



Advanced Technical Skills (ATS) North America

Managing CICS with Workload Manager



2011 Winter Share
Bradley Snyder
Email Address: bradley.snyder@us.ibm.com



CREATED WITH LOTUS® SYMPHONY™

Trademarks

The following are trademarks of the International Business Machines Corporation in the United States and/or other countries.

AlphaBlox*	GDP5*	RACF*	Tivoli*
APPN*	HiperSockets	Redbooks*	Tivoli Storage Manager
CICS*	HyperSwap	Resource Link	TotalStorage*
CICS/VSE*	IBM*	RETAIN*	VSE/ESA
Cool Blue	IBM eServer	REXX	VTAM*
DB2*	IBM logo*	RMF	WebSphere*
DFSMS	IMS	S/390*	xSeries*
DFSMShsm	Language Environment*	Scalable Architecture for Financial Reporting	z9*
DFSMSrmm	Lotus*	Sysplex Timer*	z10
DirMaint	Large System Performance Reference™ (LSPR™)	Systems Director Active Energy Manager	z10 BC
DRDA*	Multiprise*	System/370	z10 EC
DS6000	MVS	System p*	z/Architecture*
DS8000	OMEGAMON*	System Storage	Zenterprise 196*
ECKD	Parallel Sysplex*	System x*	z/OS*
ESCON*	Performance Toolkit for VM	System z	z/VM*
FICON*	PowerPC*	System z9*	z/VSE
FlashCopy*	PR/SM	System z10	zSeries*
* Registered trademarks of IBM Corporation	Processor Resource/Systems Manager		

The following are trademarks or registered trademarks of other companies.

Adobe, the Adobe logo, PostScript, and the PostScript logo are either registered trademarks or trademarks of Adobe Systems Incorporated in the United States, and/or other countries.

Cell Broadband Engine is a trademark of Sony Computer Entertainment, Inc. in the United States, other countries, or both and is used under license therefrom.

Java and all Java-based trademarks are trademarks of Sun Microsystems, Inc. in the United States, other countries, or both.

Microsoft, Windows, Windows NT, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.

Intel, Intel logo, Intel Inside, Intel Inside logo, Intel Centrino, Intel Centrino logo, Celeron, Intel Xeon, Intel SpeedStep, Itanium, and Pentium are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.

UNIX is a registered trademark of The Open Group in the United States and other countries.

Linux is a registered trademark of Linus Torvalds in the United States, other countries, or both.

ITIL is a registered trademark, and a registered community trademark of the Office of Government Commerce, and is registered in the U.S. Patent and Trademark Office.

IT Infrastructure Library is a registered trademark of the Central Computer and Telecommunications Agency, which is now part of the Office of Government Commerce.

* All other products may be trademarks or registered trademarks of their respective companies.

Notes:

Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance ratios stated here.

IBM hardware products are manufactured from new parts, or new and serviceable used parts. Regardless, our warranty terms apply.

All customer examples cited or described in this presentation are presented as illustrations of the manner in which some customers have used IBM products and the results they may have achieved. Actual environmental costs and performance characteristics will vary depending on individual customer configurations and conditions.

This publication was produced in the United States. IBM may not offer the products, services or features discussed in this document in other countries, and the information may be subject to change without notice. Consult your local IBM business contact for information on the product or services available in your area.

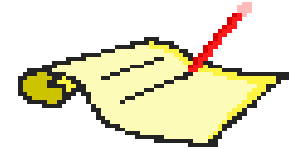
All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

Information about non-IBM products is obtained from the manufacturers of those products or their published announcements. IBM has not tested those products and cannot confirm the performance, compatibility, or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

Prices subject to change without notice. Contact your IBM representative or Business Partner for the most current pricing in your geography.

Agenda

- **WLM Concepts**
- **CICS Classification**
- **CICS/WLM Subsystem Awareness**
- **CICS Transaction Reporting**
- **CICS Server Management**
- **Sample RMF Reports**
- **Summary**



WLM Concepts

■ Service Definition

- Saved in PDS
- Installed in WLM Couple Data Set
- Managed via WLM ISPF Application
 - New capabilities to manage via z/OS Management Facility

■ Policy

- Multiple pre-defined Policies
- One active Policy per Parallel Sysplex

■ Service Class

- Period Switched
- Expectation of Arrival rate, resource use, and response time
- Recommend maximum of 30-35 ACTIVE Service Class Periods

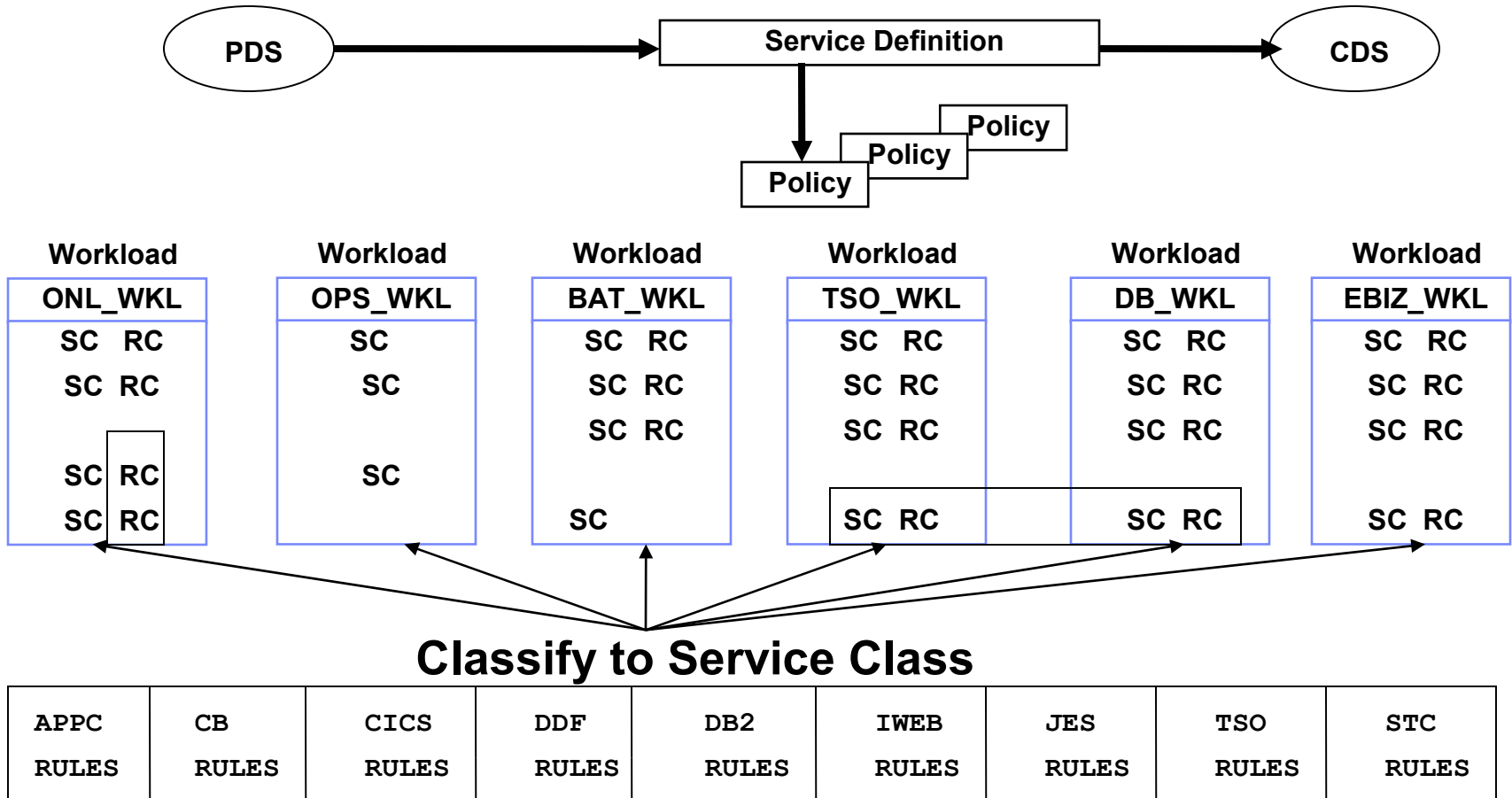
■ Report Class = Reporting Performance Group

- z/OS V1R11 allows 2,047 Report Classes

■ Resource Group

- Software Capping with a Sysplex Scope

WLM Classification



Work Enters the System

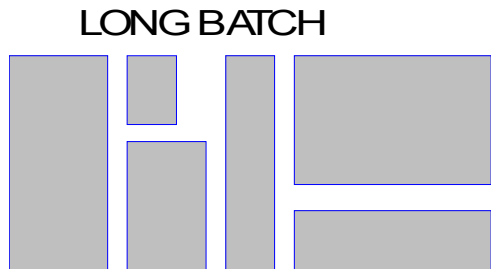
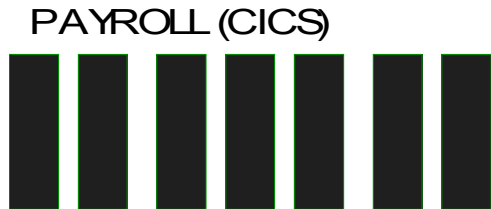
WLM Classification Options

- **Identify work as CPU Critical**
 - Lower importance work cannot be set to higher dispatching priority

- **Identify work as Storage Critical**
 - Work will lose storage only to work of equal or greater importance

- **CICS/IMS Transaction or Region management**
 - Allows work to be managed to either the region or transaction goal
 - Transaction management is default when transaction goals are set

Service Classes



Name	Goal Type	Value	IMPORTANCE	CPU Critical
"SHBAT"	Velocity	50	Low (5)	NO
"ADTSO" Periods	Avg. Response Time	1.2 Seconds	Medium (3)	NO
"PAYROLL"	Percentile Response Time	90% in less than a second	High (1)	YES
"LONGBAT"	Discretionary	N/A	N/A	NO

Setting CPU Critical

- **WLM May not react quickly enough to keep a critical workload happy in the face of major workload change**
 - ie. Stock Market Open
- **Assigned at the service class level**
 - Restricted to single period service classes with velocity or response time goals
- **CPU CRITICAL = YES means work runs at higher dispatching priority than all lower importance work even if this priority is not required to meet goals**
- **Provides guaranteed CPU access to most critical work**

```
Modify a Service Class
```

```
Service Class Name . . . : CI CSTRAN
Description . . . . . : Production CI CS Transaction
Workload Name . . . . . : CI CSPROD
Base Resource Group . .
CPU Critical . . . . . YES
```


Service Class Goal Types

■ Percentile Response Time

- Provides best control
 - Needs decent transaction rate to make statistics valid
- Set the percentile to the most repeatable portion of the workload
 - ie. 70% in 0.25 seconds

■ Average Response Time

- Work is managed to worst performing transactions
 - Best used only if very few outliers among all transactions

■ Velocity

- Work with few response times, large amounts of queue times, and variable response times

■ Discretionary

- Work with no business importance

■ WLM Defined Service Classes

- SYSTEM
- SYSSTC
- SYSOTHER

Setting Goal Importance

- **Range of Very Important (1) to Desirable (5)**
 - Relative Value, not absolute value

- **Significance of meeting goal says nothing about how easy or difficult the goal is to achieve**
 - Example: a batch service class with velocity of 5 but IMP=1

- **Used by WLM to**
 - Identify critical workloads
 - Make tradeoffs to protect critical workloads
 - React to changing capacity. Scarce resources will cause WLM to degrade work equally within importance

- **Goals measured using Performance Index (PI)**
 - $PI = 1.0$ means work is meeting goal
 - $PI < 1.0$ means work is beating the goal
 - $PI > 1.0$ means work is missing the goal

WLM Structure

- **WLM does require a sysplex, but not a parallel sysplex**
 - Require a WLM couple data set, and an active policy
 - Single system would be defined as a monoplex
- **WLM manages:**
 - CPU access
 - Storage controls, and MPL levels
- **WLM optionally manages:**
 - I/O priority
 - JES type Initiators
 - DB2 Stored Procedure Address Spaces
 - Websphere Scalable Address Spaces
 - Parallel I/O Access
 - LPAR Weight Management
 - Logical CP Management (replaced with HIPERDISPATCH=YES)
 - Channel Subsystem Priority Management

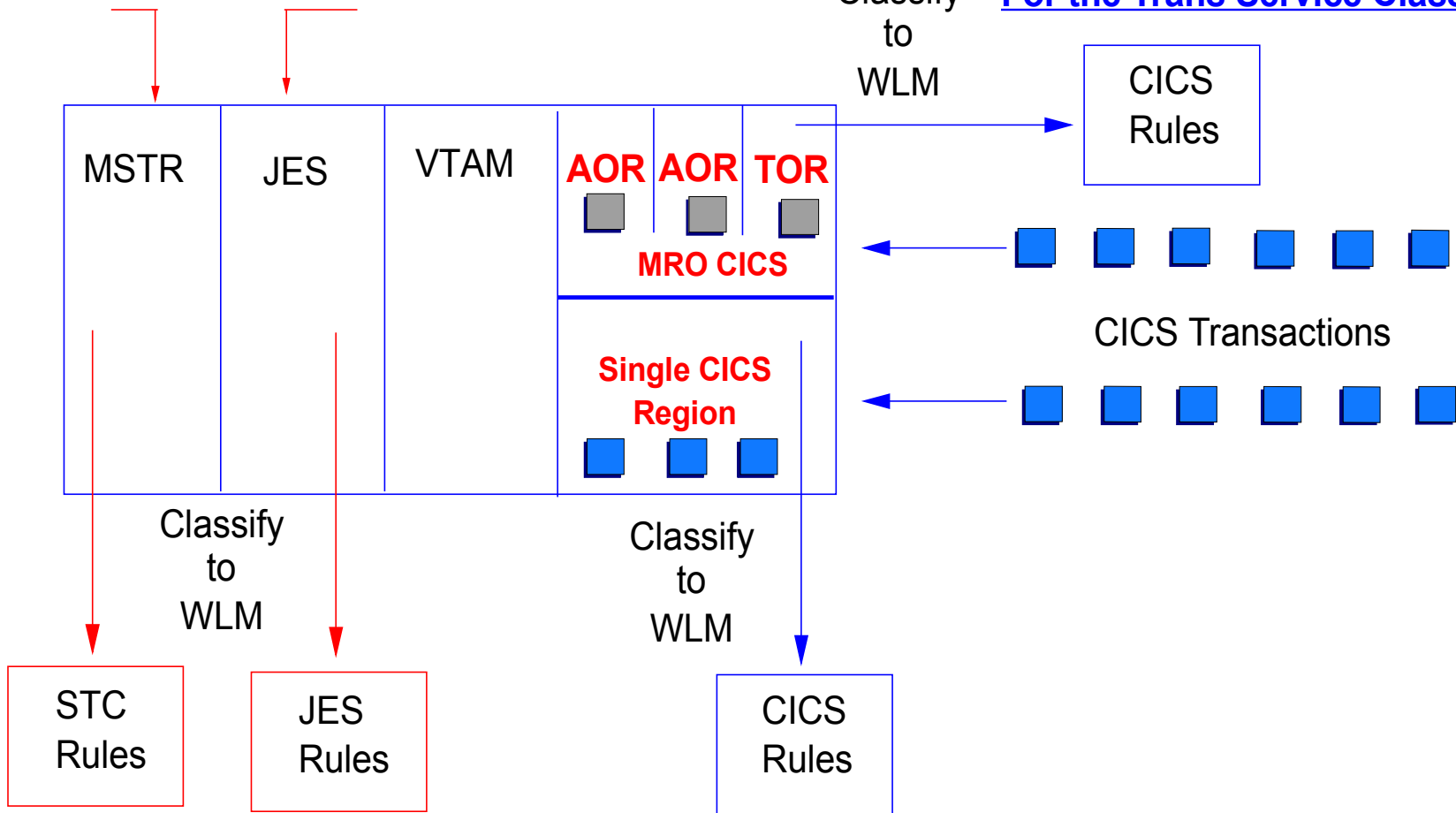
WLM Classification Rules

CICS Regions and Transactions

S CICSProd

//CICSProd JOB

Classify to WLM **For the Trans Service Class**



For the Region's Service Class

For the Trans Service Class

CICS and WLM Classification Overview

- **Must classify the regions**
 - Generally set to high velocity goal with a high importance
 - Rules used, (JES or STC), depends on how CICS is started

- **Optionally classify the transactions**
 - WLM Classify is done in the arrival region
 - Classification flows in the FMH5 via MRO

- **Region managed or transaction managed?**
 - The classification rule for the region determines if region is managed by the region's velocity goal or to the transaction's response time goals
 - If not specified, default is to use the transaction goals

CICS and WLM Classification Overview

- **Allows easier migration of CICS/IMS regions from velocity goal management to transaction response time management**

- **Allows test CICS to remain managed by velocity goals**
 - Lower system overhead
 - Simplifies WLM policy

Subsystem Type : STC

Description Classification Rules for STCs

-----Qualifier-----		----Class-----				
Action	Type	Name	Start	Service	Report	Manage Regions
			DEFAULT:	STCLOW		to Goals Of
_____	1 TN	CICSP*	_____	ONLHIGH	_____	TRANSACTION
_____	2 UI	CICSPU*	_____	ONLMED	_____	REGION
_____	1 TN	CICST*	_____	ONLMED	_____	REGION
_____	1 TN	CICSA*	_____	ONLHIGH	_____	TRANSACTION

CICS and WLM Classification Overview

- **Transaction Classification attributes are:**
 - SI - subsystem instance (APPLID)
 - SIG - subsystem instance group
 - UI - userid
 - UIG - userid group
 - TN - transaction name
 - TNG - transaction name group
 - LU - LU name
 - LUG - LU name group
 - PX - Sysplex name

- **A transaction or region may match multiple classification rules**
 - First match found in classification rules will be used

CICS Address Spaces – Goal Setting

- **Assign a velocity Goal**

- **Classify regions to different service classes from transactions**
 - Even if WLM is managing regions to transactions goals, region goals are needed for startup, shutdown, idle periods
 - Recommend a report class for each region for reporting purposes

- **To cap CICS or IMS work, regions must be in a resource group, not the transactions**

CICS Transactions – Goal Setting

- **Only a response time goal can be specified**
 - Average or Percentile
 - Must be single period

- **Keep it simple, use a few service classes for CICS work**
 - Keep it realistic, specify achievable goals

- **CICS dispatcher doesn't use WLM goals so fine granularity is not critical. WLM controls only the address space**

- **Group transactions in service classes which have similar characteristics**
 - Unlike types of work will impact response time data
 - May wish to put mission critical work in a separate service class
 - May want to manage pseudo-conversational transactions

WLM Classification Help

```

Subsystem Type . : CICS          Fold qualifier names?  Y  (Y or N)
Description . . . Use Modify to enter YOUR rules
Action codes:  A=After          C=Copy              M=Move          I=Insert rule
                B=Before        D=Delete row       R=Repeat        IS=Insert Sub-rule
                -----Qualifier-----             -----Class-----
Action   Type      Name      Start                Service      Report
-----  -
   1     ?

```

```

Qualifier Selection Row
Command ==> _____
Select a type with "/"

Sel  Name  Description
-    LU    LU Name
-    LUG   LU Name Group
-    PX    Sysplex Name
-    SI    Subsystem Instance
-    SIG   Subsystem Instance Group
-    TN    Transaction Name
-    TNG   Transaction Name Group
-    UI    Userid
-    UIG   Userid Group
***** Bottom of data *****
F1=Help      F2=Split      F5=
F7=Up        F8=Down       F9=

```

```

*****
*          CICS          *
*****

```

Listed below are the various work qualifiers which are valid for a CICS subsystem type.

LU NAME

The CICS terminal name, or TERMID, which is a 4-character identifier.

SUBSYSTEM INSTANCE

The VTAM applid for the subsystem instance, or the CICS region name.

WLM Management

- **Subsystem awareness**
- **Resources are consistently applied to important work**
- **Dynamic, on-going tuning and workload characteristics**
- **Sysplex management scope**
- **Ability to share goal information with other products**
- **CPSM**
- **Performance reporting of subsystem delays which got in the way of goal attainment**

WLM Management - cont.

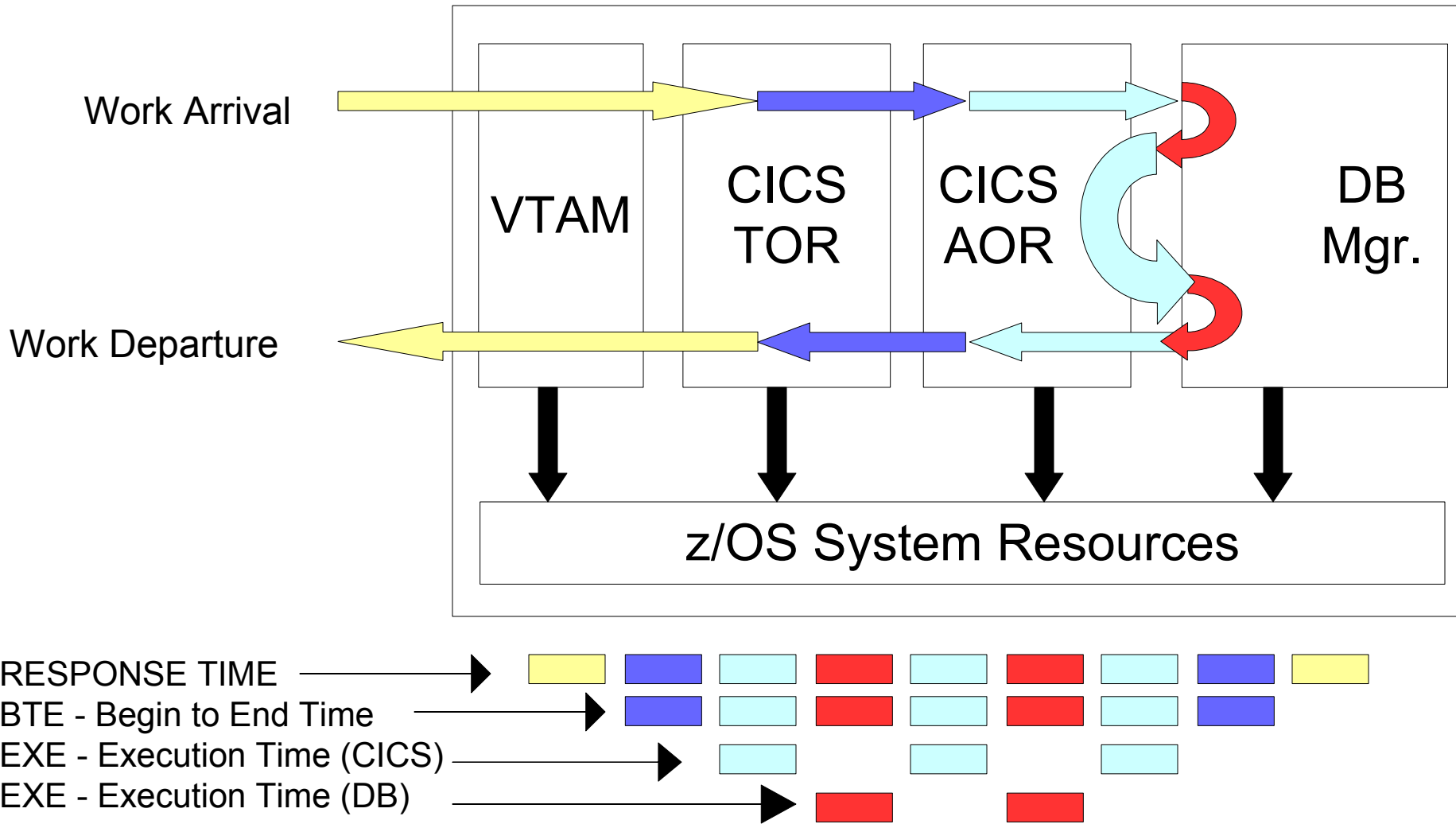
- **WLM uses samples to determine how well work is progressing**
 - WLM will not react to every CICS transaction
 - Important to:
 - Keep like work with like work to not affect sampling
 - Have enough work in a service class to get enough samples to allow WLM to make good, responsive decisions

- **WLM sets dispatch priority and access to other resources, for the **CICS region**, based on Performance Index and Importance Levels**
 - WLM does not control dispatching of CICS tasks, CICS does

WLM Server Management with Transaction Rules

- **WLM Server Management when doing transaction classification**
 - PI of CICS region is ignored when determining access to resources
 - WLM builds internal service classes to manage CICS topology
 - Based on detected WLM services calls being made by the different CICS regions on behalf of different service classes
 - WLM manages regions based on PI of transaction service classes being served
 - All regions in the internal WLM service class are managed together

Cross Sybsystem Management



Performance Blocks

■ **z/OS control block**

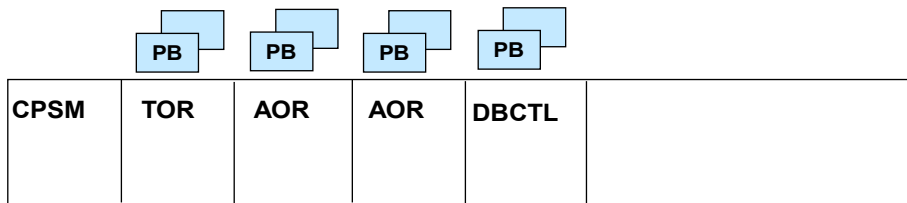
- Created and deleted by subsystem work managers like CICS
 - Associated with transactions not service classes
- Does not contain response time information or counters
- Used by WLM to:
 - Assist SRM in determining the topology
 - Report delays (no action is taken on delays by either WLM or CICS)
- Scanned on an interval basis by WLM
 - Region management only: PB's are scanned every 10th interval
 - Transaction management: PB's are scanned every interval (250 ms)

■ **For CICS:**

- Contains classification token
- Number of PB's per region is based on maxtask (don't overestimate)
- CICS updates PBs via 'change state' service

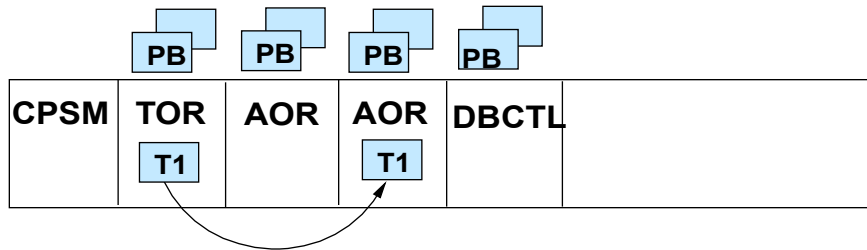
CICS and WLM Services

ASID STARTUP



ASID	WLM SERVICE	DESCRIPTION
TOR	IWM4CON ← IWM4MCRE TOR PB Token	PB's created, # determined by MAXTASK
AOR	IWM4CON ← IWM4MCRE AOR PB Token	PB's created, # determined by MAXTASK
AOR	IWM4CON ← IWM4MCRE AOR PB Token	PB's created, # determined by MAXTASK
DBCTL	IWM4MCRE ← DLI PB Token	DLI PB created

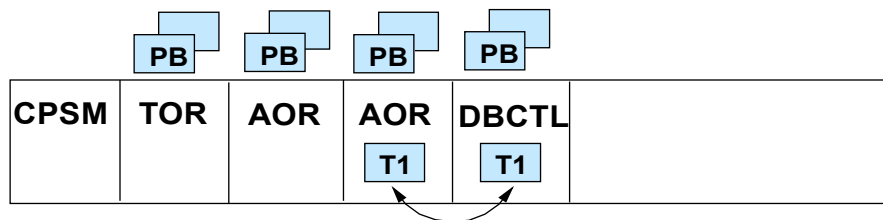
CICS and WLM Services



Transaction Processing

ASID	WLM SERVICE	DESCRIPTION
TOR	IWMCLSFY	Obtain Service Class for transaction
	IWM4MINI	Supply WLM with a PB for the tran, BTE phase starts
	IWM4MCHS	(change state(s))
	IWMMSWCH	Tran switch, (image, sysplex, network)
AOR	IWM4MINI	Supply WLM with a PB - CICS EXE starts
	IWM4MCHS	(change state)
	IWM4MCHS	(change state)
	IWM4MCHS	(change state - go to DB manager)

CICS and WLM Services

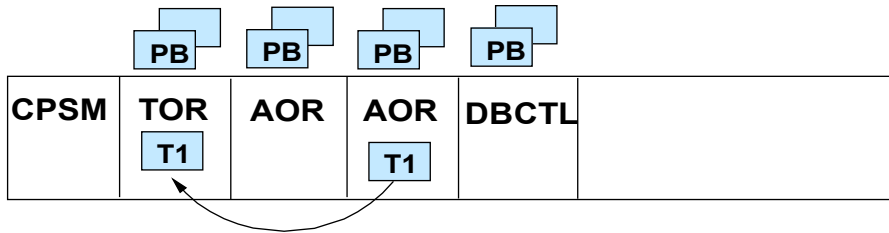


Transaction Processing

ASID	WLM SERVICE	DESCRIPTION
DL/I →	IWMMRELA Function=Create	Relate DL/I PB (dependent) with AOR PB (parent)
→	IWMMXFER Function=Continue	Real state of tran in DL/I PB, IMS EXE starts
→ Ready to Active Active to Ready	IWM4MCHS	(change state(s))
→	IWMMXFER Function=return	Real state of tran not in DL/I PB. PBs still related for future transfers, IMS EXE ends
→	IWMMRELA Function=delete	Breaks relationship, CICS EXE starts again

CICS and WLM Services

Transaction Processing



ASID	WLM SERVICE	DESCRIPTION
AOR	IWM4MCHS	(No longer switched)
	IWMMNTFY	Inform WLM CICS EXE phase is over
	Return to TOR	
TOR	IWMRPT	Inform WLM BTE is over

WLM Management

- **WLM uses samples to determine how well work is progressing**
 - WLM will not react to every CICS transaction
 - Important to:
 - Keep like work with like work to not affect sampling
 - Have enough work in a service class to get enough samples to allow WLM to make good, responsive decisions

- **WLM sets dispatch priority and access to other resources, for the CICS region, based on Performance Index and Importance Levels**
 - WLM does not control dispatching of CICS tasks, CICS does

WLM Server Topology

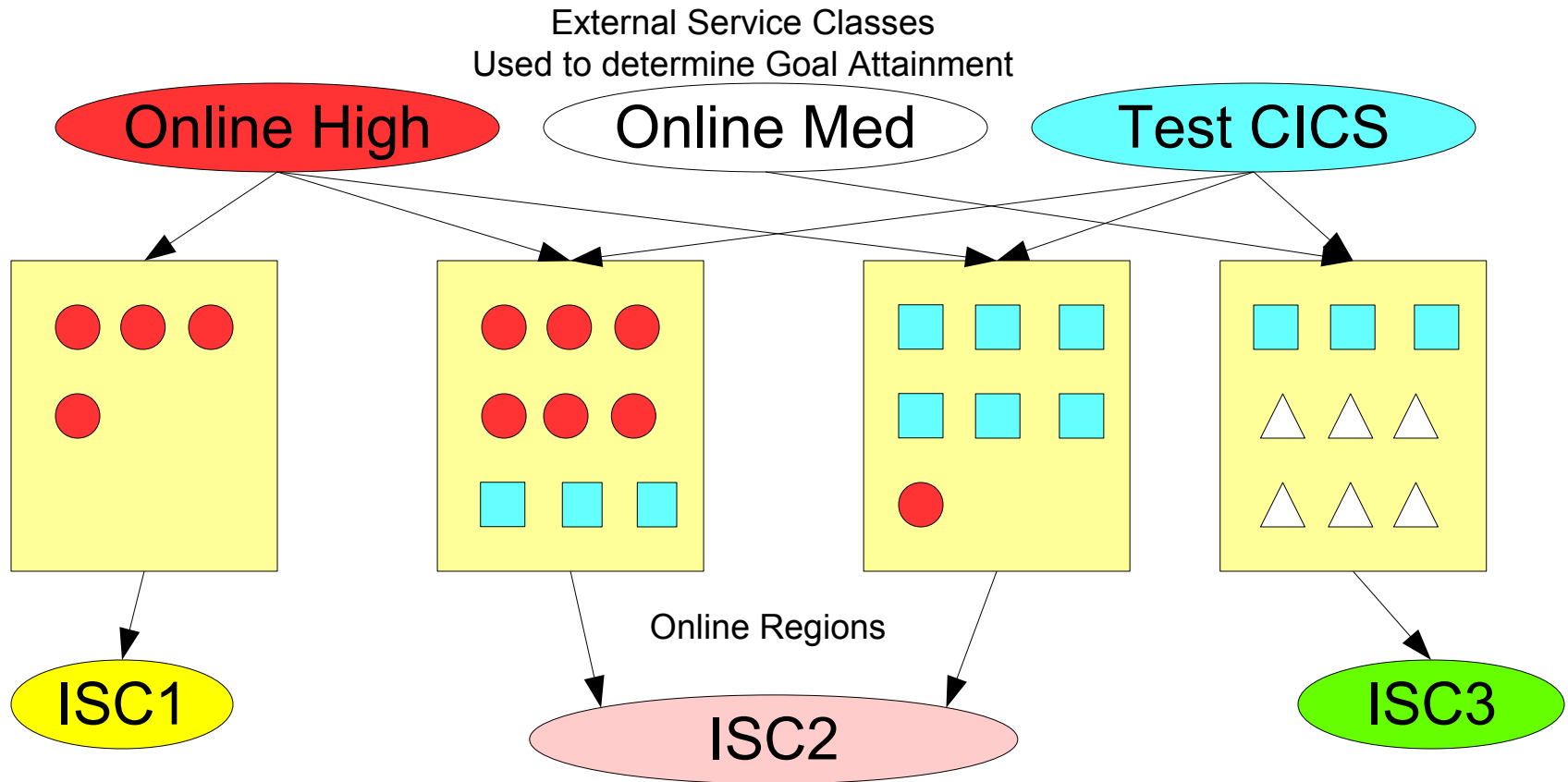
- **WLM Server Management when doing transaction classification**
 - PI of CICS region is ignored when determining access to resources
 - WLM builds internal service classes to manage CICS topology
 - Based on detected WLM services calls being made by the different CICS regions on behalf of different service classes
 - WLM manages regions based on PI of transaction service classes being served
 - All regions in the internal WLM service class are managed together
- **Address Space is a server if:**
 - Associates with a PB which represents a transaction. Done via WLM execution monitoring services
 - Issues either a WLM REPORT or NOTIFY for a transaction

WLM Server Topology

■ Internal Service Classes

- Dynamically created
- Set of address spaces which serve a given external service class and belong to the same resource group
 - It is this set of address spaces which will be given resources
- Called \$SRMSnnn
- Number depends upon:
 - Number of external service classes
 - Combination of server address spaces
 - In CICS the PB samples are used as weighting factors
- Rebuilt potentially once per minute
- Multiple Transaction Service Classes can be served by single ISC

Internal Service Class Example

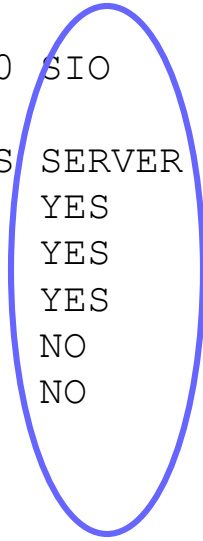


- **If Online High is missing its goal, ISC2 will be modified**
 - Highest number of PB's based on number of transactions running in ISC2
 - Test CICS transactions may begin seeing better response times
 - Diagram is modified version of one in "ABCs of z/OS System Programming Volume 12"

Displaying Server Topology

- Use SDSF DA commands to display information about Server status

```
SDSF DA SYSA SYSA PAG 0 SIO 43 CPU 84/ 86
COMMAND INPUT ==>
NP JOBNAME WORKLOAD SRVCLASS SERVER DP CPU%
CICSP1 ONLPRD ONLHIGH YES F9 12.00
CICSP2 ONLPRD ONLHIGH YES F9 37.00
CICSP3 ONLPRD ONLHIGH YES F9 10.20
CICSP4 ONLTST ONLLOW NO F7 0.20
CICSP5 ONLTST ONLLOW NO F7 0.20
```



*** Or use RMF reports to see topology**

Displaying Server Topology

■ RMF Workload Activity Service Class Report

REPORT BY: POLICY=WSCPLEX WORKLOAD=STC

SERVICE CLASS=ONLHIGH

RESOURCE GROUP=*NONE

CRITICAL =NONE

DESCRIPTION =ONLINE Service class

TRANSACTIONS	TRANS.-TIME	HHH.MM.SS.TTT	--DASD I/O--	---SERVICE---	--SERVICE RATES--	PAGE-IN RATES	----STORAGE----
AVG 14.00	ACTUAL	0	SSCHRT 16.5	IOC 7916	ABSRPTN 4	SINGLE 0.0	AVG 11367.4
MPL 14.00	EXECUTION	0	RESP 3.4	CPU 439993	TRX SERV 4	BLOCK 0.0	TOTAL 1692418
ENDED 0	QUEUED	0	CONN 1.3	MSO 0	TCB 43.7	SHARED 0.0	CENTRAL 1692418
END/S 0.00	R/S AFFINITY	0	DISC 1.7	SRB 50959	SRB 5.0	HSP 0.0	EXPAND 0.00
#SWAPS 0	INELIGIBLE	0	Q+PEND 0.4	TOT 498868	RCT 0.0	HSP MISS 0.0	
EXCTD 0	CONVERSION	0	IOSQ 0.1	/SEC 554	IIT 0.2	EXP SNGL 0.0	SHARED 3283.46
AVG ENC 0.00	STD DEV	0			HST 0.0	EXP BLK 0.0	
REM ENC 0.00					APPL % 45.4	EXP SHR 0.0	
MS ENC 0.00							

-----SERVICE CLASSES BEING SERVED-----

CICSPROD CICSTRAN CICSTEST

CICS Transaction Service Class

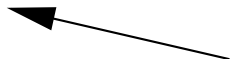
SYSRPTS(WLMGL(SCPER))

REPORT BY: POLICY=WSCPLEX WORKLOAD=CICS SERVICE CLASS=**CICSTRAN** RESOURCE GROUP=*NONE PERIOD=1 IMPORTANCE=1
 CRITICAL =NONE

TRANSACTIONS	TRANS.-TIME	HHH.MM.SS.TTT
AVG	0.00	ACTUAL 610
MPL	0.00	EXECUTION 369
ENDED	1485	QUEUED 0
END/S	0.24	R/S AFFINITY 0
#SWAPS	0	INELIGIBLE 0
EXCTD	1257	CONVERSION 0
AVG ENC	0.00	STD DEV 1.014
REM ENC	0.00	
MS ENC	0.00	

No resource data reported

		RESP	STATE SAMPLES BREAKDOWN (%)										STATE		
SUB	P	TIME	---ACTIVE---	READY	IDLE	-----WAITING FOR-----						SWITCHED	SAMPL	(%)	
TYPE		(%)	SUB	APPL		CONV	PROD	I/O	CONV	LOCK	LTCH	LOCAL	SYSPL	REMOT	
CICS	BTE	96.6	2.5	0.0	0.1	0.0	97.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CICS	EXE	29.2	48.6	0.0	14.0	0.1	0.0	23.6	13.7	0.0	0.0	0.0	0.0	0.0	
DB2	EXE	43.7	92.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.8	0.0	0.0	0.0	



CICS reported Delay information to WLM
 Only Created for CICS and IMS transaction Service Classes

VELOCITY MIGRATION: I/O MGMT N/A INIT MGMT N/A

	---RESPONSE TIME---	EX	PERF
	HH.MM.SS.TTT	VEL	INDX
GOAL	00.00.00.500	90.0%	
ACTUALS			
*ALL	96.2%	N/A	0.5
WCS1	93.4%	N/A	0.7
WSC2	97.7%	N/A	0.5
WSC3	92.0%	N/A	0.5

.... Service Class Goal
 vs
 Actual Information

Summary

- **WLM provides ability to classify CICS work at either the region or transaction level**
- **Provides cross subsystem management and reporting of CICS work throughout system and / or sysplex**
- **WLM knowledge of CICS topology and WLM goals allows dynamic ongoing tuning and workload characteristics**
- **Enhanced reporting of CICS delays via RMF (z/OS 1.2)**
- **Increased WLM functionality to improve management of CICS environment**

