INSIDE LOOK OF Z/OS WORKLOAD MANAGER

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Agenda

Basic Concepts

Inside WLM

Reporting

Basic Concepts

- What is workload? why and how to manage?
- Service definition
- Classification rules
- Service Class
- Performance goals
- Importance
- Service Class Period

WHAT IS WORKLOAD?

To workload management, "work" is a demand for service, such as a batch job, CICS, DB2, or IMS transaction, a TSO/E logon, or a TSO/E command

All work that runs in the system is classified into workloads.

Workloads and performance goals are defined in service definition.

But Why manage WORKLOAD?

One of the strengths of the mainframe platform in a commercial environment is the ability to run multiple workloads at the same time (with thousands of concurrent transactions) within one z/OS image or across multiple images in a Parallel Sysplex.

These workloads may be of differing importance to the business and have differing needs for system resources. As a result, they will have different priorities when competing system resources.

OK How to manage workload?

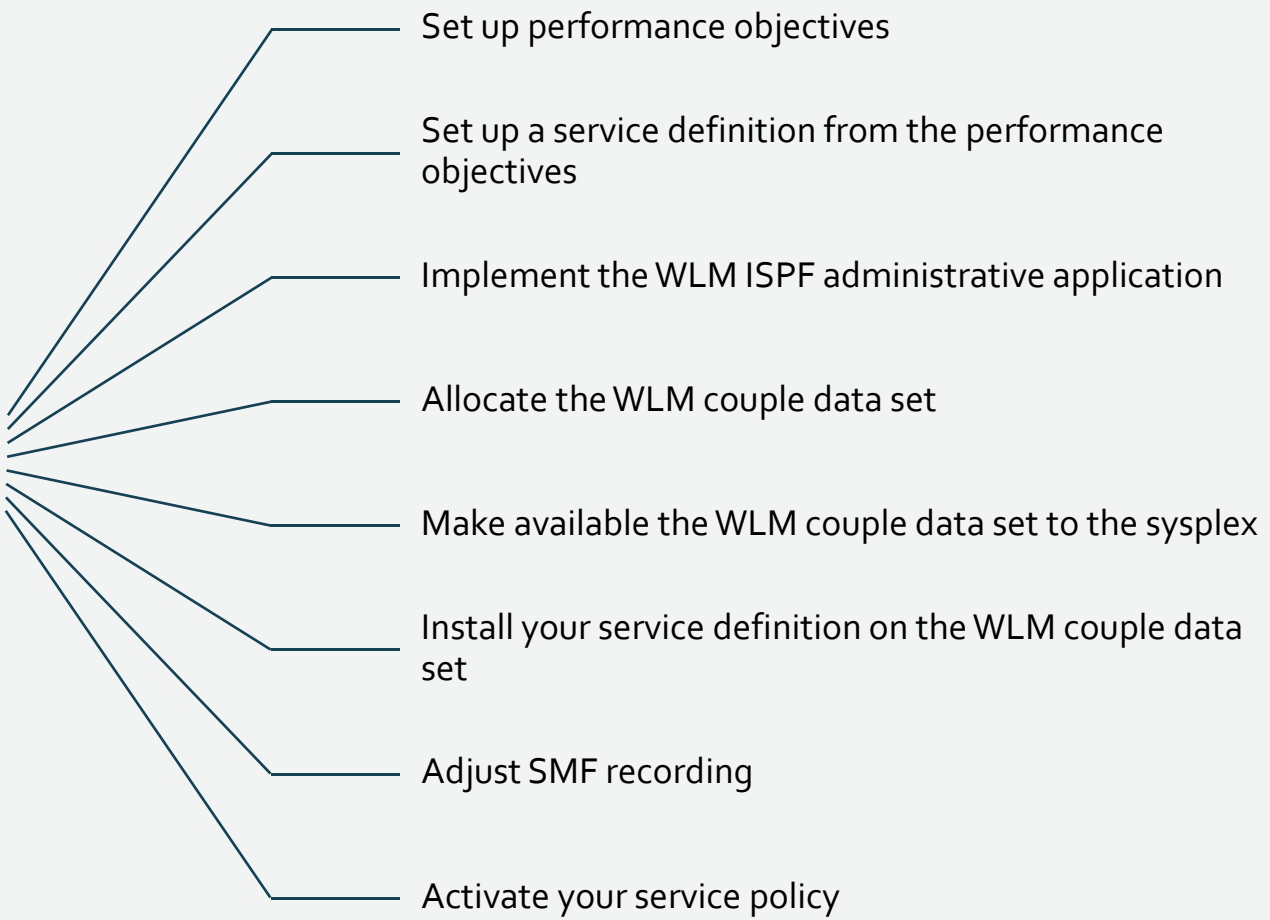
The idea of z/OS Workload Manager is to make a contract between the user and the operating system.

The user classifies the work running on the z/OS operating system in distinct service classes and defines goals for them that express the expectation of how the work should perform.

WLM a z/OS component, uses these goal definitions to manage the work across all systems in sysplex.

Overview

The following are the steps to implement goal mode:



Service Definition

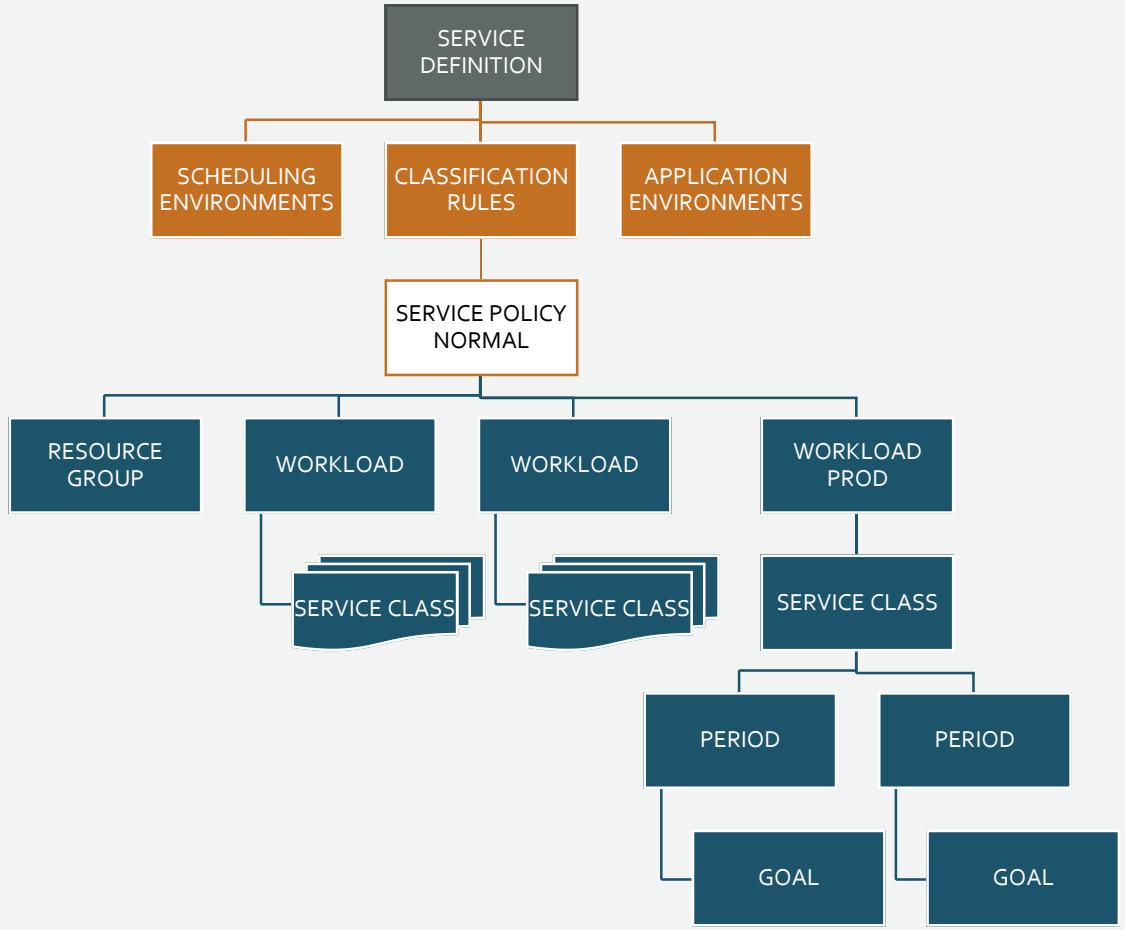
To setup service definition, identify the workloads, the resource groups, the service classes, the service class periods, and the goals based on performance objectives.

Then define classification rules and one or more service policies. The base service definition contains one or more service policies with constructs:

Service classes	Workloads	Classification rules

Then define optional service policy constructs:

Report classes	Resource groups	Application environments	Scheduling environments



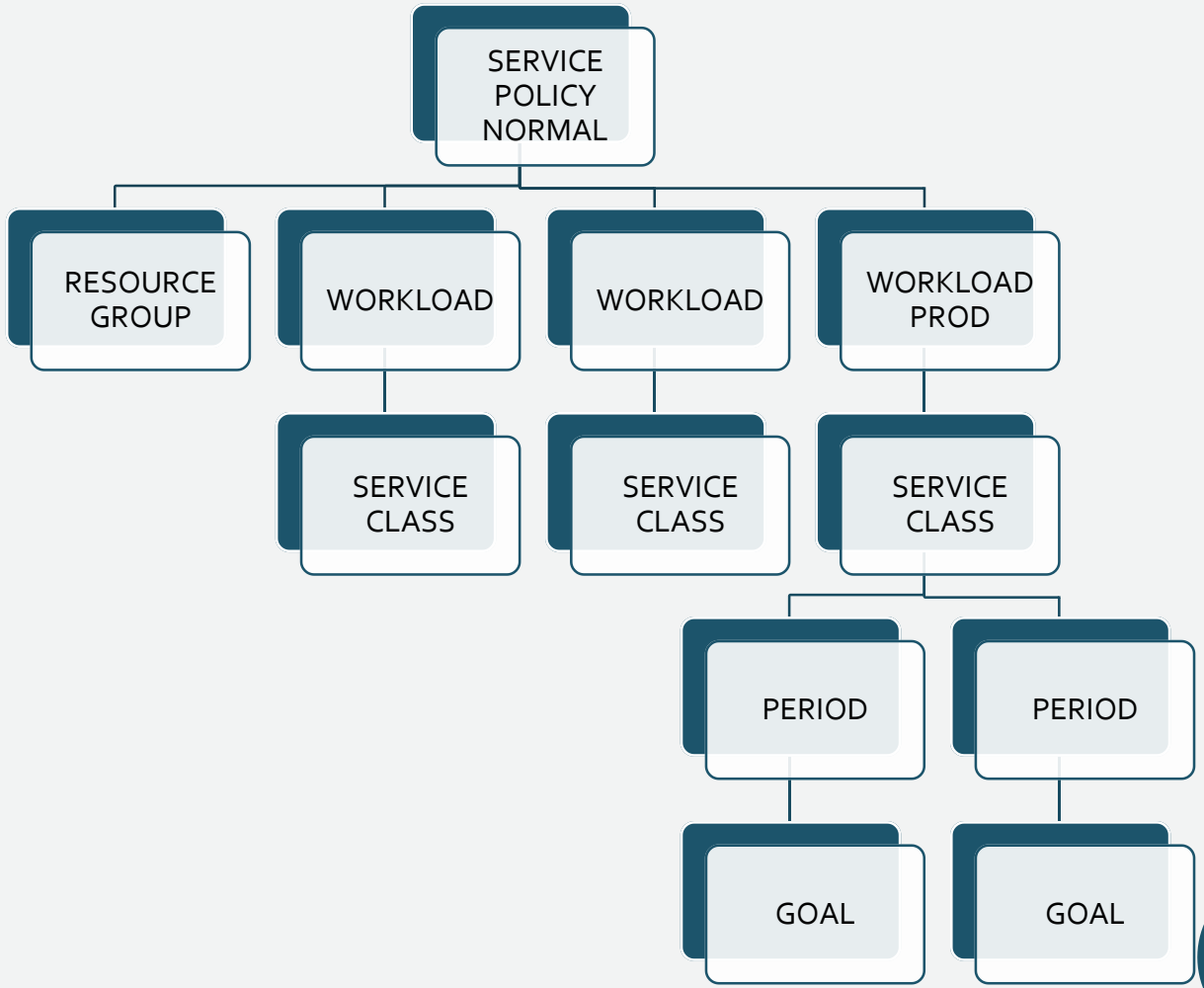
SERVICE POLICY

A service policy is a named set of overrides to the goals in the service definition. One or more service policies can be defined.

You can have different policies to specify goals intended for different times. Service policies are activated by an operator command, or through the ISPF administrative application utility function.

A policy applies to all of the work running in a sysplex.

To start workload management processing, you must define at least one service policy. You can activate only one policy at a time



Service class

A service class has the following parameters:

- **Importance** Define importance to your business
- **Performance goal** Desired level of service that WLM uses to determine the amount of resource to give to a unit of work
- **Resource Group** (optional) A Resource Group defines:
  - Minimum CPU service required (protection)
  - Maximum CPU service limit (capping)
- **CPU Critical** (optional) Defined for a service class for long-term CPU protection for critical work.
- **Storage Critical** (optional) Defined for a service class to assign long-term storage protection to critical work.

Importance


SYSOTHER
DISCRETIONARY
LOWEST (5)
LOW (4)
MEDIUM (3)
HIGH(2)
HIGHEST (1)
SYSSTC
SYSTEM

Goal Types

Average Response Time

- **Average Response Time** is the expected amount of time required to complete the work submitted under the service class, in milliseconds, seconds, minutes, and hours.

Percentile Response Time

- ***Percentile Response Time*** is the percentage of work in that period that should complete within the response time (for example, 80% of transactions ended in 0.5 of a second).

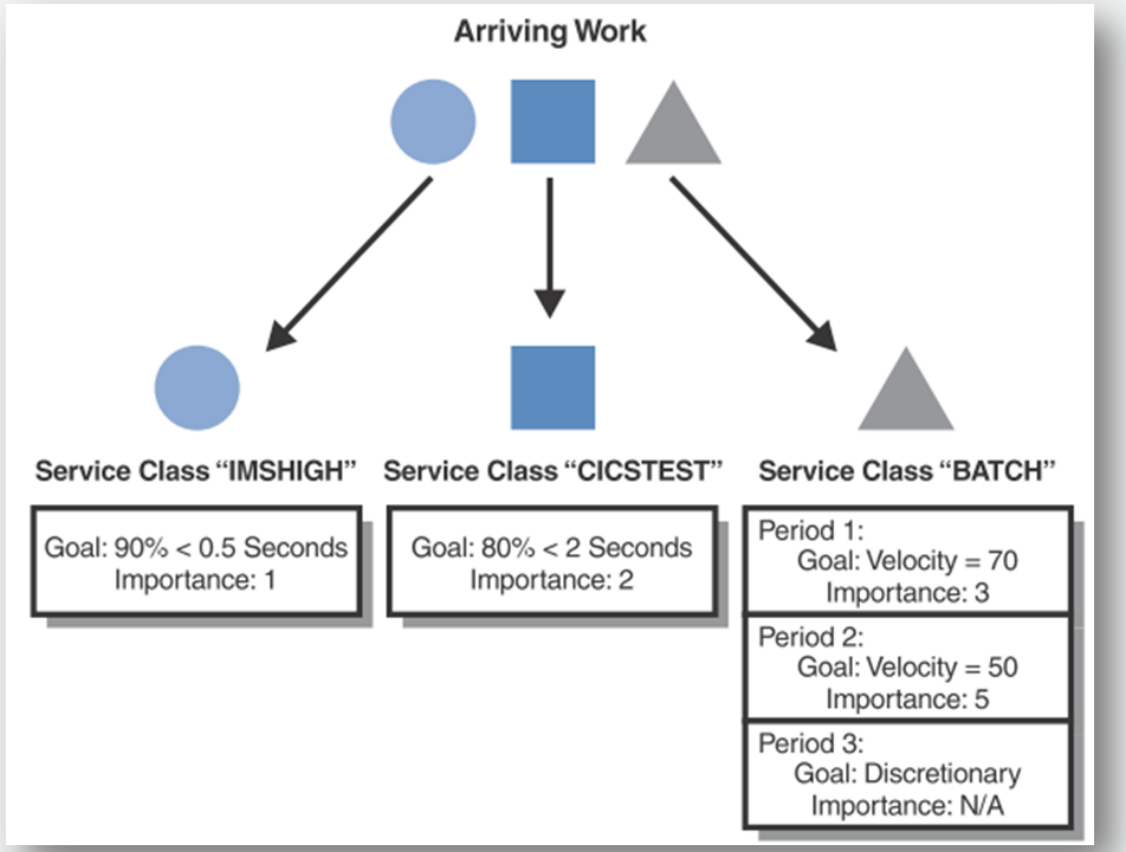
Execution velocity

- Velocity goals define the acceptable amount of delay for work when work is ready to run. Execution velocity goals are intended for work for which response time goals are not appropriate, such as started tasks, or long running batch work.

Discretionary

- Are for low priority work for which you do not have any particular performance goal. Workload management then processes the work using resources not required to meet the goals of other service classes.

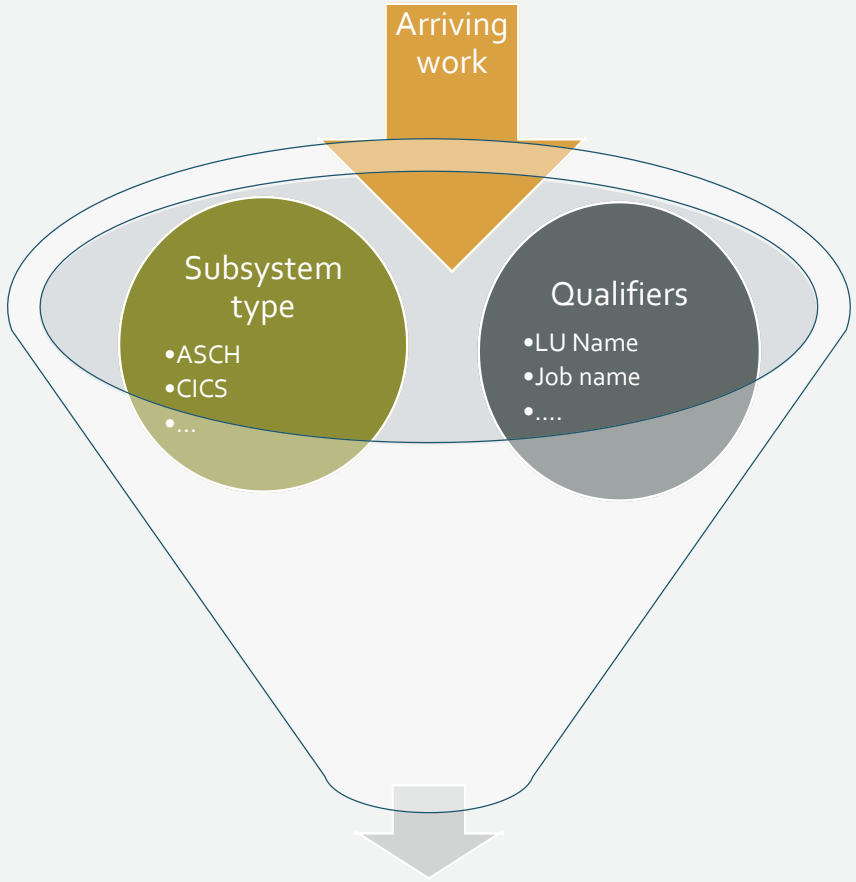
Service Class Period



- A service class is associated to only one workload and it can consist of one or more periods (specified through the DURATION keyword).
- Performance periods are available for work that has variable resource requirements and for which your goals change as the work uses more resources.
- You specify a goal, an importance, and a duration for a performance period.
- Duration is the amount of service that period should consume before going on the next goal. Duration is specified in service units.
- You can specify up to eight performance periods.

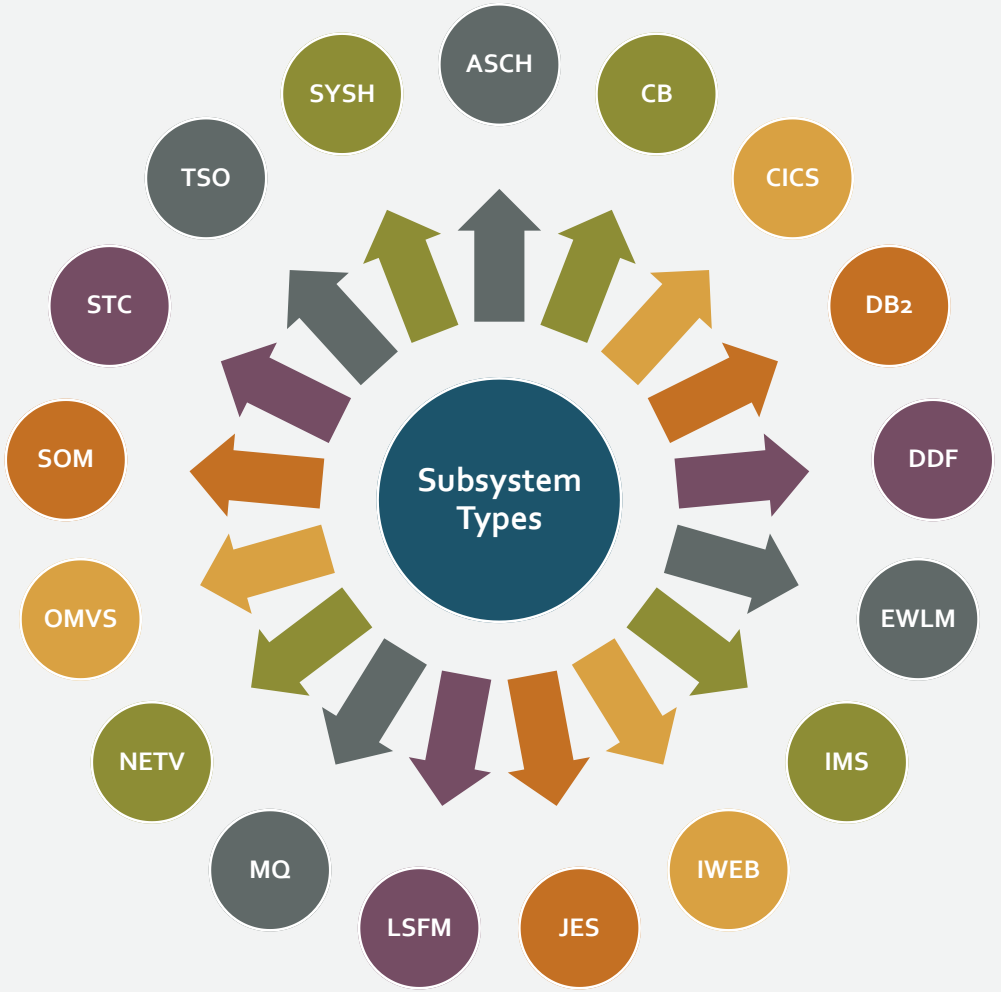
Classification Rules

- The classification rules for a subsystem are specified in terms of transaction qualifiers such as job name or transaction class.
- These qualifiers identify groups of transactions that should have the same performance goals and importance.
- The attributes of incoming work are compared to these qualifiers and, if there is a match, the rule is used to assign a service class to the work.
- A subsystem can also have a default class for work that does not match any of the rules



Service Class and Report Class

Subsystem Types



Agenda

Basic Concepts

Inside WLM

Reporting

Inside WLM – Step by step

- Overview
- When work enters, what happens?
- How WLM monitors work?
- How WLM evaluates work?
- How WLM adjust resource?
- Other functions – Capping

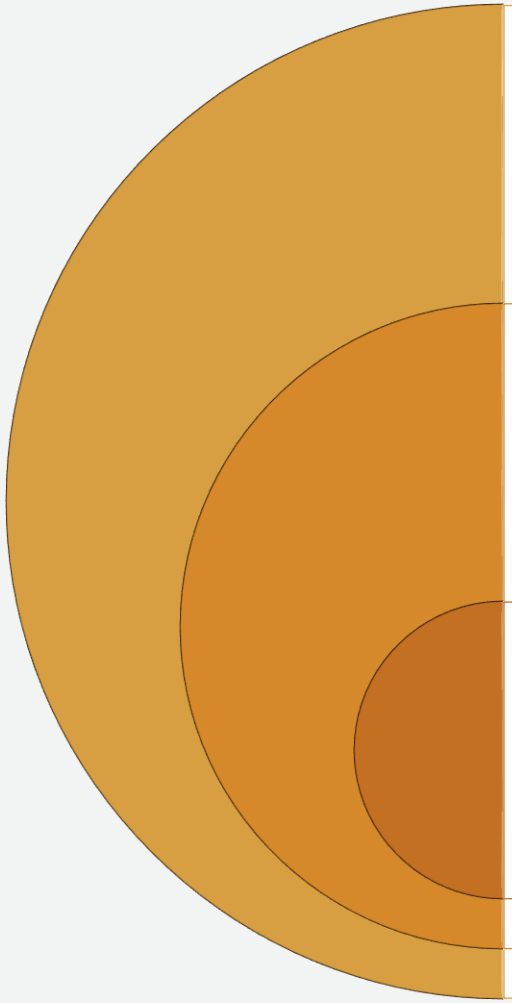
How WLM manages works ?

A solution for managing workload distribution, workload balancing, and distributing resources to competing workloads

MVS workload management is the combined cooperation of various MVS subsystems (CICS, IMS,DB2,TSO etc)

WLM will constantly monitor the system and adapt processing to meet the goals.

How WLM manages works ?



Workload management algorithms use the service definition information and internal monitoring feedback to check how well they are doing in meeting the goals. The algorithms periodically adjust the allocation of resource as the workload level changes.

Workload management coordinates and shares performance information across the sysplex. How well it manages one system is based on how well the other systems are also doing in meeting the goals. If there is contention for resources, workload management makes the appropriate trade-offs based on the importance of the work and how well the goals are being met

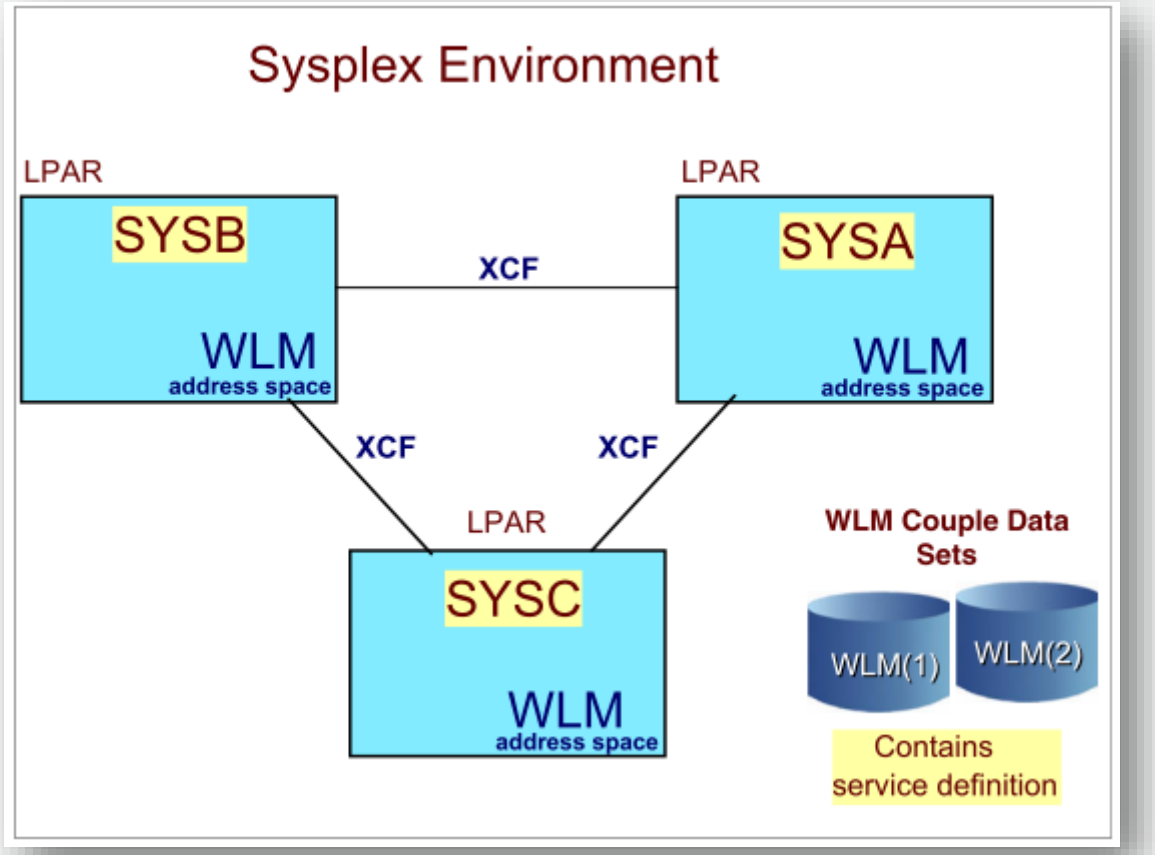
In addition to internal feedback monitoring, workload management keeps track of what is happening in the sysplex in the form of real time performance data collection, and delay monitoring. All this information is available for performance monitors and reporters for integration into detailed reports.

WLM in Sysplex

A **WLM address space** exists in each system in a sysplex. The WLM address spaces communicate with each other using XCF services by joining an XCF group (SYSWLM) as each system joins the sysplex.

A **WLM couple data set** is defined for storing the service definition information.

The **service definition** contains all the information about the installation that is needed for WLM. There is one service definition for the entire sysplex.

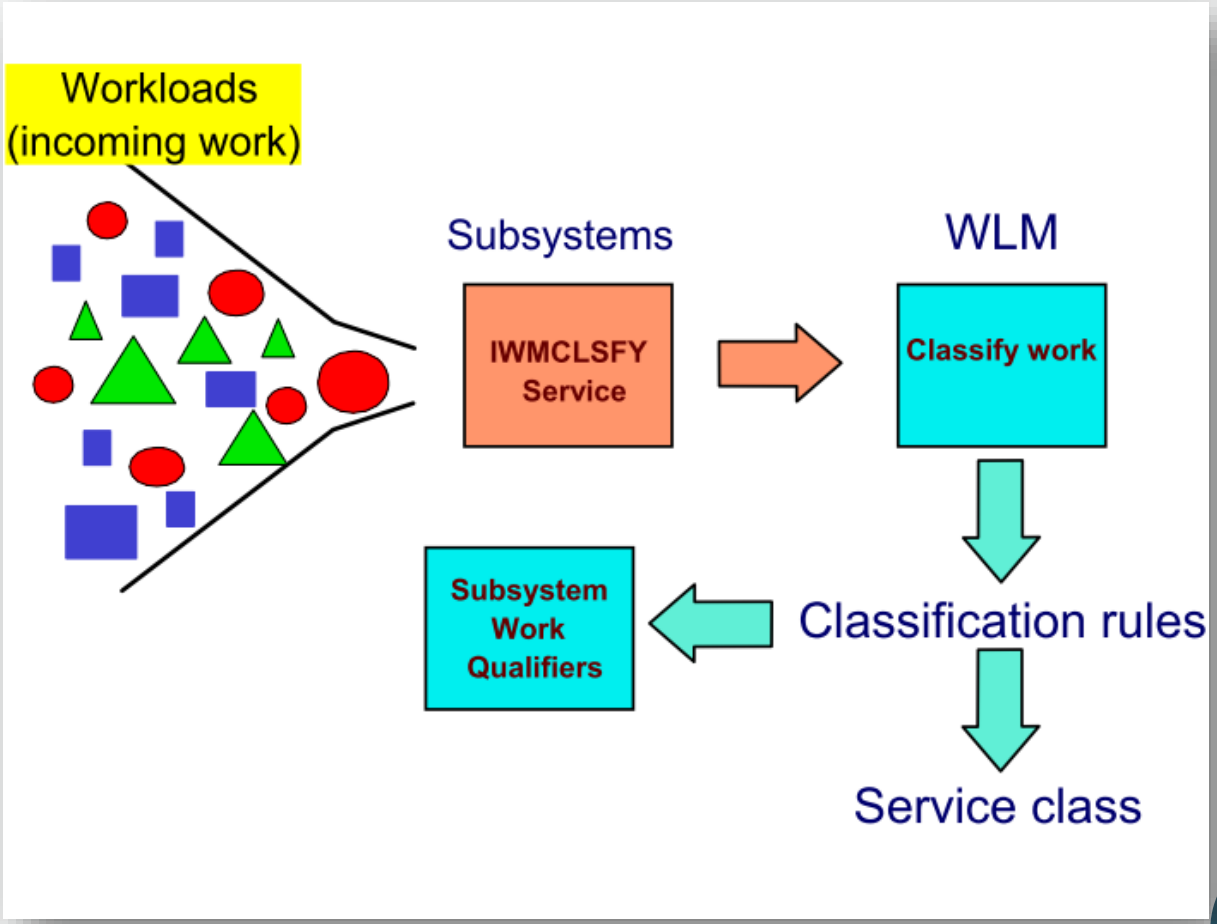


When work enters

When each subsystems transaction manager receives a work request, it issues the IWMCLSFY service to associate an incoming work request with a service class.

WLM receives this request and then uses the classification rules defined by the installation to classify the new work by assigning a service class.

Each subsystem has its own transaction work qualifiers. The attributes of incoming work are compared to these qualifiers and, if there is a match, the rule is used to assign a service class to the work



How WLM monitors workload?

Every 250 milliseconds.

- In order to enforce goals and to track the performance of a sysplex, WLM samples the states of dispatchable units

Within each sample, a unit of work can be in one of the following states:

- Using, when using CPU or DASD I/O
- Delayed, when delayed by CPU, storage, or I/O
- Idle, when without work (such as TSO or OMVS without transactions, an initiator without a job, APPC wait, or a server in STIMER wait)
- Unknown, when delayed by a non-tracked WLM resource (such as ENQ or operator) or idle for a reason other than those listed under the idle state above
- Quiesced, when the unit of work is quiesced by the RESET operator command

Every 10 seconds

- WLM summarizes the system state information and combines it with measured data like CPU service or transaction end times

How WLM evaluates workloads?

WLM maintains a Performance Index (PI) for each service class period to measure how the actual performance varies from the goal.

Because there are different types of goals, WLM needs to compare how well or how poorly workloads in one service class (SC) perform compared to other workloads. The comparison is possible through the use of the PI. PI is simply a ratio of defined goal to the achieved goal

Were the goals met ?

Meaning of the PI values

PI = 1	• Means that the SC period is exactly meeting its goal.
PI > 1	• Means that the SC period is missing its goal.
PI < 1	• Means that the SC period is beating its goal.

Sysplex PIs

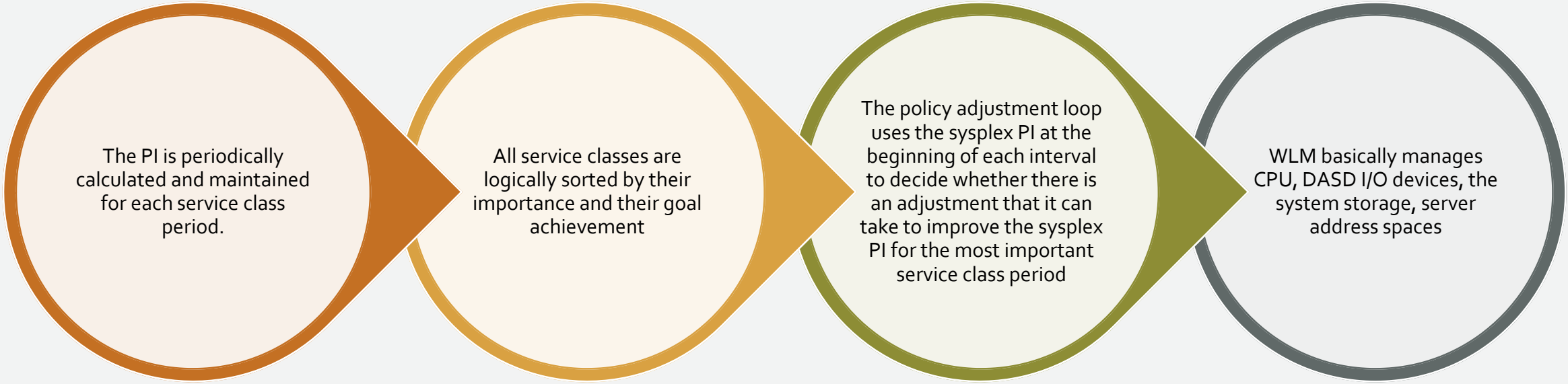
In the sysplex, every SC period can have two types of PIs:

- Local PI - tells how well the work is performing on the local system.
- Sysplex PI - tells us how well the work is performing in the sysplex

PI = Defined goal

Actual goal

How WLM adjusts ?



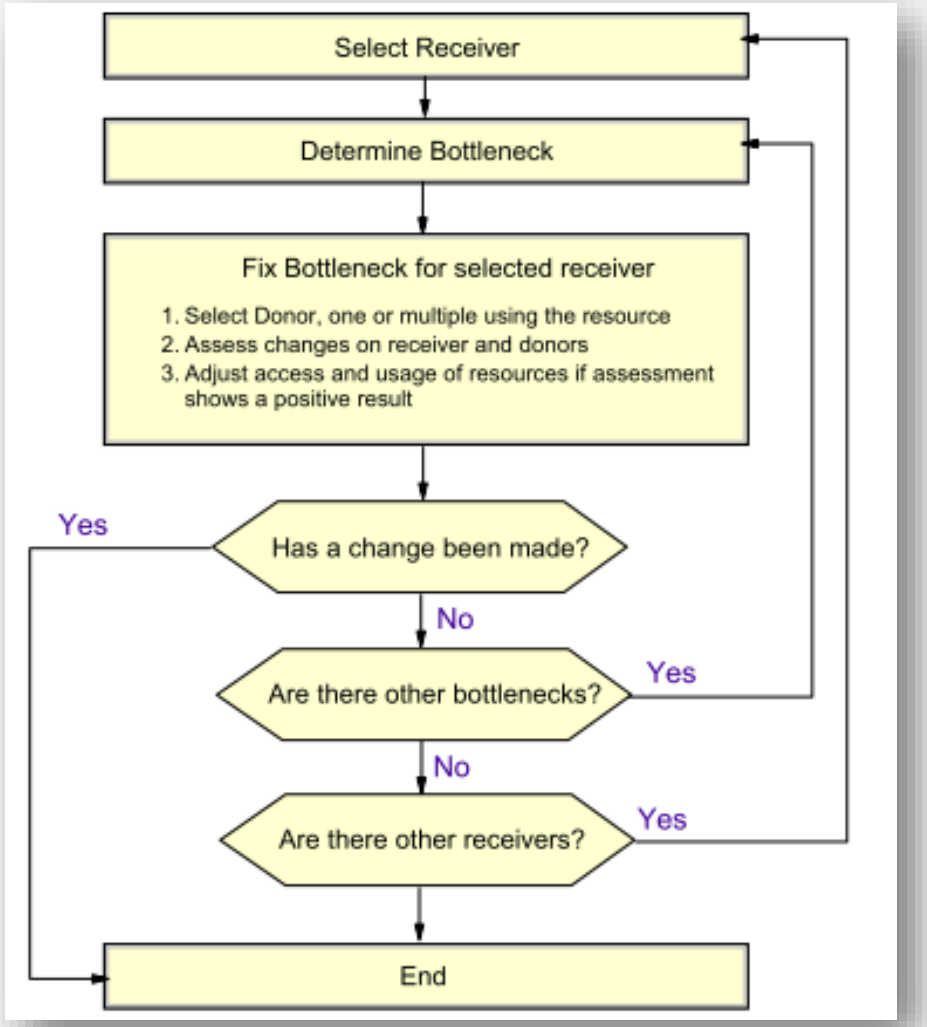
Policy Adjustment Function

All service classes are logically sorted by their importance and their goal achievement.

The first receiver is the service class with the highest importance which does meet its goals and which has the worst PI.

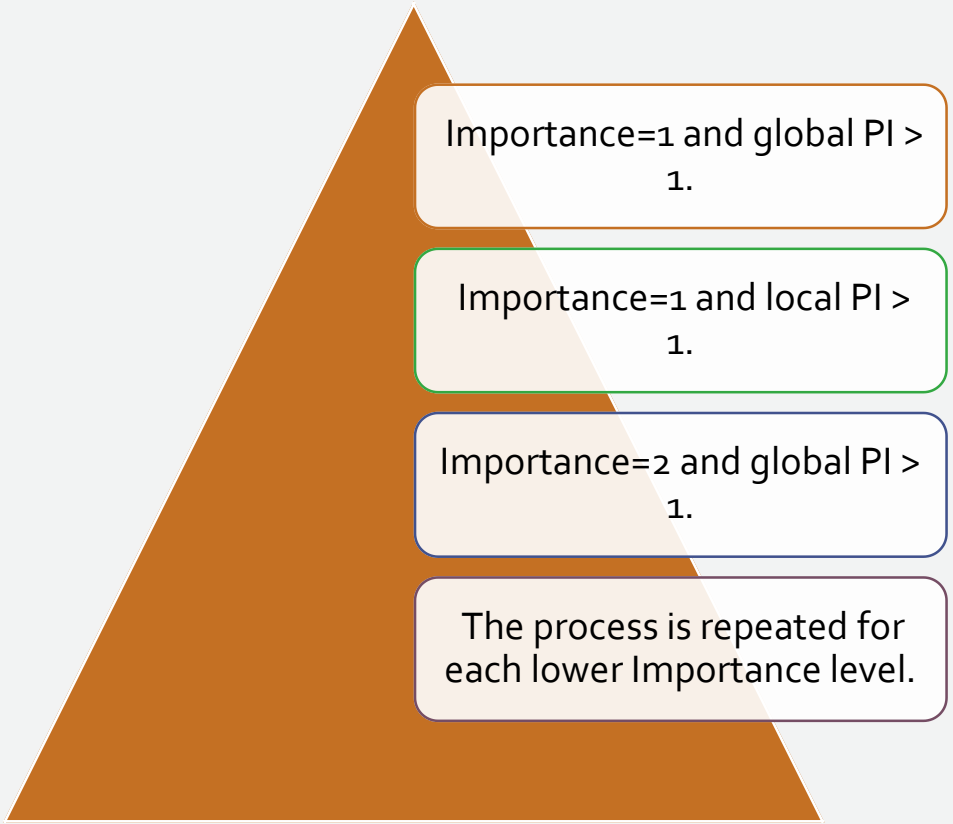
After determining the receiver WLM examines its bottlenecks. The biggest bottleneck is those for which the highest number of delays has been found.

Then WLM searches one or multiple donors which also use the resource.

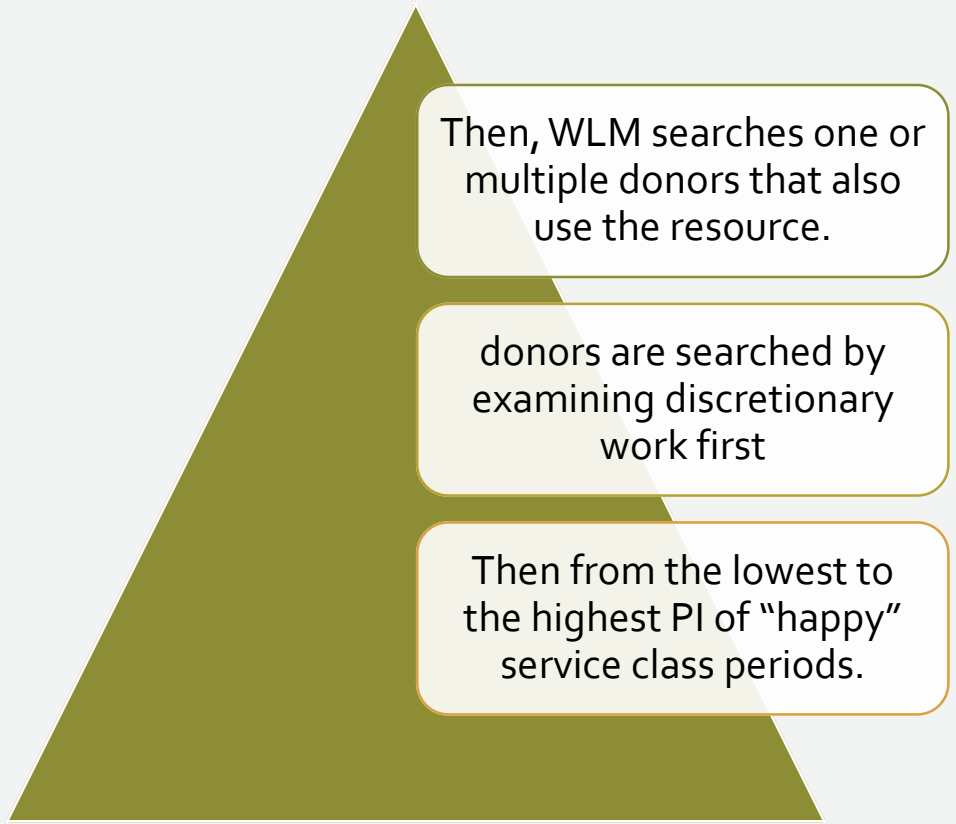


Side by Side

Receiver



Donor(s)



Resource Adjustment Functions

- CPU
- Storage
- I/O
- Server Address Space

CPU Resources Adjusting

255	• SYSTEM
254	• SYSSTC, SYSSTC1-5
253 - 249	• Reserved
248	• Small consumer
247 - 203	• Dynamically Managed Dispatch Priorities
202	• Not used
201 – 192	• Discretionary
191	• Quiesce

Access to the CPU is controlled through Dispatch Priorities. The dispatcher maintains a queue of ready work units which is sorted in priority order.

The interesting range is from 203 to 247. WLM assigns these dispatch priorities to the user defined service classes which have a goal. The assignment is based on the CPU consumption, CPU demand and goal achievement of the work.

In the previous slides we saw that WLM determines through the performance index which service classes meet and which miss their goals. In the next step WLM start to look for a receiver by starting with the most important service class with the worst PI. Then it determines the resource for which an adjustment is required.

For CPU, the service class with high number of CPU delays. Now WLM looks for donors. Based on the captured data WLM knows how much CPU is consumed by each service class and how much CPU is consumed by all work at the same dispatch priority.

WLM logically moves the service class to higher dispatch priority

Storage Resource Adjustment

4 types of storage targets

Protective Processor	A storage target to protect a target number of pages in processor storage
Restrictive Processor	A storage target to preferentially migrate pages to AUX, if the current working set in processor storage is above this target
Protective Central	A storage target to protect a target number of pages in central storage.
Restrictive Central	A storage target to preferentially steal pages from central storage if the current working set in central storage is above this target

There are multiple algorithms which go hand in hand to assure that the pages which are needed by the work is in the central storage of the system.

Restrictive storage targets tell the real storage manager an upper limit of pages which can be kept in central storage for work and a protective storage target tells it that a certain amount of pages should always be available.

If the system gets more and more constraint it is possible to swap work out of storage so that the remaining work can make better use of it

These mechanisms, named the Multi Programming Level, control from a higher view point how many address spaces of each service class are allowed to be instorage at every given point in time.

Storage protection in WLM

STORAGE CRITICAL is an attribute for an address space or for the classification rules for CICS and IMS to help be protected against page stealing.

Server Address Spaces Adjustment

WLM also manages server address spaces for applications based on the number of executed units of work.

The subsystems can use a set of programming interfaces to inform WLM about incoming work.

In addition WLM supports a so called application environment which tells it how to start the server address spaces.

Based on the incoming work requests and goal definitions of the service classes WLM starts and stops the server address spaces and optimizes the use of system resources for these applications.

I/O Resource Adjustment

FF	System work
FE	Importance 1 and 2 missing goals
FD	Importance 1 and 2 missing goals
F9-FC	Meeting goals - adjusted by ratio of connect time to elapsed time
F8	Discretionary

Priority settings by type of work

For the I/O subsystem WLM supports a set of priorities for the access to DASD devices and for the channel subsystem itself.

For DASD devices it is important to find out which service classes use the same set of volumes in order to assign meaningful priorities. In case the captured data tells WLM that a service class encounters many I/O delays the first step is to identify other service classes which use the same DASDs.

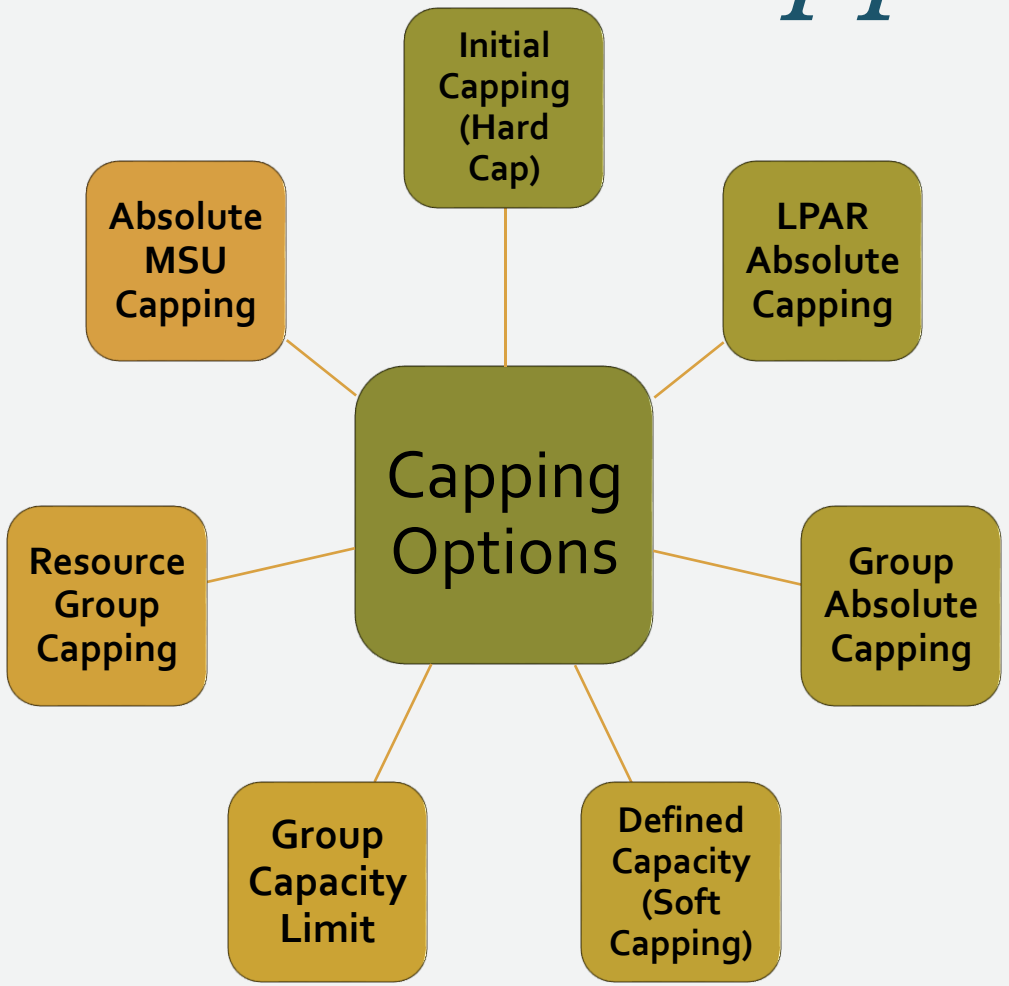
Between those it is now possible to set I/O priorities based on the importance, goal definitions and I/O demand of the work. Another possibility becomes available with the exploitation of Parallel Access Volumes

To manage I/O priorities, information is needed about the delays of each DASD device. When WLM wants to increase a service class period I/O priority, it does it with donor/receiver logic

Capping and WLM

- Capping controls the amount of CPU consumption by an IBM z System logical partition LPAR.
- In this context, CPU here is general purpose CPU and not a specialty processors like z Integrated Information Processor (zIIP), Integrated Facility for Linux (IFL) or Internal Coupling Facility (ICF)
- When capping occurs, the workload currently running on the LPAR is delayed. If the WLM policy is set appropriately, the WLM will run the most critical work and delays the low-importance work
- One of the reasons for capping is to control cost

Capping Options



Agenda

Basic Concepts

Inside WLM

Reporting

Reporting

- What goals for the work?
- Goals met?
- What's response time?
- Any bottlenecks?

Execution velocity by report class

```
PRODUCED BY CMF ANALYZER (6.0.00  RSL 1604 )  WORKLOAD MANAGER GOAL MODE REPORT (DETAIL)                RPTSEQ     5 PAG
BMC SOFTWARE, INC.                                BMC SOFTWARE, INC.                                   REPORT DATE: 09
SHFT   INTERVAL                                      HOUSTON, TX.                                      SYSTEM ID: SJSD
ACTL 09 AUG 17 18.30.00  09 AUG 17 18.45.00

BASED ON REC TYPE/# RECS/# SAMPLES/REC HOURS:  72-3/63/3,584/0.25
------------------------------------------------------------ DETAIL SECTION ------------------------------------------
- POLICY: BBPLEX01 - BMC Software Service Policy -----ACTIVATED: 25JUL2017  14:57:12 - INSTALLED: 25JUL2017  14:57:06 ID
----- WORKLOAD: ---------- ------------------------------- REPORT CLASS: MAINVIEW --- Mainview related ----------
PERIOD: 1     HETEROGENEOUS REPORT CLASS
-TRANSACTIONS-  TRANS. TIME  HHH.MM.SS.TTT  --DASD I/O--  ---SERVICE UNITS---  -SERVICE SECONDS-  -----APPL%-----  -----
AVG        4.98  ACTUAL                0.000  RATE     2.3  CPU          469,024  CPU           13.0  CP%           0.5  AVG
MPL        4.98  EXECUTION             0.000  RESP     0.2  SRB            7,551  SRB            0.2                     TOTAL
ENDED         0  QUEUED                0.000  CONN     0.1  I/O            2,136  RCT            0.0                     CENTR
END/SEC    0.00  R/S AFFINITY          0.000  DISC     0.0  MEM                0  I/O INT        0.0                     SHARE
#SWAPS        0  INELIGIBLE            0.000  PEND     0.1  TOTAL        478,711  HS SERV        0.0                     --PAG
EXECUTD       0  CONVERSION            0.000  IOSQ     0.0  SU/SEC           532  ZAAPonCP       0.0  ZAAPonCP%     0.0  SINGL
AVG ENC       0  STD DEV               0.000                ABSRPTN        106.7  ZAAP           0.0  ZAAP%         0.0  BLOCK
REM ENC       0                                           TRX SRV        106.7  ZIIPonCP       0.0  ZIIPonCP%     0.0  SHARE
MS ENC        0                                                                 ZIIP           4.1  ZIIP%         0.5  HSP
                                                                                ----PROMOTED-----                         HSP M
                                                                                BLKWL          0.0
                                                                                ENQUE          0.0
                                                                                RSRCE          0.0
                                                                                LOCK           0.3
                                                                                SPVSR          0.0

TRANSACTION APPL%:  TOTAL:      CP     1.02  ZAAP/ZIIPonCP         0  ZAAP/ZIIP     0.45
                    MOBILE:     CP        0  ZAAP/ZIIPonCP         0  ZAAP/ZIIP        0

SERVICE CLASSES SERVED: N/A

GOAL: EXECUTION VELOCITY:  30.0

EXECUTION VELOCITY MIGRATION:   I/O MGMT  20.7   INIT MGMT  20.7

     -- RESPONSE TIME --   EX    PERF   AVG    ----- USING % -----   ----- EXECUTION DELAYS % -----  %DLY %    %    -CRYPTO
     HH.MM.SS.TTT    PCT   VEL   INDX   # AS    CPU ZAAP ZIIP  I/O  TOTAL  CPU                      UNKN IDLE QUIE  USG  D

*ALL                      20.7    1.4    6.0    0.1    0    0.1    0    0.5    0.5                     16.6 82.8    0    0
```

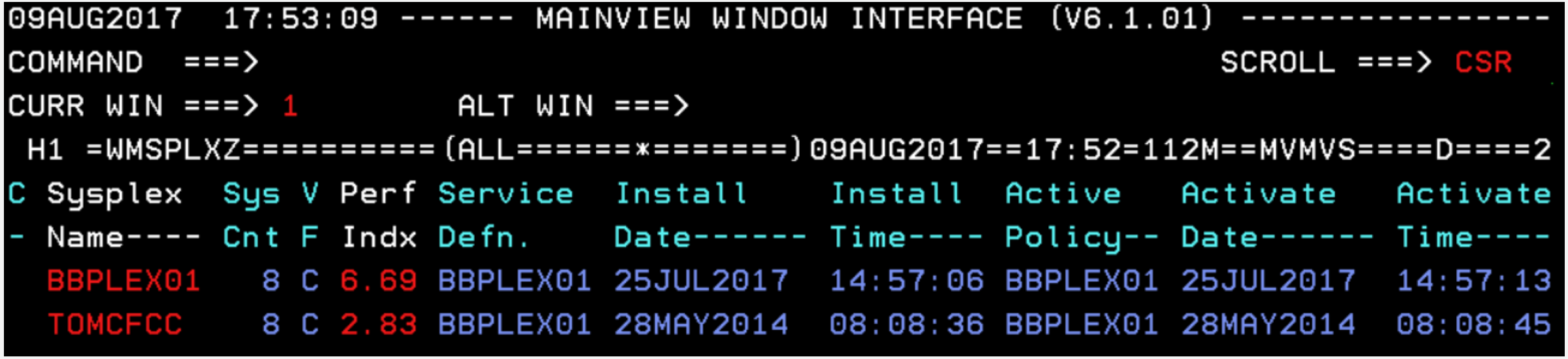
Service class period with an execution velocity

```
PRODUCED BY CMF ANALYZER (6.0.00  RSL 1604 )  WORKLOAD MANAGER GOAL MODE REPORT (DETAIL)                RPTSEQ      5 PAG
BMC SOFTWARE, INC.                                  BMC SOFTWARE, INC.                                 REPORT DATE: 09
SHFT    INTERVAL                                       HOUSTON, TX.                                    SYSTEM ID: SJSD
ACTL 09 AUG 17 18.30.00  09 AUG 17 18.45.00

BASED ON REC TYPE/# RECS/# SAMPLES/REC HOURS:  72-3/63/3,584/0.25
------------------------------------------------------------ DETAIL SECTION ------------------------------------------------
- POLICY: BBPLEX01 - BMC Software Service Policy -----ACTIVATED: 25JUL2017  14:57:12 - INSTALLED: 25JUL2017  14:57:06 ID
----- WORKLOAD: STC -------- STC Workload ---------------------- SERVICE CLASS: STCPAS ----- PAS STC's ----------------
PERIOD: 1     IMPORTANCE: 3   RESOURCE GROUP: PASSTC    (MV PAS(es) - MIN CAP)
-TRANSACTIONS-  TRANS. TIME  HHH.MM.SS.TTT  --DASD I/O--  ---SERVICE UNITS---  -SERVICE SECONDS-  -----APPL%-----  -----
AVG        1.72  ACTUAL                0.000  RATE      2.5  CPU           463,694  CPU           12.9  CP%           0.4  AVG
MPL        1.72  EXECUTION             0.000  RESP      0.2  SRB             4,460  SRB            0.1                     TOTAL
ENDED         0  QUEUED                0.000  CONN      0.1  I/O             2,175  RCT            0.1                     CENTR
END/SEC    0.00  R/S AFFINITY          0.000  DISC      0.0  MEM                 0  I/O INT        0.0                     SHARE
#SWAPS      180  INELIGIBLE            0.000  PEND      0.1  TOTAL         470,329  HS SERV        0.0                     --PAG
EXECUTD       0  CONVERSION            0.000  IOSQ      0.0  SU/SEC            523  ZAAPonCP       0.0  ZAAPonCP%     0.0  SINGL
AVG ENC       0  STD DEV               0.000                 ABSRPTN         304.4  ZAAP           0.0  ZAAP%         0.0  BLOCK
REM ENC       0                                            TRX SRV         304.4  ZIIPonCP       0.0  ZIIPonCP%     0.0  SHARE
MS ENC        0                                                                   ZIIP           4.1  ZIIP%         0.5  HSP
                                                                                  ----PROMOTED-----                       HSP M
                                                                                  BLKWL          0.0
                                                                                  ENQUE          0.0
                                                                                  RSRCE          0.0
                                                                                  LOCK           0.3
                                                                                  SPVSR          0.0

TRANSACTION APPL%:  TOTAL:      CP     0.99  ZAAP/ZIIPonCP         0  ZAAP/ZIIP     0.45
                    MOBILE:     CP        0  ZAAP/ZIIPonCP         0  ZAAP/ZIIP        0

SERVICE CLASSES SERVED: NONE

GOAL: EXECUTION VELOCITY:  30.0

EXECUTION VELOCITY MIGRATION:   I/O MGMT  56.5   INIT MGMT  56.5

      -- RESPONSE TIME --   EX    PERF   AVG    ----- USING % -----   ----- EXECUTION DELAYS % -----  %DLY %    %    -CRYPTO
      HH.MM.SS.TTT    PCT   VEL   INDX   # AS   CPU ZAAP ZIIP  I/O   TOTAL  CPU                      UNKN IDLE QUIE  USG  D
*ALL                        56.5   0.5    3.0   0.1    0    0.1    0    0.2   0.2                      33.2 66.4    0    0
```

Percentile Response time goal example

```
PRODUCED BY CMF ANALYZER (6.0.00  RSL 1604 )  WORKLOAD MANAGER GOAL MODE REPORT (DETAIL)                RPTSEQ      5 PAG
BMC SOFTWARE, INC.                                  BMC SOFTWARE, INC.                                 REPORT DATE: 09
SHFT    INTERVAL                                       HOUSTON, TX.                                    SYSTEM ID: SJSD
ACTL 09 AUG 17 18.30.00  09 AUG 17 18.45.00

BASED ON REC TYPE/# RECS/# SAMPLES/REC HOURS:  72-3/63/3,584/0.25
------------------------------------------------------------ DETAIL SECTION ------------------------------------------
- POLICY: BBPLEX01 - BMC Software Service Policy -----ACTIVATED: 25JUL2017  14:57:12 - INSTALLED: 25JUL2017  14:57:06 ID
----- WORKLOAD: OMVS ------- Open MVS Workload ------------------ SERVICE CLASS: WEBMED ----- CB/WEB Medium -------------
PERIOD: 1     IMPORTANCE: 4    RESOURCE GROUP: ---
-TRANSACTIONS-  TRANS. TIME  HHH.MM.SS.TTT  --DASD I/O--  ---SERVICE UNITS---  -SERVICE SECONDS-  -----APPL%-----  -----
AVG        1.00  ACTUAL                0.033  RATE     0.0  CPU          22,660  CPU              0.6  CP%          0.0  AVG
MPL        1.00  EXECUTION             0.000  RESP     0.0  SRB               0  SRB              0.0                    TOTAL
ENDED       848  QUEUED                0.032  CONN     0.0  I/O               0  RCT              0.0                    CENTR
END/SEC    0.94  R/S AFFINITY          0.000  DISC     0.0  MEM               0  I/O INT          0.0                    SHARE
#SWAPS        0  INELIGIBLE            0.000  PEND     0.0  TOTAL        22,660  HS SERV          0.0                    --PAG
EXECUTD       0  CONVERSION            0.000  IOSQ     0.0  SU/SEC           25  ZAAPonCP         0.0  ZAAPonCP%   0.0  SINGL
AVG ENC    1.00  STD DEV               0.464                ABSRPTN        25.2  ZAAP             0.0  ZAAP%       0.0  BLOCK
REM ENC       0                                           TRX SRV        25.2  ZIIPonCP         0.0  ZIIPonCP%   0.0  SHARE
MS ENC        0                                                                 ZIIP             0.2  ZIIP%       0.0  HSP
                                                                                ----PROMOTED-----                       HSP M
                                                                                BLKWL            0.0
                                                                                ENQUE            0.0
                                                                                RSRCE            0.0
                                                                                LOCK             0.0
                                                                                SPVSR            0.0

TRANSACTION APPL%:  TOTAL:      CP     0.05  ZAAP/ZIIPonCP          0  ZAAP/ZIIP     0.02
                    MOBILE:     CP        0  ZAAP/ZIIPonCP          0  ZAAP/ZIIP        0

SERVICE CLASSES SERVED: NONE

SUBSYSTEM   RESP   ------------------------------------------ RESOURCE MANAGER STATES % ------------------------------
TYPE  PHA  TIME %  --ACTIVE-- READY IDLE ------------------------------- DELAYS -------------------------------  -C
                    SUB  APPL                TOTAL                                                             L
*ALL              0    0     0     0    0   0.0
CB    BTE         0    0     0     0    0   0.0
CB    EXE         0    0     0     0    0   0.0

                SUBSYS  ------------------------------------------ DELAY NAMES ------------------------------------
                 CB     CB01 - RRS                  CB02 - IIOP CONN/RESP     CB03 - GETADDRINFO/LCOM   CB04 - CONNECTO
                        CB05 - SR WAIT CR FUNC      CB06 - SR OUTBOUND IIOP

GOAL:  40.0 PERCENTILE RESPONSE TIME WITHIN 00.03.00.000 (HH.MM.SS.TTT)

     -- RESPONSE TIME --   EX    PERF   AVG   ----- USING % -----   ----- EXECUTION DELAYS % -----  %DLY %    %    -CRYPTO
     HH.MM.SS.TTT     PCT   VEL   INDX  # AS   CPU ZAAP ZIIP  I/O   TOTAL                          UNKN IDLE QUIE  USG  D

*ALL                  100   0.0    0.5   1.0     0    0    0    0      0                            100    0    0    0
```

Overview by Sysplex



References…

- Redbooks (Now on mobile as App)
  - ABCs of z/OS System Programming
  - System Programmer's Guide to: Workload Manager
- www.ibm.com/support/knowledgecenter
- Workload Manager—Interpreting New WLM Measurements by Peter Enrico
- Workload Manager How it Works And How To Use It by Robert Vaupel

BACKUP REFERENCE SLIDES

DISPLAY WLM COMMAND

Example 1: To display the name of the active service policy, enter: D WLM

- The system responds with:

```
IWM025I  17.40.54  WLM DISPLAY 913
ACTIVE WORKLOAD MANAGEMENT SERVICE POLICY NAME: WEEKDAY
ACTIVATED: 2009/08/12  AT: 12:55:57  BY: USER01    FROM: SYS2
DESCRIPTION: Weekday policy with ResGrp
RELATED SERVICE DEFINITION NAME: COEFFS
INSTALLED: 2009/08/12  AT: 12:55:51  BY: IBMUSER   FROM: SYS2
WLM VERSION LEVEL:        LEVEL025
WLM FUNCTIONALITY LEVEL: LEVEL025
WLM CDS FORMAT LEVEL:     FORMAT 3
STRUCTURE SYSZWLM_WORKUNIT STATUS: CONNECTED
STRUCTURE SYSZWLM_EBAE2097 STATUS: CONNECTED
STATE OF GUEST PLATFORM MANAGEMENT PROVIDER (GPMP): CONNECTED
```

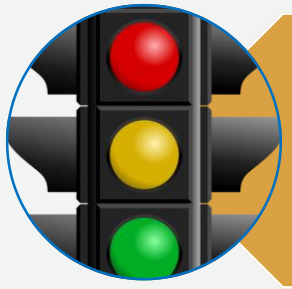
DISPLAY WLM COMMAND

To display status information associated with system WLTEAM9, enter:	• D WLM,SYSTEM=wlteam9
To display status information associated with all systems in the sysplex, enter:	• D WLM,SYSTEMS
To display the status of the application environment named DB2PAY, enter:	• D WLM,APPLENV=db2pay
To display status of all application environments, enter:	• D WLM,APPLENV=*
To display status of the scheduling environment DB2LATE, enter:	• D WLM,SCHENV=DB2LATE
To display status of all scheduling environments in a sysplex beginning with the string 'DB2', enter:	• D WLM,SCHENV=DB2*
To display status of all resources on all systems in a sysplex, enter:	• D WLM,RESOURCE=*,SYSTEMS

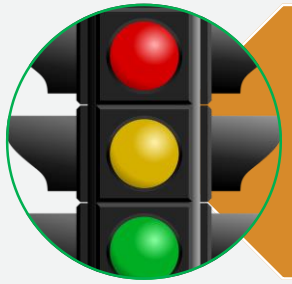
Subsystem types explained

ASCH	APPC transaction programs
CB	Component Broker client object method requests
CICS	CICS transactions
DB2	DB2 quires
DDF	DB2 distributed data facility work requests.
EWLM	EWLM transaction
IMS	IMS requets
IWEB	requests from the Web that are serviced by the Internet Connection Server (ICS), Domino® Go Webserver, or IBM HTTP Server for z/OS
JES	JES2 or JES3 initiates
LSFM	all work from LAN Server for MVS
MQ	MQSeries Workflow work
NETV	NetView network management subtasks
OMVS	work processed in z/OS UNIX System Services
SOM	SOM client object class binding requests
STC	work initiated by the START and MOUNT commands
TSO	all commands issued from foreground TSO sessions
SYSH	Identifies non-z/OS partitions

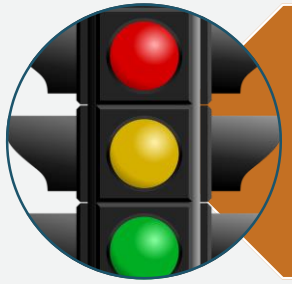
Classification Rules



Classification rules determine how to assign incoming work to a service class and report class based on work qualifiers.



A work qualifier is what identifies a work request to the system. The first qualifier is the subsystem type that receives the work request.



Classification rules are defined using WLM application.

Service class

Service Class

- Classifies the work into distinct classes called service classes
- The user associates a goal with each class; the goal determines how much service the work in the class is able to receive.
- Next, define importance work. In the case where several service classes do not achieve their target goals, the importance helps WLM decide which service class it should help get resources.

Importance

Each service class is associated to an Importance level that specifies how important it is to your business.

The importance defines how work is treated by the WLM. It indicates which service class period should receive resources in order to achieve the target goal.

The absolute value specified is meaningless. What matters is the relative value. Importance is ignored when you are meeting your goals.

Discretionary work has implicitly no importance. SYSTEM and SYSSTC work are considered the highest importance works because of their top dispatching priority.

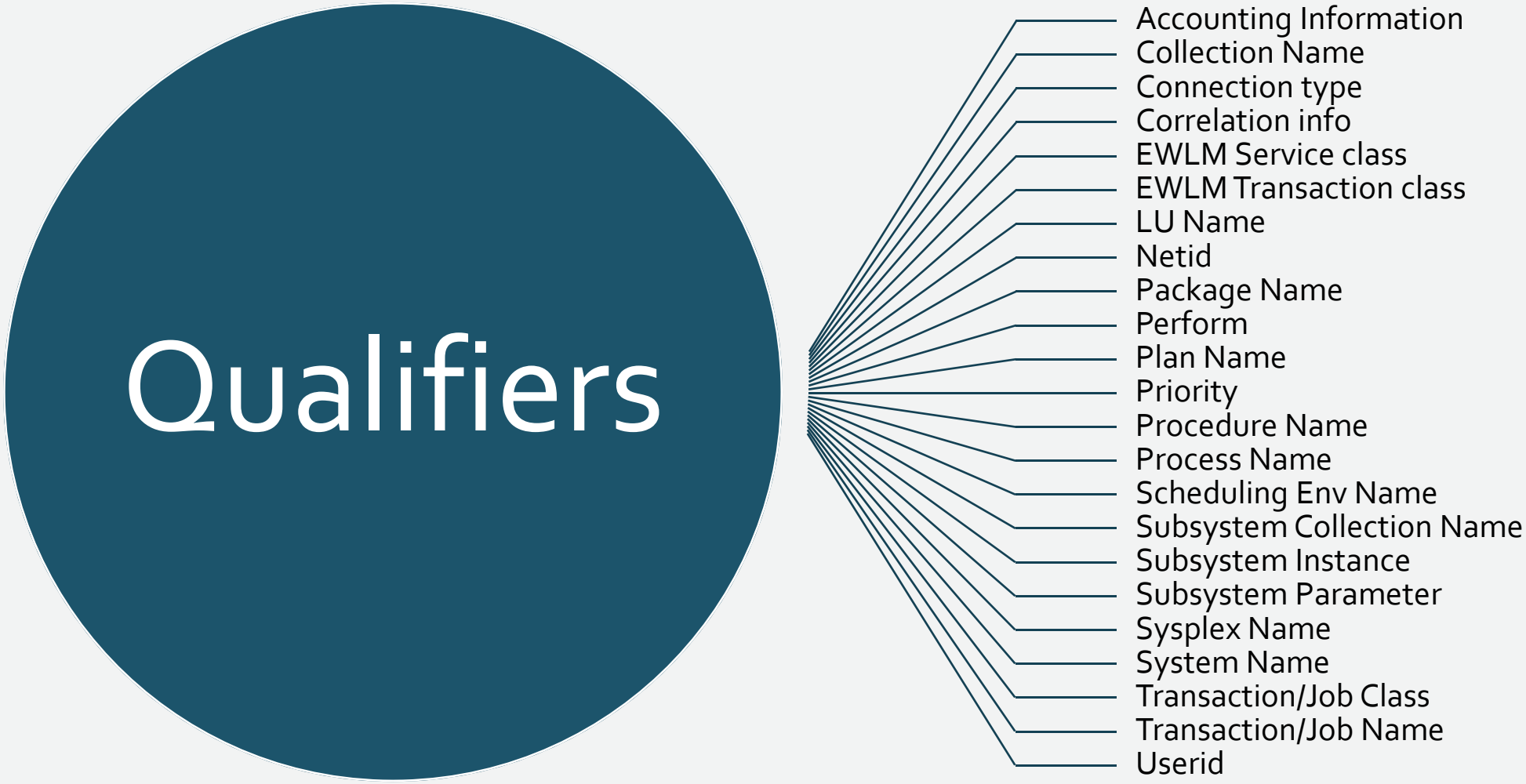
Resource Group

The Resource Group (RG) definition describes the amount of CPU capacity available to work associated to a specific service class.

With RG:

- Limit (capping) the amount of CPU capacity available to the service classes.
- Guarantee some minimum CPU capacity to the service classes when work in the group is missing its goals.

Subsystem Type Qualifiers



Workload Manager Goal Mode Report

```
PRODUCED BY CMF ANALYZER (6.0.00  RSU 1408 )  WORKLOAD MANAGER GOAL MODE REPORT (DETAIL)                RPTSEQ     3 PAGE      7
BMC SOFTWARE, INC.                                    BMC SOFTWARE, INC.                              REPORT DATE: DD MMM YY  4.23
ACTL 14 MAY 14 23.04.21  15 MAY 14 02.00.00              HOUSTON, TX.                                 SYSTEM ID: SJSD     Z 2.01.0


BASED ON REC TYPE/# RECS/# SAMPLES/REC HOURS:  72-3/720/42.2K/2.93
------------------------------------------------------------ DETAIL SECTION ------------------------------------------------------------
- POLICY: BBPLEX01 - BMC Software Service Policy -----ACTIVATED: 08MAYYYYY  17:53:37 - INSTALLED: 08MAYYYYY  17:53:27 ID: CSTCXN   -
----- WORKLOAD: ------------ ------------------------------------ REPORT CLASS: BATCH ------ BATCH Report Class ------------------
PERIOD: 2     HETEROGENEOUS REPORT CLASS
-TRANSACTIONS-  TRANS. TIME  HHH.MM.SS.TTT  --DASD I/O--  ---SERVICE UNITS---  -SERVICE SECONDS-  -----APPL%-----  -----STORAGE-----
AVG       0.02  ACTUAL              37.921  RATE     3.2  CPU         511,658  CPU           16.8  CP%          0.2  AVG       1,734.1
MPL       0.02  EXECUTION            9.607  RESP     0.9  SRB          86,931  SRB            2.9                    TOTAL        38.4
ENDED       26  QUEUED               0.807  CONN     0.8  I/O         156,861  RCT            0.0                    CENTRAL      38.4
END/SEC   0.00  R/S AFFINITY         0.000  DISC     0.1  MEM               0  I/O INT        0.2                    SHARED        0.0
#SWAPS       0  INELIGIBLE          27.505  PEND     0.0  TOTAL       755,450  HS SERV        0.0                    --PAGE-IN RATES--
EXECUTD      0  CONVERSION           1.573  IOSQ     0.0  SU/SEC           72  ZAAPonCP       0.0  ZAAPonCP%    0.0  SINGLE        0.0
AVG ENC      0  STD DEV           1.54.209                ABSRPTN      3239.8  ZAAP           0.0  ZAAP%        0.0  BLOCK         0.0
REM ENC      0                                           TRX SRV      3239.8  ZIIPonCP       0.0  ZIIPonCP%    0.0  SHARED        0.0
MS ENC       0                                                               ZIIP           0.0  ZIIP%        0.0  HSP           0.0
                                                                             ----PROMOTED-----                        HSP MISS      0.0
                                                                             BLKWL          0.0
                                                                             ENQUE          0.0
                                                                             RSRCE          0.0
                                                                             LOCK           0.1
                                                                             SPVSR          0.0

SERVICE CLASSES SERVED: N/A

GOAL: EXECUTION VELOCITY:  20.0

EXECUTION VELOCITY MIGRATION:   I/O MGMT  65.2   INIT MGMT  41.9

      -- RESPONSE TIME --    EX    PERF   AVG    ----- USING % -----   ----- EXECUTION DELAYS % -----  %DLY %    %    -CRYPTO%- -RESCNT%-
      HH.MM.SS.TTT    PCT    VEL   INDX   # AS    CPU ZAAP ZIIP  I/O  TOTAL  CPU                    UNKN IDLE QUIE  USG  DLY  USG  DLY

*ALL                       41.9    0.5    0.0    9.2    0    0 14.7  12.7  12.7                    63.3    0    0    0    0    0    0
 SJSD                      41.9    0.5    0.0    9.2    0    0 14.7  12.7  12.7                    63.3    0    0    0    0    0    0
```

Workload Manager Goal Mode Report

```
PRODUCED BY CMF ANALYZER (6.0.00  RSU 1408 )  WORKLOAD MANAGER GOAL MODE REPORT (DETAIL)                RPTSEQ     3 PAGE      9
BMC SOFTWARE, INC.                                    BMC SOFTWARE, INC.                              REPORT DATE: DD MMM YY  4.23
ACTL 14 MAY 14 23.04.21  15 MAY 14 02.00.00              HOUSTON, TX.                                 SYSTEM ID: SJSD     Z 2.01.0


BASED ON REC TYPE/# RECS/# SAMPLES/REC HOURS:  72-3/720/42.2K/2.93
------------------------------------------------------------ RPTCLASS SUMMARY ------------------------------------------------------------
- POLICY: BBPLEX01 - BMC Software Service Policy -----ACTIVATED: 08MAYYYYY  17:53:37 - INSTALLED: 08MAYYYYY  17:53:27 ID: CSTCXN   -
----- WORKLOAD: ------------ ------------------------------------ REPORT CLASS: BATCH ------ BATCH Report Class ------------------
PERIOD: *ALL
-TRANSACTIONS-  TRANS. TIME  HHH.MM.SS.TTT  --DASD I/O--  ---SERVICE UNITS---  -SERVICE SECONDS-  -----APPL%-----  -----STORAGE-----
AVG       0.07  ACTUAL           16.52.297  RATE     3.4  CPU          601,479  CPU           19.7  CP%          0.2  AVG       1,119.7
MPL       0.07  EXECUTION           19.686  RESP     0.9  SRB           88,672  SRB            2.9                    TOTAL        76.9
ENDED       51  QUEUED            1.32.439  CONN     0.8  I/O          159,285  RCT            0.0                    CENTRAL      76.9
END/SEC   0.00  R/S AFFINITY         0.000  DISC     0.1  MEM                0  I/O INT        0.3                    SHARED        0.2
#SWAPS       0  INELIGIBLE       15.00.171  PEND     0.0  TOTAL        849,436  HS SERV        0.0                    --PAGE-IN RATES--
EXECUTD      0  CONVERSION           0.904  IOSQ     0.0  SU/SEC            81  ZAAPonCP       0.0  ZAAPonCP%    0.0  SINGLE        0.0
AVG ENC      0  STD DEV        1.56.53.804                  ABSRPTN      1174.1  ZAAP           0.0  ZAAP%        0.0  BLOCK         0.0
REM ENC      0                                            TRX SRV      1174.1  ZIIPonCP       0.0  ZIIPonCP%    0.0  SHARED        0.0
MS ENC       0                                                                 ZIIP           0.0  ZIIP%        0.0  HSP           0.0
```

Workload Manager Goal Mode Report

```
PRODUCED BY CMF ANALYZER (6.0.00  RSU 1408 )  WORKLOAD MANAGER GOAL MODE REPORT (DETAIL)                RPTSEQ     3 PAGE     87
BMC SOFTWARE, INC.                                    BMC SOFTWARE, INC.                              REPORT DATE: DD MMM YY  4.23
ACTL 14 MAY 14 23.04.21  15 MAY 14 02.00.00              HOUSTON, TX.                                 SYSTEM ID: SJSD     Z 2.01.0


BASED ON REC TYPE/# RECS/# SAMPLES/REC HOURS:  72-3/720/42.2K/2.93
------------------------------------------------------------ WORKLOAD SUMMARY ------------------------------------------------------------
- POLICY: BBPLEX01 - BMC Software Service Policy -----ACTIVATED: 08MAYYYYY  17:53:37 - INSTALLED: 08MAYYYYY  17:53:27 ID: CSTCXN   -
----- WORKLOAD: TSO -------- TSO Workload ------------------------ SERVICE CLASS: *ALL ------- All Service Classes ------------------
PERIOD: *ALL  IMPORTANCE: -   RESOURCE GROUP: TSOLOW   (Low Service (Resource CAP))
-TRANSACTIONS-  TRANS. TIME  HHH.MM.SS.TTT  --DASD I/O--  ---SERVICE UNITS---  -SERVICE SECONDS-  -----APPL%-----  -----STORAGE-----
AVG       0.01  ACTUAL              0.095  RATE     1.6  CPU         263,263  CPU           8.6  CP%          0.1  AVG       1,484.2
MPL       0.01  EXECUTION           0.090  RESP     0.5  SRB           7,094  SRB           0.2                    TOTAL        14.6
ENDED     1,057 QUEUED              0.005  CONN     0.3  I/O          10,837  RCT           0.5                    CENTRAL      14.6
END/SEC    0.10 R/S AFFINITY        0.000  DISC     0.1  MEM               0  I/O INT       0.1                    SHARED        0.0
#SWAPS    1,055 INELIGIBLE          0.000  PEND     0.1  TOTAL       281,194  HS SERV       0.0                    --PAGE-IN RATES--
EXECUTD       0 CONVERSION          0.000  IOSQ     0.0  SU/SEC           27  ZAAPonCP      0.0  ZAAPonCP%    0.0  SINGLE        4.5
AVG ENC       0 STD DEV             0.649               ABSRPTN      2713.8  ZAAP          0.0  ZAAP%        0.0  BLOCK         0.0
REM ENC       0                                         TRX SRV      2701.1  ZIIPonCP      0.0  ZIIPonCP%    0.0  SHARED        0.0
MS ENC        0                                                             ZIIP          0.0  ZIIP%        0.0  HSP           0.0
                                                                            ----PROMOTED-----                      HSP MISS      0.0
                                                                            BLKWL         0.0
                                                                            ENQUE         0.0
                                                                            RSRCE         0.0
                                                                            LOCK          0.3
                                                                            SPVSR         0.0

SERVICE CLASSES SERVED: N/A

GOAL: N/A

      -- RESPONSE TIME --    EX   PERF   AVG   ----- USING % -----  ----- EXECUTION DELAYS % -----  %DLY %    %    -CRYPTO%- -RESCNT%-
      HH.MM.SS.TTT    PCT   VEL  INDX   # AS   CPU ZAAP ZIIP  I/O  TOTAL                          UNKN IDLE QUIE  USG  DLY  USG  DLY

*ALL                      29.3   ---    4.3     0    0    0    0     0                            0.1 99.8    0    0    0    0    0
```

Workload Manager Goal Mode Report

```
PRODUCED BY CMF ANALYZER (6.0.00  RSU 1408 )  WORKLOAD MANAGER GOAL MODE REPORT (DETAIL)                RPTSEQ     3 PAGE     88
BMC SOFTWARE, INC.                                  BMC SOFTWARE, INC.                                REPORT DATE: DD MMM YY  4.23
ACTL 14 MAY 14 23.04.21  15 MAY 14 02.00.00            HOUSTON, TX.                                   SYSTEM ID: SJSD     Z 2.01.0


BASED ON REC TYPE/# RECS/# SAMPLES/REC HOURS:  72-3/720/42.2K/2.93
------------------------------------------------------------ POLICY SUMMARY ------------------------------------------------------------
- POLICY: BBPLEX01 - BMC Software Service Policy -----ACTIVATED: 08MAYYYYY  17:53:37 - INSTALLED: 08MAYYYYY  17:53:27 ID: CSTCXN   -
----- WORKLOAD: *ALL ------- All Workloads ---------------------- SERVICE CLASS: *ALL ------- All Service Classes ------------------
PERIOD: *ALL  IMPORTANCE: -   RESOURCE GROUP: ---
-TRANSACTIONS-  TRANS. TIME  HHH.MM.SS.TTT  --DASD I/O--  ---SERVICE UNITS---  -SERVICE SECONDS-  -----APPL%-----  -----STORAGE-----
AVG     292.75  ACTUAL             13.793  RATE   323.5  CPU     112,460,229  CPU       3,690.1  CP%        28.2  AVG      12,639.6
MPL     292.75  EXECUTION           4.724  RESP     1.0  SRB       9,484,852  SRB         311.2                   TOTAL   3.700E+06
ENDED     9,395  QUEUED              0.535  CONN     0.5  I/O      11,179,213  RCT           4.2                   CENTRAL 3.700E+06
END/SEC    0.89  R/S AFFINITY        0.000  DISC     0.1  MEM               0  I/O INT      35.0                   SHARED    5,993.2
#SWAPS     8,582  INELIGIBLE          4.886  PEND     0.3  TOTAL   133,124,294  HS SERV       0.0                   --PAGE-IN RATES--
EXECUTD        0  CONVERSION          0.009  IOSQ     0.1  SU/SEC       12,632  ZAAPonCP      0.3  ZAAPonCP%   0.0  SINGLE         0.0
AVG ENC     4.88  STD DEV          8.54.625                  ABSRPTN        43.1  ZAAP        118.4  ZAAP%       1.1  BLOCK          0.0
REM ENC        0                                            TRX SRV        43.1  ZIIPonCP      2.4  ZIIPonCP%   0.0  SHARED         0.0
MS ENC         0                                                                 ZIIP        336.8  ZIIP%       3.2  HSP            0.0
                                                                                 ----PROMOTED-----                     HSP MISS       0.0
                                                                                 BLKWL         0.0
                                                                                 ENQUE         0.1
                                                                                 RSRCE         0.0
                                                                                 LOCK         62.6
                                                                                 SPVSR         0.0

SERVICE CLASSES SERVED: N/A

SUBSYSTEM   RESP   ---------------------------------------------- RESOURCE MANAGER STATES % ----------------------------------------------
TYPE  PHA  TIME %  --ACTIVE-- READY IDLE ------------------------------- DELAYS ---------------------------------  -CONTINUATION-
                    SUB  APPL           TOTAL DIST UNKN TIMR PROD CONV  I/O LOCK LSES                              LOC  REM SPLX
*ALL       5,029.0  123     0     0 15.2 162.0 77.2 75.9  7.1  1.8    0    0    0    0                               0    0    0
CB    BTE      0.2 22.8     0     0    0  77.2 77.2    0    0    0    0    0    0    0                               0    0    0
CB    EXE        0  100     0     0    0     0    0    0    0    0    0    0    0    0                               0    0    0
CICS  BTE  5,028.9    0     0     0 15.2  84.8    0 75.9  7.1  1.8    0    0    0    0                               0    0    0
CICS  EXE        0    0     0     0    0     0    0    0    0    0    0    0    0    0                               0    0    0

GOAL: N/A

      -- RESPONSE TIME --    EX   PERF   AVG   ----- USING % -----  ----- EXECUTION DELAYS % -----  %DLY %    %    -CRYPTO%- -RESCNT%-
      HH.MM.SS.TTT    PCT    VEL  INDX   # AS   CPU ZAAP ZIIP  I/O  TOTAL  CPU                    UNKN IDLE QUIE  USG  DLY  USG  DLY

*ALL  00.00.13.794          12.5   ---  415.4   0.1    0    0  0.1   0.5   0.5                    29.3 69.9    0    0    0    0    0
 SJSD 00.00.13.794          12.5   ---  415.4   0.1    0    0  0.1   0.5   0.5                    29.3 69.9    0    0    0    0    0

TRANSACTION RESPONSE TIME DISTRIBUTION   (MSEC = MILLISECONDS   SECS = SECONDS   MINS = MINUTES   HRS = HOURS)

  PERCENTAGE OF GOAL------50------60------70------80------90-----100-----110-----120-----130-----140-----150-----200-----400----->400
  RESP TIME (SECS)       0.5     0.6     0.7     0.8     0.9     1.0     1.1     1.2     1.3     1.4     1.5     2.0     4.0     >4.0
  % IN BUCKET           82.3     0.1     1.4     0.0     0.1     1.0     0.0     0.1     0.1     0.6     0.2     0.5     3.1      3.2
  % CUMULATIVE          82.3    82.4    83.9    83.9    84.0    85.0    85.0    85.0    85.1    85.7    85.9    86.4    89.5     92.7
  # IN BUCKET          7,733      10     135       3       8      95       0       5       6      59      18      44     295      297
  # CUMULATIVE         7,733   7,743   7,878   7,881   7,889   7,984   7,984   7,989   7,995   8,054   8,072   8,116   8,411    8,708
```