Advanced Technical Skills (ATS) North America

Managing CICS with Workload Manager

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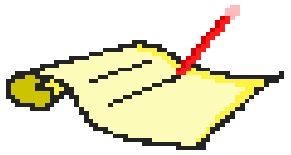
Agenda

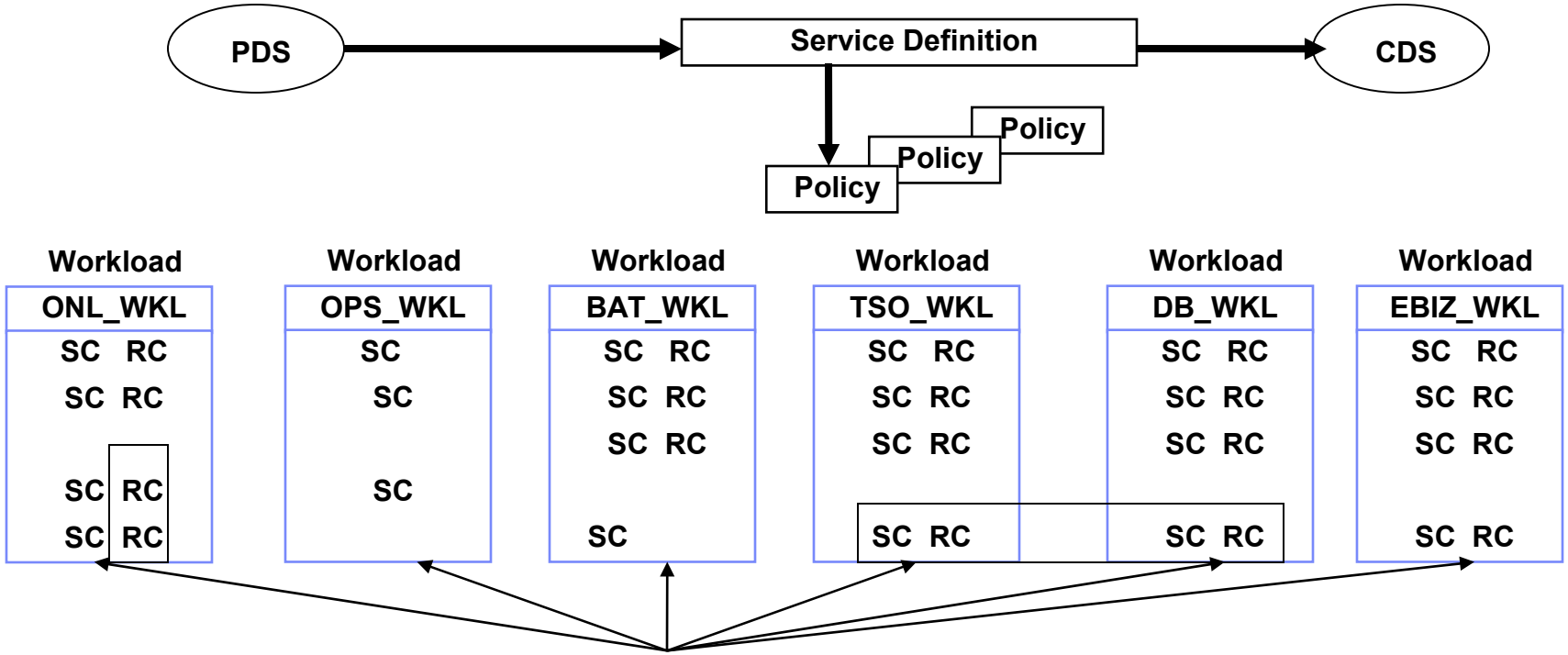
- **WLM Concepts**
- **CICS Classification**
- **CICS/WLM Subsystem Awareness**
- **CICS Transaction Reporting**
- **CICS Server Management**
- **Sample RMF Reports**
- **Summary**



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

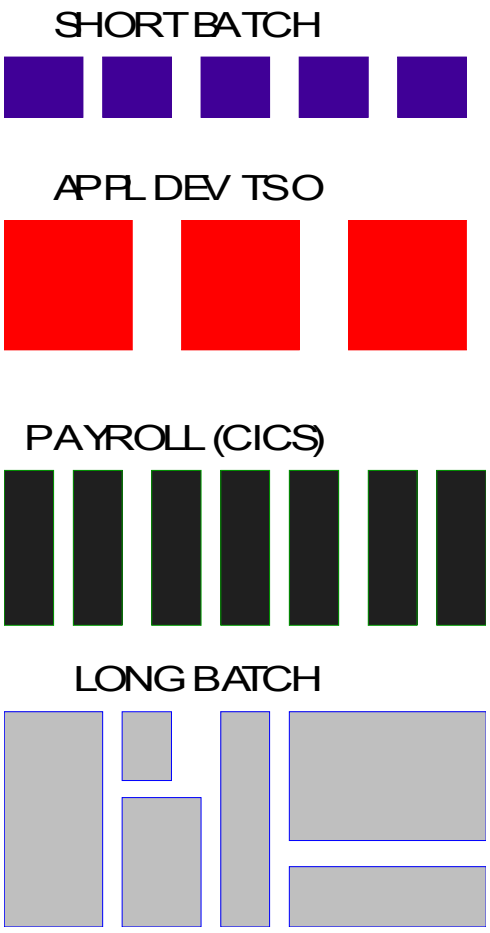


Work Enters the System

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 . . : CICSTRAN
Description  . . . . . .Production CICS Transaction
Workload Name  . . . . . CICSPROD
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

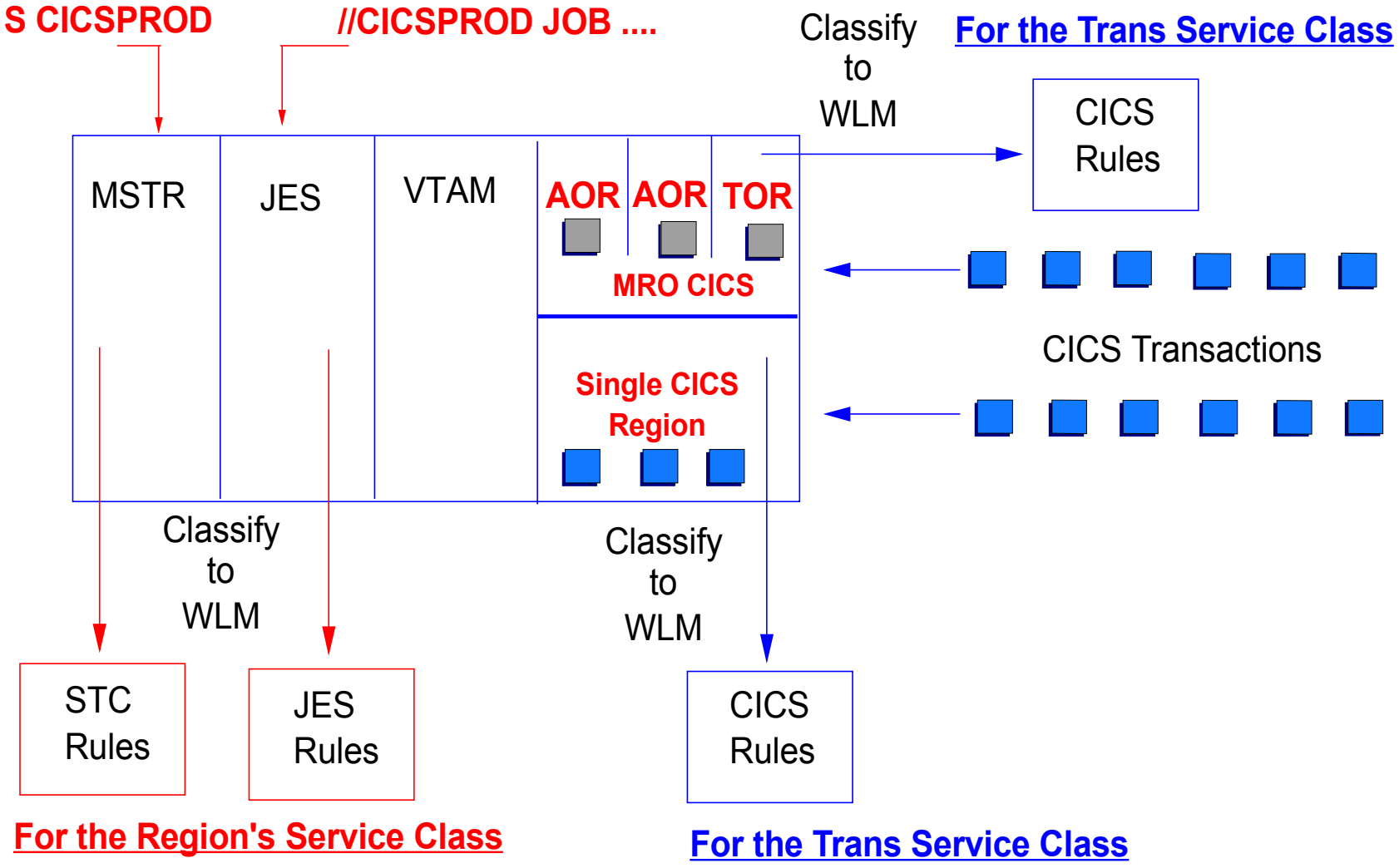
- **Range of Very Important (1) to Desirable (5)**
  - Relative Value, not absolute value
- **Significance of meeting goal says nothing about how easy or difficult the goal is to achieve**
  - Example: a batch service class with velocity of 5 but IMP=1
- **Used by WLM to**
  - Identify critical workloads
  - 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



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 my 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
                                                DEFAULTS: ________     ________
 ____   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.

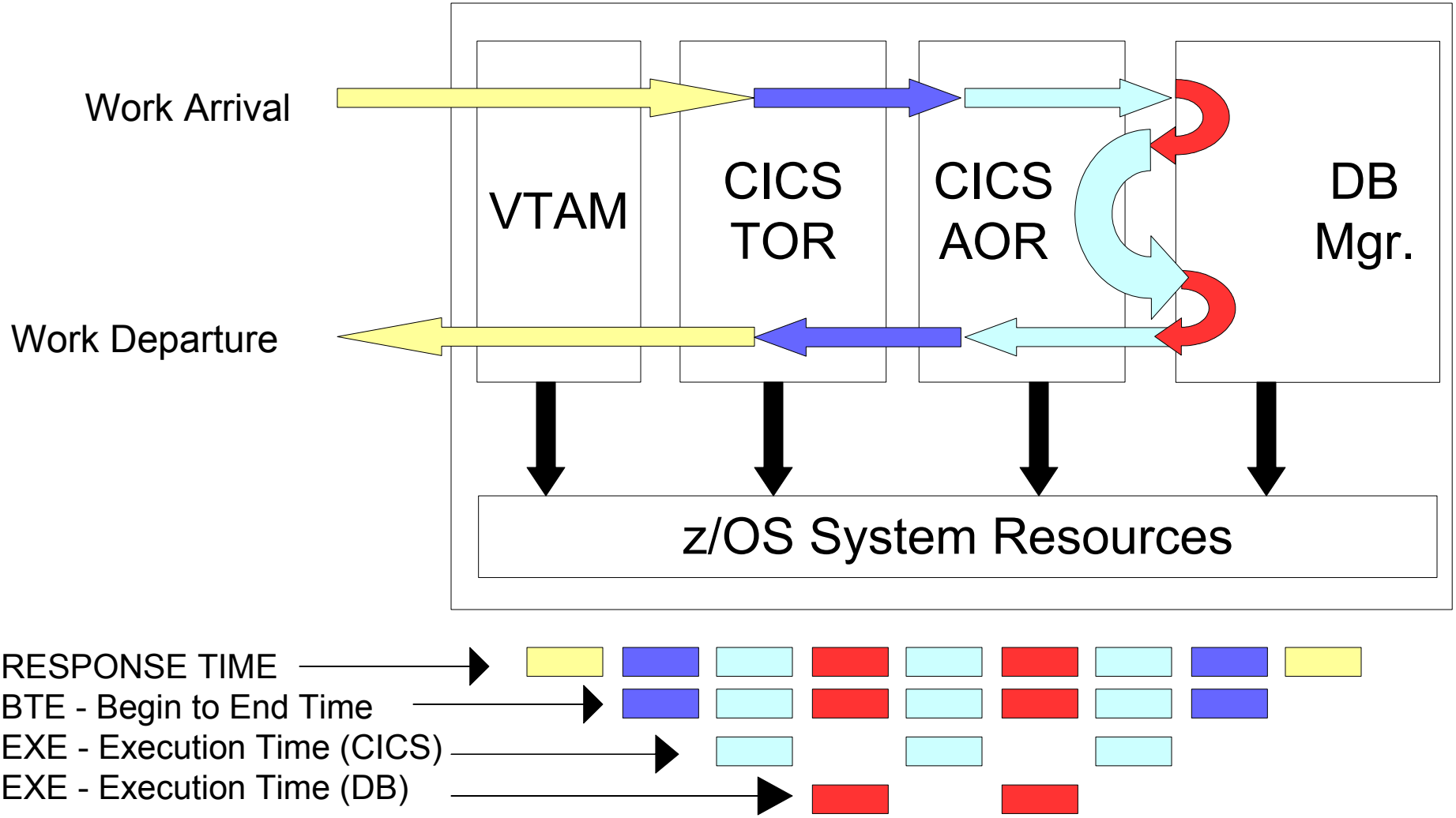
- **WLM uses samples to determine how well work is progressing**
  - WLM will not react to every CICS transaction
  - Important to:
    - Keep like work with like work to not affect sampling
    - Have enough work in a service class to get enough samples to allow WLM to make good, responsive decisions

- **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

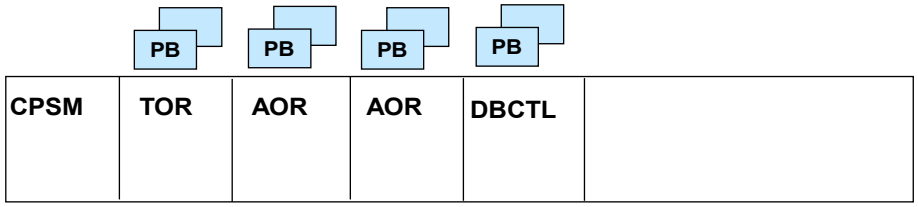


Performance Blocks

- **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

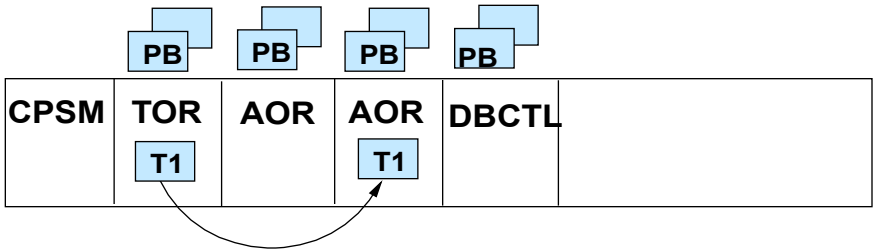
CICS and WLM Services



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	DL/I PB created

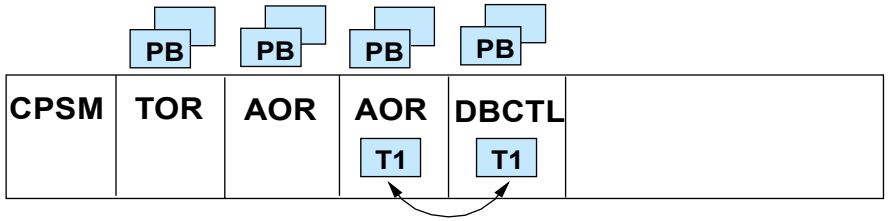
CICS and WLM Services



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
Active to Ready →	IWM4MCHS	(change state(s))
Waiting for Conv		
	IWMMSWCH	Tran switch, (image, sysplex, network)
AOR →	IWM4MINI	Supply WLM with a PB - CICS EXE starts
Ready to Run →	IWM4MCHS	(change state)
Active →	IWM4MCHS	(change state)
Invoke DL/I →	IWM4MCHS	(change state - go to DB manager)

CICS and WLM Services

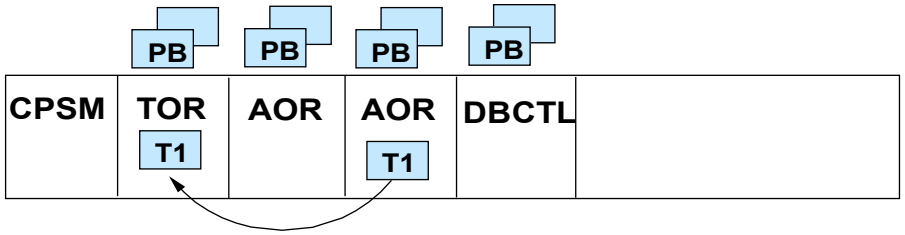


Transaction Processing

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
→	IWM4MCHS	(change state(s))
Ready to Active Active to Ready		
→	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:
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- **WLM sets dispatch priority and access to other resources, for the CICS region, based on Performance Index and Importance Levels**
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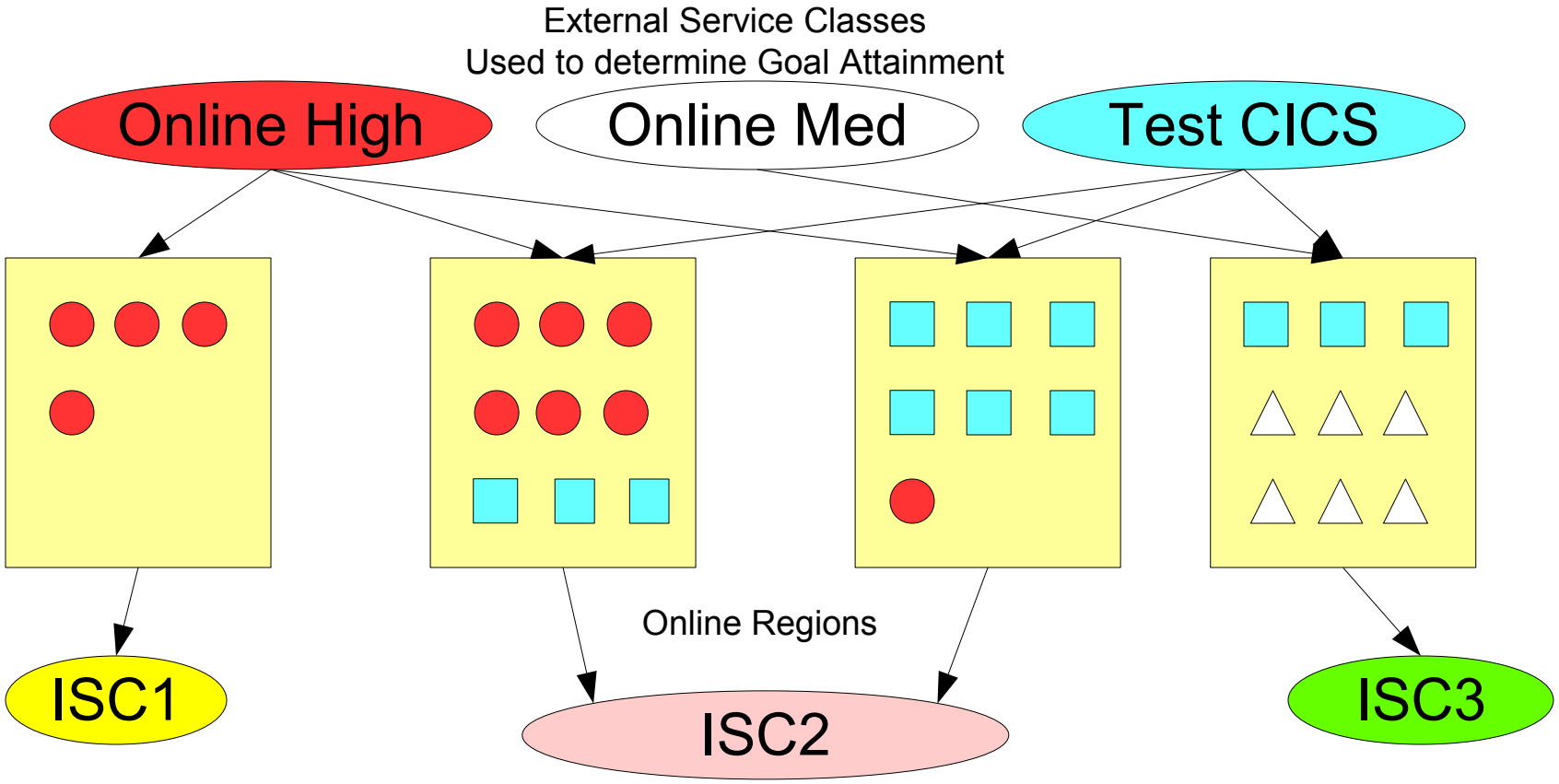
WLM Server Topology

- **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 topolgy
    - 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                                     97.4   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   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   0.0

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

CICS reported Delay information to WLM

Only Created for CICS and IMS transaction Service Classes

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**