What were the most recent changes to the application?



Best Practice - 2

- Processor related considerations:
 1. Does the application have delays caused by higher priority work within CICS, within MVS, within the processor (among LPAR-s)?
 2. If answer to Q1 is yes, do you have the proper priority, and is there adequate processor capacity available?

Recommendation: Always monitor wait-for-CPU-dispatch as a component of the total CICS response time.



Best Practice - 3

- **Recommendation:** Avoid all limit conditions being hit within CICS? Examples of limit conditions:
 - Max Tasks
 - Class Max Tasks
 - TCB-s
 - Threads
 - Buffers...some more shown later in statistics.
- The single reason to cause limit conditions: You wish to cause delay & pain to some unfortunate...



Best Practice - 4

- VSAM related **recommendations:**
 1. Continually focus on IO elimination via data in memory techniques.
This benefits CPU, response time, storage occupancy, IO subsystems performance.
 2. Track CICS VSAM file statistics as 1st indicator of possible tuning candidates. SMF 64s and 40s are the best sources of file performance data.
 3. Produce ongoing reports of total IO time by file and remember 80/20 rule.
 4. Track CI and CA split activity rates.
 5. Optimize LSR buffer pools (8 max. now).



Best Practice - 5

- **PRTYAGE=nnnnn**
 - If you made a transaction low priority, does it become more important if it lingers longer? We think NOT!
 - Higher priority reached by ageing good for just a one time dispatch, then transaction reverts to original priority.
Recommendation: Don't do it!



Best Practice - 6

- **MRO Long running mirrors**
MROLRM = YES
 - Good idea – can save CPU
 - No reason not to do it in any region servicing MRO requests.
 - CPU savings achieved by eliminating constant creation/destruction of mirror transactions.
Recommendation: Just do it!



Best Practice - 7

- MRO Batching
MROBTCH = nn
 - Could save CPU in regions originating MRO requests
 - Will increase response time of some trans.
 - CPU is saved because MRO requests are not sent until “nn” is reached or the system’s ICV value is reached (the maximum possible increase in response time)**Recommendation:** Use it only if desperate and you understand the delays you will cause.



Best Practice - 8

- **Recommendation:** TRACE = NO
 - Saves up to 20 – 35% CPU!
 - If **needed** for problem determination, Consider selective tracing by domain or transaction name – over 30 options!!!



Best Practice - 9

- **Recommendation: MN = ON**
 - CPU cost of 2 – 3% is all it takes to produce CMF records if you will actually do something useful with them once collected.

Otherwise:

Recommendation: MN = OFF

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Best Practice - 10

- **Recommendation:** If no storage violations in your CICS region, TRANISO = NO and STGPROT = NO
 - Transaction isolation and storage protection are NOT FREE! Do not just use them if you do not need them.
 - May cause SOS in DSA
 - May cause small increases in CPU / transaction

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Best Practice - 11

- **Recommendation: Use CICS TS Ver. 1.1+ Log Manager**
 - Replaced journal control – has 3 “flavors”
 1. Nonvolatile Coupling Facility (CF) – uses CF and MVS data space for backup – highest performer!
 2. Volatile CF – uses CF and disk file
 3. Disk file only – uses disk file for log and a data space – lowest performer



Best Practice – 11 continued

- CICS TS Ver. 1.1+ Log Manager
 - LGDFINT considerations
 - Low value may:
 - Reduce response time
 - Increase CPU consumption
 - High value
 - Increase response time
 - Reduce CPU consumption
- Recommendation:** Avoid use of LGDFINT and fix problem that made you use it.



Best Practice - 12

- **Recommendation: DPMODE = What??**
Option gone with initially shipped CICS 2.2 – now back via maintenance and in 2.3 – so what is this prove?
- **DPMODE=HIGH**
 - Best for high volumes with little DB2 use as long as ample CPU capacity is available with multiple CPUs/complex
- **DPMODE=EQUAL (is/was CICS 2.2 default!)**
 - **May(!)** provide better performance for non-SQL transactions
- **DPMODE=LOW**
 - Can provide more consistent service in some CPU constrained situations – otherwise only an experiment will tell...!
- **Important Note:** All 3 will work **OK** if non-CPU constrained in a multi-CP complex!



CICS TS V2 Performance



CICS TS V2 Performance

- **Traditional**
 - Release to Release comparisons
- **Database Access**
 - CICS/DB2 Attach
- **Performance Improvements**

Source: Geoff Sharman- with thanks to John Burgess, IBM, Hursley

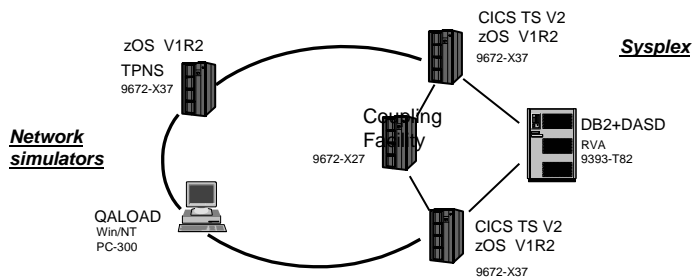
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Hursley Performance Measurement Environment



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Release to Release

- **Hardware**
 - 9672-X37 system under test
 - 9672-X27 TPNS driver
- **CICS Environment**
 - 2 TORs, 2 AORs, 1 FOR all MRO connected
 - All VSAM files recoverable
 - VTAM HPO used
 - No transaction isolation or storage protection
 - Long running mirror in FOR
- **Software**
 - z/OS 1.2
- **Workload**
 - 34 transaction types
 - COBOL applications
 - 40% transactions invoke menu
 - 32 VSAM KSDS files
 - average 6 FC calls per transaction
 - EXEC CICS LINK to program for each FC call
 - 69% Read, 10% Read for Update, 9% Update, 11% Add , 1% Delete
 - XEIIN and XEIOU enabled
 - TRUE enabled

Source: Geoff Sharman- with thanks to John Burgess, IBM, Hursley

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Release to Release Measurements

*Measurements at PTF level:
25/11/2001*

	<u>ETR</u> tps	<u>TOR</u> CPU%	<u>AOR</u> CPU%	<u>FOR</u> CPU%	<u>CEC</u> CPU%	<u>Resp</u> sec	<u>ITR</u> tps	<u>ITR</u> Delta
<i>CICS 4.1</i>	522.30	25.70	77.80	39.30	52.16	0.046	1001.3	- - -
<i>CTS 1.1</i>	516.10	27.00	79.00	36.80	52.02	0.046	992.10	- 0.9%
<i>CTS 1.2</i>	516.20	27.20	80.70	37.40	52.89	0.046	975.98	- 1.6%
<i>CTS 1.3</i>	516.60	29.00	86.10	39.30	55.42	0.045	927.10	- 5.0%
<i>CTS 2.1</i>	516.00	28.70	85.90	38.00	55.40	0.046	931.40	0.5%
<i>CTS 2.2</i>	514.70	28.70	87.90	38.60	56.23	0.046	915.34	-1.7%

Source: Geoff Sharman- with thanks to John Burgess, IBM, Hursley

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CICS Database Access

EJB

	<u>Connect + 1st Select</u>	<u>Subsequent Selects</u>
JDBC non-prepared statement	3.14ms	

Procedural

	<u>Connect + 1st Select</u>	<u>Subsequent Selects</u>
COBOL static SQL	0.71ms	0.17ms
'C' static SQL	0.92ms	0.17ms

Java

	<u>Connect + 1st Select</u>	<u>Subsequent Selects</u>
SQLJ	2.55ms?	0.62ms?
JDBC non-prepared statement	3.14ms	1.30ms
JDBC prepared statement	3.14ms	0.53ms

DB2 V7 - simple select

Source: Geoff Sharman- with thanks to John Burgess, IBM, Hursley

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CICS/DB2 Performance Improvements -1

- **Save TCB switch costs with DB2 ver. 6 +**
 - Application needs to be marked as Threadsafte
 - CICS APIs used between DB2 calls must be Threadsafte
- **Percentage savings depend on application**
 - based on the saved number of TCB switches and total path length
- **A switch to another TCB and back is about 4K instructions**

Source: Geoff Sharman- with thanks to John Burgess, IBM, Hursley

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CICS/DB2 Performance Improvements -2

- How? With CSD program definition CONCURRENCY(THREADSAFE)
- Control with MAXOPENTCB in SIT
- DB2CONN TCBLIMIT defines number of TCB-s that can be connected to DB2
- See CICS Application Programmer Reference manual Appendix L.



CICS File Control Improvements

Reduced CI locks

- **CILOCK=YES**
Lock held until Rewrite complete
- **CILOCK=NO (default)**
Lock held only until ReadUpdate complete
- **Can reduce response times**
- **Can increase throughput**

Source: Geoff Sharman- with thanks to John Burgess, IBM, Hursley



CICS & WLM

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Best Practice - 13

- Minimize OS/390 (z/OS) Workload Manager (WLM) CPU needs by tuning MXT for every region.
 - One PB created for each unit of MXT in every CICS!
 - If transaction management, Performance Blocks (PB) states sampled at 250 millisecond intervals
 - If region management: PBs are sampled every 10 intervals (10 * 250 ms = 2.5 sec)
- **Recommendation:** Keep MXT as low as possible without turning it into a bottleneck unless you intend to cause PAIN!

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Best Practice - 14

- **Recommendation:** Use WLM Goal Mode for best protection available for CICS performance. However, if OS/390 version is < 2.10, stay with compatibility mode workload management because:
 - Goal mode can NOT guarantee that CPU access of your loved CICS work will be protected from all lower priority work
 - DITTO for central storage – can cause CICS “pain” due to paging



Best Practice - 15

- **Recommendation:** Choose response time goals for maximum potential benefit of Goal Mode WLM operation. The other choices :
 - Percentile response time
 - Average response time
 - Velocity – to guarantee access only...



Percentile Response Time

- The recommended way to manage loved CICS production work
- Example – can be stated as:
 - 90% of transactions with < 1 sec. Resp.
- Can address problems caused by long running or never ending transactions

Note: See RMF Workload Activity Report for easiest and least overhead way of determining percentile goals.



Average Response Time

- Can work acceptably for homogeneous CICS workloads
- Stated as:
 - ALL transactions < 1 sec. AVG. Resp.
- “Fooled” by long running transactions ending in the interval
- Once “fooled” it will over-protect CICS



Velocity Goals -1

- “Execution velocity is an abstract mathematical description with no objectively measurable metric.”
--John Arwe, WLM Developer
- Velocity calculated from sampled states:
$$\text{CPU_Using_Time} / (\text{CPU_Using_Time} + \text{WLM_Managed_Delays})$$
 - WLM Managed delays: CPU, paging, swapping, MPL, IOs,...



Velocity Goals -2

- Velocity goals NEVER work as tools for relative priority
- Velocity goals do not determine CPU dispatching priority
- CICS TOR velocities fluctuate severely
- CICS TORs can be hurt by WLM's efforts to manage them



Velocity Goals – When?

- Recommended for non-transactional work or work that “needs” a limiter
- Low importance + low velocity can control known “loopers”
- Consider use of resource group maximum with velocity goals to impose an absolute limit
- CICS test regions



Best Practice - 16

- **Recommendation:** Consider use of WLM service class option CPU Critical = YES
 - Defined for single period service classes with velocity or response time goals
 - CICS region’s CPU dispatching priority will be kept higher than all less important work even if all of CICS’ goals are being met
- Goal mode problem before WLM R10
 - WLM’s slow reaction to sudden increases in CICS CPU demand

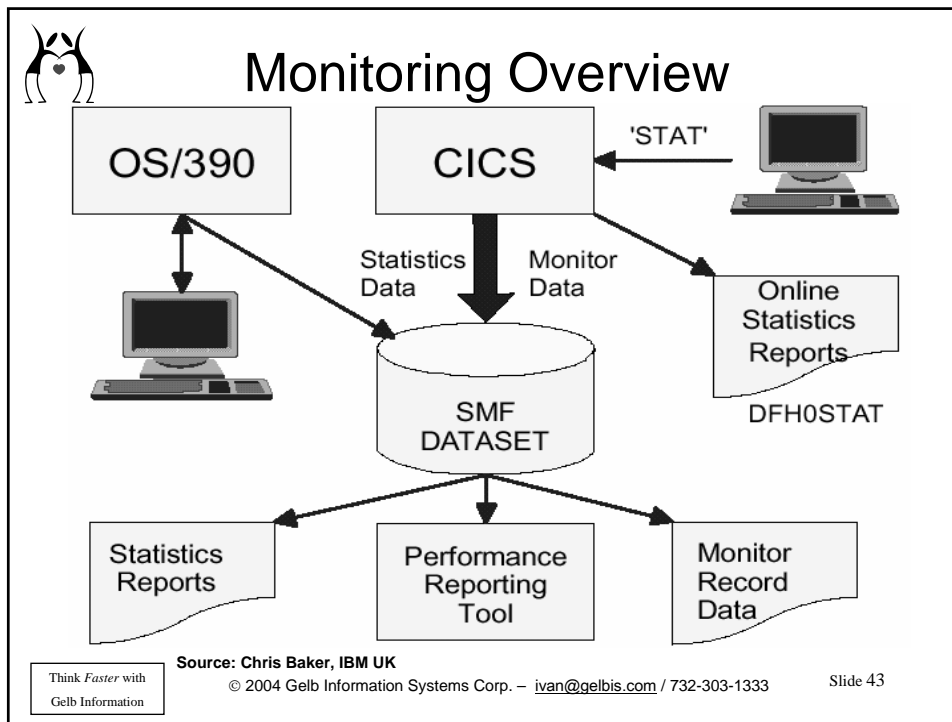


Best Practice - 17

- **Recommendation:** Consider use of WLM service class option Storage Critical = YES
 - CICS protected from paging because region's working set is kept very close to its high water mark (HWM)
- Goal mode problem before WLM R10
 - CICS with fluctuating activity levels exposed to page stealing that results in demand paging related delays



Performance Monitoring



- ## Measurement Data Sources
- Resource Measurement Facility (RMF)
 - System wide resource level details: CPU disks, storage, work details and summary
 - System Management Facility (SMF)
 - Address space level details for work: batch, STC, CICS, etc. + resource level details/address space
 - CICS daily and interval statistics
 - Region level statistics and resource counters for: CPU, IO, storage, etc...
 - CICS Monitoring Facility (CMF)
 - Transaction level excruciating details by region
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Performance Reporting

- **Recommendation:** Consider RMF for reporting CICS response time BUT—
- If goal = REGION, response times not reported to service class(es)
- At least TORs must be managed with goal = TRANSACTION to get response time reports from RMF records.



RMF Reports

- **Recommended** because effective reporting for least cost in computer resources highly depends on CICS work classification
- 2 – 6% CPU/CICS region can be saved if CMF based response time reporting is replaced with RMF only reports



RMF Workload Activity - 2

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

```

-TRANSACTIONS-- TRANSACTION TIME   HHH.MM.SS.TTT
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

```

-----RESPONSE TIME BREAKDOWN IN PERCENTAGE-----
SUB  P  TOTAL ACTIVE READY  IDLE  -----WAITING FOR-----  STATE
TYPE                                     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  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  46.7 0.0  0.0  0.0  0.0

```

Time in DB2

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

Source: Chris Baker, IBM

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CICS Statistics Highlights

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CICS Statistics -1

- Written to SMF
- Control:
CEMT SET STATISTICS
INTERVAL(hhmmss)
ENDOFDAY(hhmmss)
- Can be requested via CEMT for any one of the over 20 specific areas of CICS
- Reports via DFHSTUP



CICS Statistics –2

- Requested statistics produced by:
CEMT PERFORM STATISTICS RECORD
ALL or over 20 specific domains
- Requested RESET statistics produced by:
CEMT PERFORM STATISTICS RECORD
ALL RESETNOW or specific domains
- Unsolicited statistics are produced for dynamically managed resources: buffer pools, terminals, files...



CICS Statistics Data Mining

1. DB2
 2. Dispatcher Domain
 3. Enqueue
 4. File Control
 5. LSR Buffer Pools
 6. Loader
 7. Statistics Domain
 8. Storage Manager Domain
 9. Transactions
 10. Temporary storage
 11. Transient data
 12. VTAM
- Possibly interesting but not included are another 7+ domains because they are seldom the places to look for performance or capacity problems. You should not ignore them all the time.

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DB2ENTRY Statistics - 1

DB2ENTRY STATISTICS - REQUESTS

DB2Entry	Call	Signon	Partial	Commit	Abort	Single	Thread	Thread	Thread	Thread
Name	Count	Count	Signon	Count	Count	Phase	Reuse	Terms	Waits/Overfl	
AMD2	2730679	24238	8147	0	26	24222	23644	594	0	0
MDI	0	0	0	0	0	0	0	0	0	0
MDI1	0	0	0	0	0	0	0	0	0	0
MDI2	0	0	0	0	0	0	0	0	0	0
MNIF	1213	31	4	0	0	31	0	0	0	31
MT1010MQ	43872	871	868	30	3	841	0	871	0	0
MT4I	2814	22	15	68	0	4	0	0	0	22

Note: Many repetitive lines deleted from here

TOTALS	2778578	25162	9034	98	29	25098	23644	1465	53	
----------	---------	-------	------	----	----	-------	-------	------	----	--



Recommendations:

- “Thread Waits/Overfl” objective of less than 1% of total or ZERO.
- If “Thread Waits/Overfl” non-ZERO , then thread waits must be checked to minimize or eliminate them.

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DB2ENTRY Statistics - 2

DB2ENTRY STATISTICS - PERFORMANCE

DB2Entry Name	Thread Limit	Thread HWM	Pthread Limit	Pthread HWM	Task HWM	Task Total	Readyq HWM
AMD2	20	9	20	8	9	24238	0
MDI	3	0	0	0	0	0	0
MDI1	3	0	0	0	0	0	0
MDI2	0	0	0	0	0	0	0
MNIF	0	0	0	0	2	31	0
MT1010MQ	10	3	0	0	3	871	0

Note: Many lines deleted from here

TOTALS 25162

Recommendations:

- All HWM (High Water Mark) statistics should be less than the Limit values.
- If HWM = Limit for threads, then thread waits must be checked to minimize or eliminate them.

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Dispatcher Domain -1

1. Current MXT limit
2. ☠ Nr. Of Times MXT reached
3. Peak tasks??
4. TRANCLASS limit by class
5. ☠ TRANCLASS limit reached by class

NOTE: Limits should only be hit intentionally, and watch out for MXT as cause of increased WLM CPU needs!

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Dispatcher Domain –2

- Processor timings by TCB type:
 - QR = Quasi-reentrant (system & **applications**)
 - CO = Concurrent (VSAM)
 - FO = File Owning (VSAM)
 - RO = Resource Owning
 - RP = ONC/RPC
 - SL = Sockets Listener
 - SO = Sockets
 - SZ = FEPI
 - J8 = JVM (also J9 with CICS TS V2.3)
 - L8 = Open (**used by DB2 as of TS V2.2**)
 - S8 = Secure Sockets Layer



Dispatcher Domain -3

1. Number of MVS waits /TCB
2. Accum time in MVS wait /TCB
3. Accum. Time dispatched /TCB
4. Accum. CPU time /TCB

Track & Note:

- a) Total CPU consumption rate of region
- b) Wait-for-dispatch (incl. measurement distortions) = 3 – 4 (w/o capture ratio)



Dispatcher Statistics – 1

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
Number of CICS TCB MODEs.	: 13
Number of CICS TCB POOLs.	: 3

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 – 2

DISPATCHER STATISTICS

CICS TCB Mode Statistics

TCB Mode	Open	Pool	Attached	In Use	Attaches	Detached Unclean	Detached Stolen	Detached Excess	Detached Other	TCB Steals	TCB Mismatches
QR	No	N/A	1	1	1	0	0	0	0	0	0
RO	No	N/A	1	1	1	0	0	0	0	0	0
CO	Unk	N/A	0	0	0	0	0	0	0	0	0
SZ	Unk	N/A	0	0	0	0	0	0	0	0	0
RP	Unk	N/A	0	0	0	0	0	0	0	0	0
FO	No	N/A	1	1	1	0	0	0	0	0	0
SL	No	N/A	1	1	1	0	0	0	0	0	0
SO	No	N/A	1	1	1	0	0	0	0	0	0
S8	Unk	N/A	0	0	0	0	0	0	0	0	0
D2	No	N/A	1	1	1	0	0	0	2	0	0
L8	Yes	Open	24	24	55	0	0	51	0	0	0
H8	Unk	N/A	0	0	0	0	0	0	0	0	0
J8	Unk	N/A	0	0	0	0	0	0	0	0	0

TCB Mode	Attached	In Use	Attaches	Failures	MVS Waits	Total Time in MVS wait	Total Time Dispatched	Total CPU Time / TCB
QR	1	1	1	0	13051397	000-18:18:33.24	000-01:49:46.74	000-01:12:02.27
RO	1	1	1	0	48658	000-20:05:12.28	000-00:02:46.27	000-00:01:00.80
CO	0	0	0	0	0	000-00:00:00.00	000-00:00:00.00	000-00:00:00.00
SZ	0	0	0	0	0	000-00:00:00.00	000-00:00:00.00	000-00:00:00.00
RP	0	0	0	0	0	000-00:00:00.00	000-00:00:00.00	000-00:00:00.00
FO	1	1	1	0	800	000-19:00:52.61	000-00:00:44.05	000-00:00:06.50
SL	1	1	1	0	1	000-00:00:00.00	000-00:00:00.00	000-00:00:00.00
SO	1	1	1	0	2	000-00:00:00.00	000-00:00:00.00	000-00:00:00.00
S8	0	0	0	0	0	000-00:00:00.00	000-00:00:00.00	000-00:00:00.00
D2	1	1	1	0	2419	000-20:18:01.28	000-00:00:03.26	000-00:00:00.43
L8	24	24	55	0	16952578	007-03:07:31.31	000-05:36:18.48	000-01:13:35.37
H8	0	0	0	0	0	000-00:00:00.00	000-00:00:00.00	000-00:00:00.00
J8	0	0	0	0	0	000-00:00:00.00	000-00:00:00.00	000-00:00:00.00

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Dispatcher Statistics – 3

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 “Total Time Dispatched” is more than 1.5 times “Total CPU Time/TCB,” determine causes.

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Dispatcher Statistics – 4

DISPATCHER STATISTICS
CICS TCB Pool Statistics

TCB Pool		OPEN
Peak TCBS attached in this TCB Pool	24	Peak TCBS in use in this TCB Pool
Max TCB Pool limit (MAXOPENTCBS)	200	Times at Max TCB Pool Limit (MAXOPENTCBS)
Total Requests delayed by Max TCB Pool Limit		
Total Max TCB Pool Limit delay time	000-00:00:00	
Average Max TCB Pool Limit delay time		
Peak Requests delayed by Max TCB Pool Limit		

TCB Pool		JVM
Peak TCBS attached in this TCB Pool	0	Peak TCBS in use in this TCB Pool
Max TCB Pool limit (MAXJVMTCBS)	5	Times at Max TCB Pool Limit (MAXJVMTCBS)
Total Requests delayed by Max TCB Pool Limit		
Total Max TCB Pool Limit delay time	000-00:00:00	
Average Max TCB Pool Limit delay time		
Peak Requests delayed by Max TCB Pool Limit		

TCB Pool		HP
Peak TCBS attached in this TCB Pool	0	Peak TCBS in use in this TCB Pool
Max TCB Pool limit (MAXHPTCBS)	5	Times at Max TCB Pool Limit (MAXHPTCBS)
Total Requests delayed by Max TCB Pool Limit		
Total Max TCB Pool Limit delay time	000-00:00:00	
Average Max TCB Pool Limit delay time		
Peak Requests delayed by Max TCB Pool Limit		

Recommendation: If “Total Requests delayed by Max TCB Pool Limit” is non-zero, monitor and minimize total and average delay time.

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Enqueue Statistics

ENQUEUE STATISTICS

ENQ	ENQs	ENQs	Enqueue	Sysplex	Sysplex
Poolname	Issued	Waited	Waiting time	Waited	Waiting time
DISPATCH	0	0	000-00:00:00	0	000-00:00:00
EXECADDR	13704	5	000-00:04:00	0	000-00:00:00
EXECPLEX	0	0	000-00:00:00	0	000-00:00:00
EXECSTRN	179816	1889	000-01:02:16	0	000-00:00:00
FCDSSEWR	376788	29906	000-00:05:55	0	000-00:00:00
FCDSLMD	0	0	000-00:00:00	0	000-00:00:00
FCDSRECD	403085	0	000-00:00:00	0	000-00:00:00
FCDSRNGE	0	0	000-00:00:00	0	000-00:00:00

Recommendation: If Enqueue or Sysplex “Waiting time” is significant portion of transaction response time, they must be investigated to determine the cause(s).



File Control Statistics

1. FC Calls total by type: Get, Get Upd, Browse, Update, Add, Delete, Brws Upd
2. VSAM Data component IOs
3. VSAM Index component I/Os

Recommendation: Tuning Objective is to Maximize ratio of:
 $\Sigma \text{Calls} / (\text{Data} + \text{Index I/Os})$



VSAM Files Statistics

File Name	Get	Get Upd	Browse	Update	Add	Delete	Brws Upd	VSAM EXCP	Requests	RLS req
	Requests	Requests	Requests	Requests	Requests	Requests	Requests	Data	Index	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
MMULHD	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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LSR Buffer Pools

1. Buffer size
 2. Number of buffers
 3. Look-aside hits (This = saved I/Os)
 4. Buffer reads (I/Os required)
 5. User-initiated buffer writes (bad for LSR!)
 6. ☠ Number of requests waited for strings
- **Recommendations:** Maximize 3 & minimize 4 by adding buffers; isolate 5s; minimize 6s!!!

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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

Pool Number	Look- asides	Reads	User writes	Non-user writes
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
TOTALS	1711783	86408	50862	0

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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Loader Statistics

LOADER STATISTICS

```

Library load requests . . . . . : 3944
Total loading time. . . . . : 000-00:00:46.26
Average loading time. . . . . : 00:00.011728
Program uses. . . . . : 1063584
Requests that waited. . . . . : 3 ←
Peak waiting Loader requests. . . . . : 1 ←
Times at peak . . . . . : 3 ←
Total waiting time. . . . . : 000-00:00:00.05 ←
Times DFHRPL Library re-opened. . . . . : 0

```

LOADER DSA STATISTICS

CDSA

```

Programs removed by compression . . . . . : 0
Total Not In Use queue membership time. . . . . : 000-00:00:00.00
Average Not In Use queue membership time. . . . . : 00:00.000000
Reclaims from Not In Use queue. . . . . : 731 ☹️
Programs loaded but Not In Use. . . . . : 15 ☹️

```

ECDSA

```

Programs removed by compression . . . . . : 0
Total Not In Use queue membership time. . . . . : 000-00:00:00.00
Average Not In Use queue membership time. . . . . : 00:00.000000
Reclaims from Not In Use queue. . . . . : 135 ☹️
Programs loaded but Not In Use. . . . . : 9 ☹️

```

NOTE: Section for SDSA, ESDSA, RDSA, ERDSA were omitted to improve legibility

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Statistics Domain Statistics

STATISTICS DOMAIN STATISTICS

Total number of Interval Collections	6
Total number of SMF writes	335
Total number of SMF writes suppressed.	0
Total number of SMF errors	0
Total number of INT statistics records	144
Total number of EOD statistics records	47
Total number of USS statistics records	151
Total number of REQ statistics records	0
Total number of RRT statistics records	0

Statistics Settings

Statistics Interval	03:00:00	<
Statistics End-of-Day Time.	00:00:00	<
Statistics Recording.	ON	<

Recommendations:

1. Use INTERVAL for important periods
2. Use END-OF-DAY to offset statistics of different regions
3. Use utility supplied with CICS to produce the time offsets.

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Storage Manager

1. DSA & EDSA+others size
2. DSA & EDSA+others used
3. DSA & EDSA+others cushion sizes
4. *D&E=0 Times no storage returned*
5. *D&E=0 Times requests suspended*
6. *D&E=0 Times cushion released*
7. *D&E=0 Times short-on-storage (SOS)*
8. *Total time SOS*

Recommendation: Avoid/minimize 4, 5, 6, 7, & 8!!!

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Storage Manager Statistics - 1

STORAGE MANAGER STATISTICS

Global Statistics

Storage protection	:	ACTIVE
Transaction isolation	:	INACTIVE
Reentrant programs	:	NOPROTECT
Current DSA limit	:	7168K
Current DSA total	:	2816K
Peak DSA total	:	2816K
Current EDSA limit	:	160M
Current EDSA total	:	79M
Peak EDSA total	:	79M

Subspace Statistics

Total unique subspace users	:	0
Peak unique subspace users	:	0
Total common subspace users	:	0
Peak common subspace users	:	0

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Storage Manager Statistics - 2

Dynamic Storage Areas (below 16M)

	CDSA	USDA	SDSA	RDSA
Current DSA size	: 1536K	768K	256K	256K
Peak DSA Size	: 1536K	768K	256K	256K
Cushion Size	: 64K	64K	64K	64K
Peak free storage	: 632K	768K	256K	256K
Lowest free storage	: 28K	60K	92K	56K
Getmain Requests	: 350285	93182	102691	20
Freemain Requests	: 349912	93186	102678	0
Times no storage returned	: 0	0	0	0
Times request suspended	: 0	0	0	0
Peak requests suspended	: 0	0	0	0
Purged while waiting	: 0	0	0	0
Times cushion released	: 0	0	0	0
Times went short on storage	: 0	0	0	0
Total time SOS	: 000-00:00:00.00	000-00:00:00.00	000-00:00:00.00	000-00:00:00.00
Storage violations	: 0	0	0	0
Access	: CICS	USER	USER	CICS
Current extents	: 6	3	1	1
Extents added	: 6	3	1	1
Extents released	: 0	0	0	0

Recommendation: Avoid any storage related stress conditions as reported by the four items circled above.

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Storage Manager Statistics - 3

Dynamic Storage Areas (above 16M)

	ECDSA	EUDSA	ESDSA	ERDSA
Current DSA size :	15360K	28672K	18432K	18432K
Peak DSA Size :	15360K	28672K	18432K	18432K
Cushion Size :	128K	0K	128K	256K
Peak free storage :	3316K	28608K	2372K	2724K
Lowest free storage :	508K	64K	800K	428K
Getmain Requests :	33411166	9266236	261169	1279
Freemain Requests :	33382895	9266227	255838	866
Times no storage returned :	0	0	0	0
Times request suspended :	0	0	0	0
Peak requests suspended :	0	0	0	0
Purged while waiting :	0	0	0	0
Times cushion released :	0	0	0	0
Times went short on storage :	0	0	0	0
Total time SOS :	000-00:00:00.00	000-00:00:00.00	000-00:00:00.00	000-00:00:00.00
Storage violations :	0	0	0	0
Access :	CICS	USER	USER	CICS
Current extents :	15	28	10	12
Extents added :	15	28	10	12
Extents released :	0	0	0	0

Recommendation: Avoid any storage related stress conditions as reported by the four items circled above.

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Temp. Stor. Statistics

TEMPORARY STORAGE	
Put/Putq main storage requests :	78701 <
Get/Getq main storage requests :	70899 <
Peak storage for temp. storage (main) :	135916 <
Put/Putq auxiliary storage requests :	78756 <
Get/Getq auxiliary storage requests :	135961 <
Peak temporary storage names in use :	66
Number of entries in longest queue :	58
Times queues created :	131425
Control interval size :	4096
Available bytes per control interval :	4032
Segments per control interval :	63
Bytes per segment :	64
Writes more than control interval :	3
Longest auxiliary temp storage record :	32080
Number of control intervals available :	3599
Peak control intervals in use :	13
Times aux. storage exhausted :	0 <
Number of temp storage compressions :	1507 <
Temporary storage buffers :	6 <
Buffer waits :	0 <
Peak users waiting on buffer :	0 <
Buffer writes :	22 <
Forced writes for recovery :	0 <
Buffer reads :	25 <
Format writes :	0 <
Temporary storage strings :	6 <
Peak number of strings in use :	1 <
Times string wait occurred :	0 <
Peak number of users waiting on string :	0 <
I/O errors on TS dataset :	0 <
Shared pools defined :	0
Shared pools currently connected :	0
Shared read requests :	0
Shared write requests :	0

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Best Practice - 18

- **Recommendation:** Tune CICS Temporary Storage to minimize IO-s and activities that can waste CPU capacity.
 1. Minimize auxiliary storage requests by adding enough buffers and modifying applications that force TS activity to AUX.
 2. Avoid causing spanned TS records via proper CI size.
 3. Reduce/eliminate buffer and string waits.
 4. Avoid format writes with properly sized TS file.

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Transaction Class Report

TRANSACTION CLASS STATISTICS																
T O T A L																
Tclass	Max Purge											Peak	Peak	Times	Times	Average
Name	Act Thresh	Attaches	AccptImm	PurgdImm	Queued	PurgQ'd	Queuing-Time	Act	Queued	Max Act	PurgeThr	Queuing-Time				
AMD2CLS	80	30	34238	34238	0	0	0	000-00:00:00	49	0	0	0	000-00:00:00			
DFHCOMCL	10	0	0	0	0	0	0	000-00:00:00	0	0	0	0	000-00:00:00			
DFHEDFTC	10	0	0	0	0	0	0	000-00:00:00	0	0	0	0	000-00:00:00			
DFHTCLND	10	0	0	0	0	0	0	000-00:00:00	0	0	0	0	000-00:00:00			
DFHTCL01	1	0	0	0	0	0	0	000-00:00:00	0	0	0	0	000-00:00:00			
DFHTCL02	1	0	0	0	0	0	0	000-00:00:00	0	0	0	0	000-00:00:00			
DFHTCL03	1	0	0	0	0	0	0	000-00:00:00	0	0	0	0	000-00:00:00			
MNYTCL01	1	0	0	0	0	0	0	000-00:00:00	0	0	0	0	000-00:00:00			
MNYTCL02	1	0	0	0	0	0	0	000-00:00:00	0	0	0	0	000-00:00:00			
MNYTCL03	3	0	0	0	0	0	0	000-00:00:00	0	0	0	0	000-00:00:00			
MNYTCL04	1	0	0	0	0	0	0	000-00:00:00	0	0	0	0	000-00:00:00			
MNYTCL05	1	0	0	0	0	0	0	000-00:00:00	0	0	0	0	000-00:00:00			
MNYTCL06	1	0	0	0	0	0	0	000-00:00:00	0	0	0	0	000-00:00:00			
MNYTCL07	1	0	0	0	0	0	0	000-00:00:00	0	0	0	0	000-00:00:00			
MNYTCL08	1	0	0	0	0	0	0	000-00:00:00	0	0	0	0	000-00:00:00			
SYCNCLS	80	30	3632	3632	0	0	0	000-00:00:00	48	0	0	0	000-00:00:00			
TOTALS			37870	37870	0	0	0	000-00:00:00				0	000-00:00:00			

Recommendation: Queue Time should only be caused intentionally and otherwise minimized via tuning activity. If you cause waits in CICS, WLM can never help your loved one.

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Transient Data Statistics

<u>TRANSIENT DATA</u>		
Control interval size	:	4096
Peak control intervals used	:	2
Times NOSPACE occurred	:	0 <
Writes to intrapartition dataset	:	0
Reads from intrapartition dataset	:	0
Formatting writes	:	0
I/O errors	:	0 <
Intrapartition buffers	:	3
Peak intra. buffers containing valid data	:	1
Intrapartition accesses	:	5
Peak concurrent intrapartition accesses	:	1
Intrapartition buffer waits	:	0 <ⓧ
Peak intrapartition buffer waits	:	0 <ⓧ
Times string accessed	:	0
Peak concurrent string accesses	:	0
Intrapartition string waits	:	0 <ⓧ
Peak string waits	:	0 <ⓧ

Recommendation: Minimize all buffer and string waits.



VTAM Statistics

VTAM STATISTICS

Times at RPL maximum	:	1 <
Peak RPLs posted	:	2
Short on storage count	:	0 <
Dynamic opens count	:	0
Average LUs in session	:	8 <
HWM LUs in session	:	28 <
PS inquire count	:	0
PS nib count	:	0
PS opndst count	:	0
PS unbind count	:	0
PS error count	:	0

Recommendations:

1. Minimize “Times at RPL maximum”
2. Track Average and HWM LUs in session.



References

- CICS Performance Guide, Ver. 2, Rel. 2, SC34-6009-05
- CICS Performance Management Guide, SC33-1699



Session End / Affair Beginning

CICS



YOU

