Smarter Systems for a
Smarter Planet

zEnterprise eXposed!
zManager and z/OS Workload Manager

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Session 10004

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IBM Advanced Technical Skills

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Agenda

- Short zEnterprise Overview

- ARM, GPMP, and Platform Performance Manager

- ARM – Application Response Measurement

- Platform Performance Manager – Performance Policy

  ▶ Customer example

- z/OS Workload Manager Classification

- Summary

zEnterprise Ensemble

- **A zEnterprise ensemble is a collection of 1 to 8 nodes managed collectively by the Unified Resource Manager as a single logical virtualized system using the HMC**

- **A zEnterprise node is a z196 CPC with/without zBX.**
  - A zEnterprise node can be a member of at most one ensemble
  - zEnterprise modes are deployed within a single site

- **A zBX is 1 to 4 racks with up to 2 BladeCenters per rack**

- **Z196 CPCs are deployed within a single site**

- **Blade based fit-for-purpose Solutions**

- **Integrated Advanced Virtualization Management**

- **Implements well-defined external interface to Data Center Service Management functions**

- **Virtual Resource Management and Automation**

zEnterprise Node
zEnterprise Ensemble
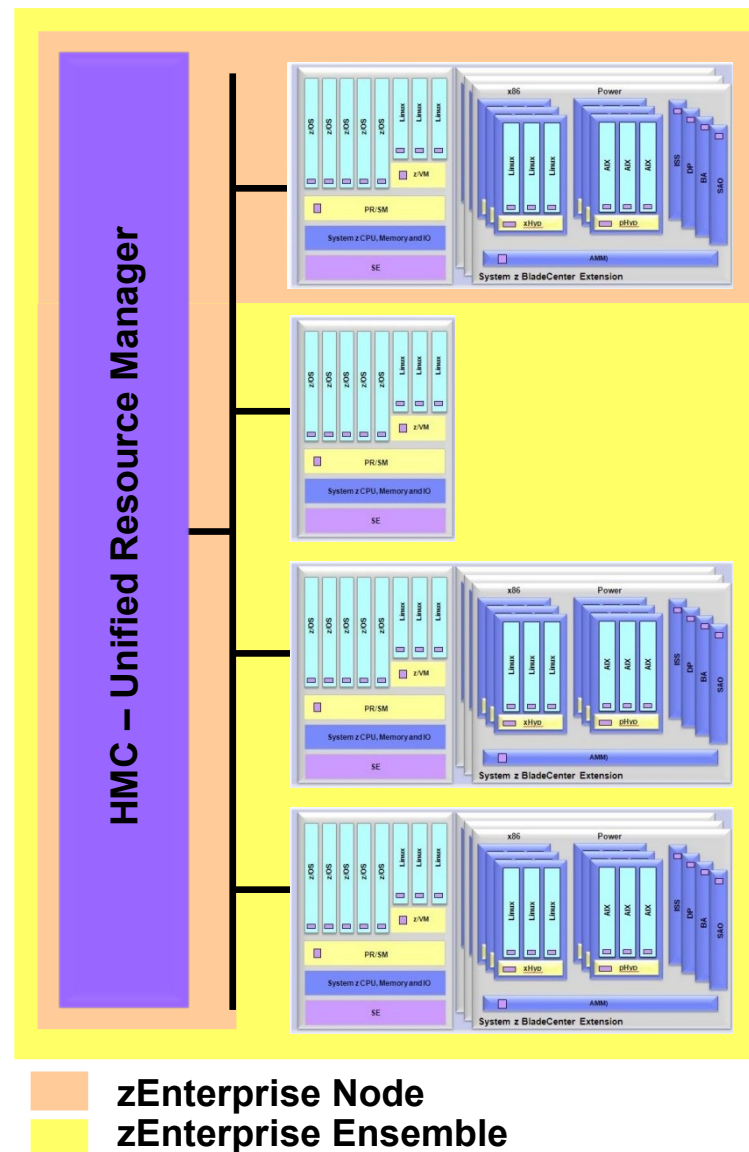
ARM GPMP and PPM

- ## ARM – Application Response Measurement
  - ▶ Provides tracking and measurement of a transaction as it flows across multiple servers
  - ▶ Allows measurement of end-to-end response time, as well as showing how much time was spent on each server in its path

- ## GPMP – Guest Platform Management Provider
  - ▶ Primarily collects statistics and data provided by ARM, sends data to Support Element and HMC for reporting

- ## PPM – Platform Performance Management
  - ▶ Define a PPM Performance Policy to measure, monitor, and adjust performance among a group of individual virtual servers
  - ▶ Goals are set in the Performance Policy to define how much CPU resource a virtual server is entitled to, and its relative importance to other virtual servers
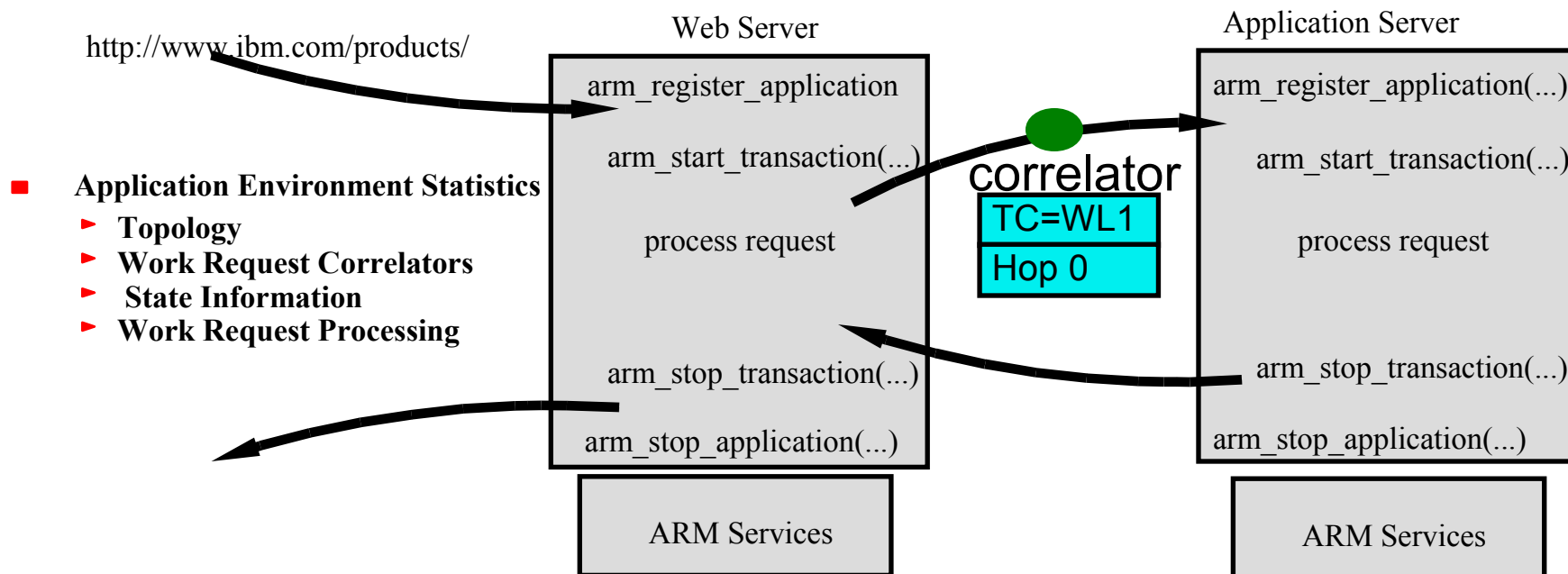
ARM

- **ARM – Application Response Measurement**
  - ▶ Allows measurement of end-to-end response time
    - ● Correlator assigned to classify work. Correlator is passed to secondary applications and other managed servers that process the application
    - ● Similar to Performance Blocks in z/OS Workload Manager

- **zManager uses information to determine**
  - ▶ The amount of time that each application or server used to process the transaction
  - ▶ The name of the application or server that processed the transaction
  - ▶ The end-to-end transaction flow as it moves from one application or server to the next

- **Movement of work request from one application OR server to another is considered a 'HOP'**
  - ▶ Data viewed from the HOPS Report

- **For accurate data, all applications and servers that will process a work request must be ARM enabled**

Basic ARM calls

- arm_register_application

- arm_register_transaction

- arm_start_application

- for (each transaction)
  - ▶ arm_start_transaction
  - ▶ arm_bind_thread
  - ▶ arm_blocked
    - ● Call downstream sub-transaction
  - ▶ arm_unblocked
  - ▶ arm_unbind_thread
  - ▶ arm_stop_transaction

- arm_stop_application

- arm_destroy_application

Workflow Example with ARM

Standards Based Application Instrumentation

http://www.ibm.com/products/

Web Server

arm_register_application

arm_start_transaction(...)

process request

arm_stop_transaction(...)

arm_stop_application(...)

ARM Services

correlator

TC=WL1

Hop 0

Application Server

arm_register_application(...)

arm_start_transaction(...)

process request

arm_stop_transaction(...)

arm_stop_application(...)

ARM Services

- **Application Environment Statistics**
  - **Topology**
  - **Work Request Correlators**
  - **State Information**
  - **Work Request Processing**

- **The Open Group ARM Standard V4.0**
  - Process registration, deregistration
  - Work request classification, start, and stop

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ARM Instrumented Middleware

- **Web Server support:**
  - ► WebSphere provided plugin
    - IHS/Apache
    - IIS
    - Domino
    - iPlanet

- **WebSphere Application Server**
  - ► WAS 6.0, WAS 7.0

- **DB2**
  - ► z/OS DB2
  - ► DB2 Universal Database for Linux/Unix/Windows
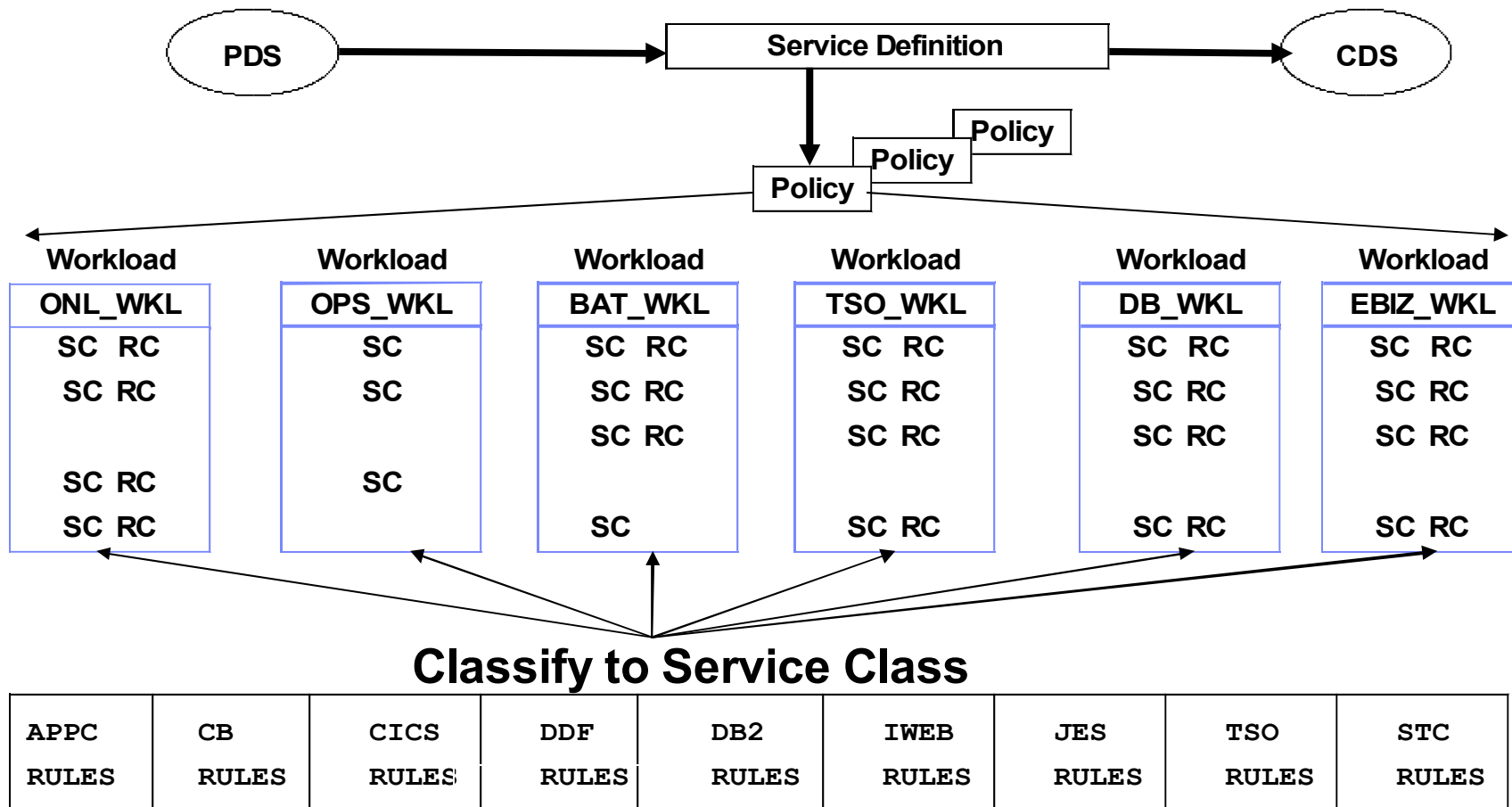
Platform Performance Manager

- Component of zManager

- Monitors and manages performance of virtual servers in the zEnterprise

- Based on a workload performance policy, PPM will adjust CPU resources between those virtual servers that share resources
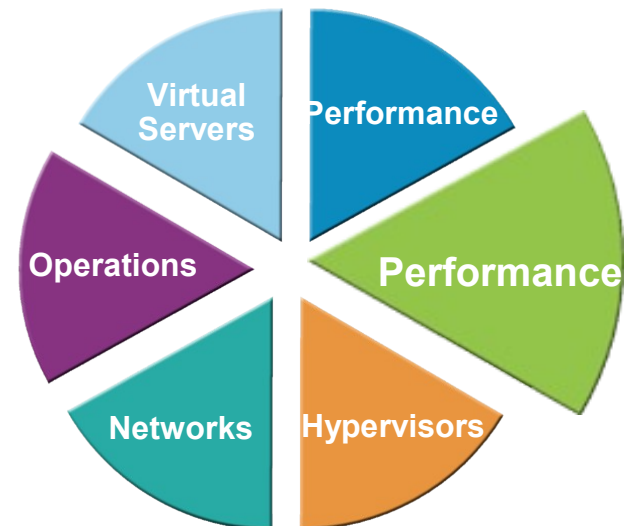
z/OS Workload Manager and PPM Terminology

- Both z/OS use the same terms, but will mean different things
- z/OS
  - ► Workload Manager has a Service Definition
  - ► Service Definition has an active POLICY, which is the container for all Workloads and Service Classes
    - Definition can have multiple Policies, only one active
  - ► As work comes into the system, it is classified to a Service Class
  - ► Service Classes can be grouped together in a Workload for reporting purposes

- PPM
  - ► Workload Performance Policy
  - ► First definition is to define one or more virtual servers to a workload
  - ► Within the workload, define one or more service classes and assign the virtual servers to the appropriate service class
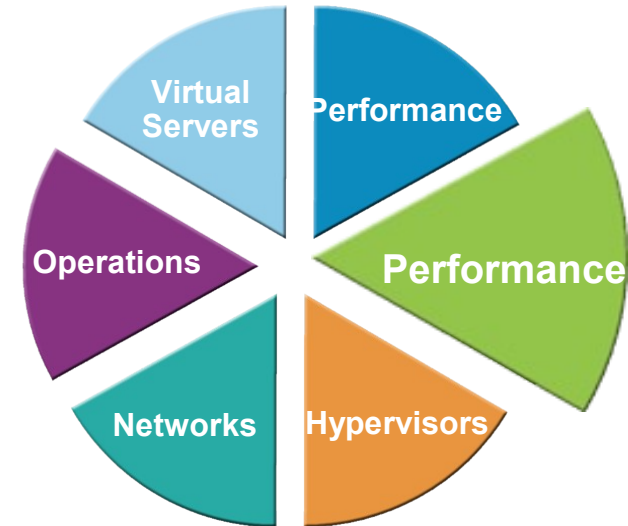
z/OS Workload Manager

```
   PDS  ───────────────────────────►  Service Definition  ───────────►  CDS
                                              │
                                              │                    ┌──────────┐
                                              │              ┌─────┤  Policy  │
                                              │        ┌─────┤ Policy │
                                              ▼        │ Policy │
                                           ┌────────┐
                                           │ Policy │
                                           └────────┘
```

Workload	Workload	Workload	Workload	Workload	Workload
ONL_WKL	**OPS_WKL**	**BAT_WKL**	**TSO_WKL**	**DB_WKL**	**EBIZ_WKL**
SC RC	SC	SC RC	SC RC	SC RC	SC RC
SC RC	SC	SC RC	SC RC	SC RC	SC RC
		SC RC	SC RC	SC RC	SC RC
SC RC	SC				
SC RC		SC	SC RC	SC RC	SC RC

Classify to Service Class

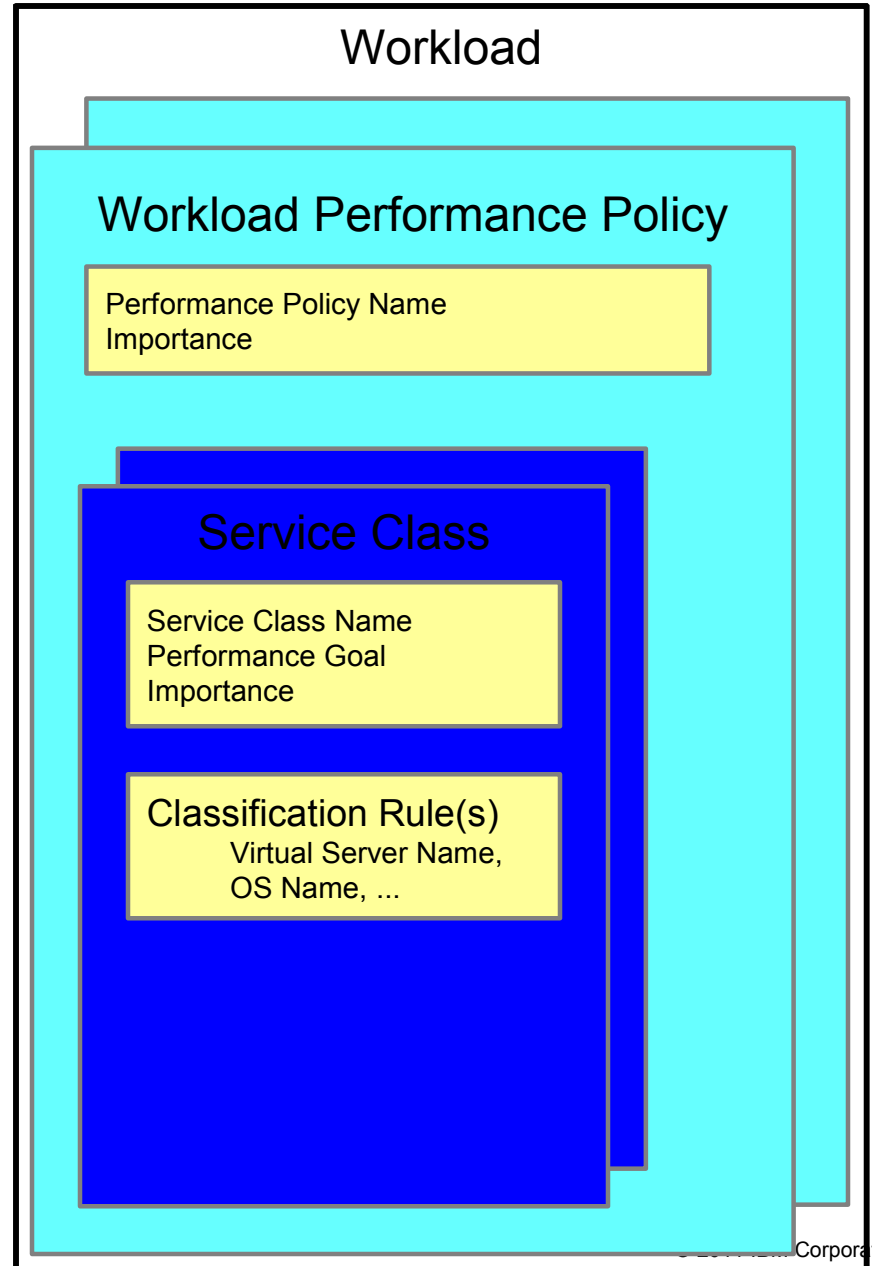| APPC	CB	CICS	DDF	DB2	IWEB	JES	TSO	STC
RULES	RULES	RULES	RULES	RULES	RULES	RULES	RULES	RULES

Work Enters the System

Workload Performance Policy

- Defines performance goals for virtual servers in a workload

  ▶ Conceptually similar to simplified z/OS WLM Policy

- Provides basis for monitoring and management of platform resources used by virtual servers in a Workload

- Workload to performance policy relationship:

  ▶ Multiple performance policies associated with a workload

  ▶ A single policy is active at a given time

  ▶ Can dynamically change the policy that is active

    • Through the UI

    • Through a time-based schedule

    • Example: Day shift / night shift policy

zManager Performance Policy

- Define one or more virtual servers to a workload

- A workload can have one or more performance policies to describe its business importance and objectives

- Only one Policy is active at any time
  - ► Every new workload has at least the 'Default' performance Policy
  - ► Additional policies may be defined as needed

- Each performance policy has one or more service classes that set the priority of and classify the virtual servers
  - ► zManager uses the active performance policy and its service classes to determine how physical resources are applied to the virtual servers

Workload

Workload Performance Policy

Performance Policy Name
Importance

Service Class

Service Class Name
Performance Goal
Importance

Classification Rule(s)
   Virtual Server Name,
   OS Name, ...

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PPM Workload Service Class Goals

- Every Workload has a business importance level (Highest to Lowest) to manage resources among different workloads running on same physical server

- Every Service Class has a business importance level (Highest to Lowest) to help manage resource among different Service Classes running on the same physical Server

  ▶ Therefore, at most can only have 25 combinations

  ▶ For simplification, use common names for a specific combination

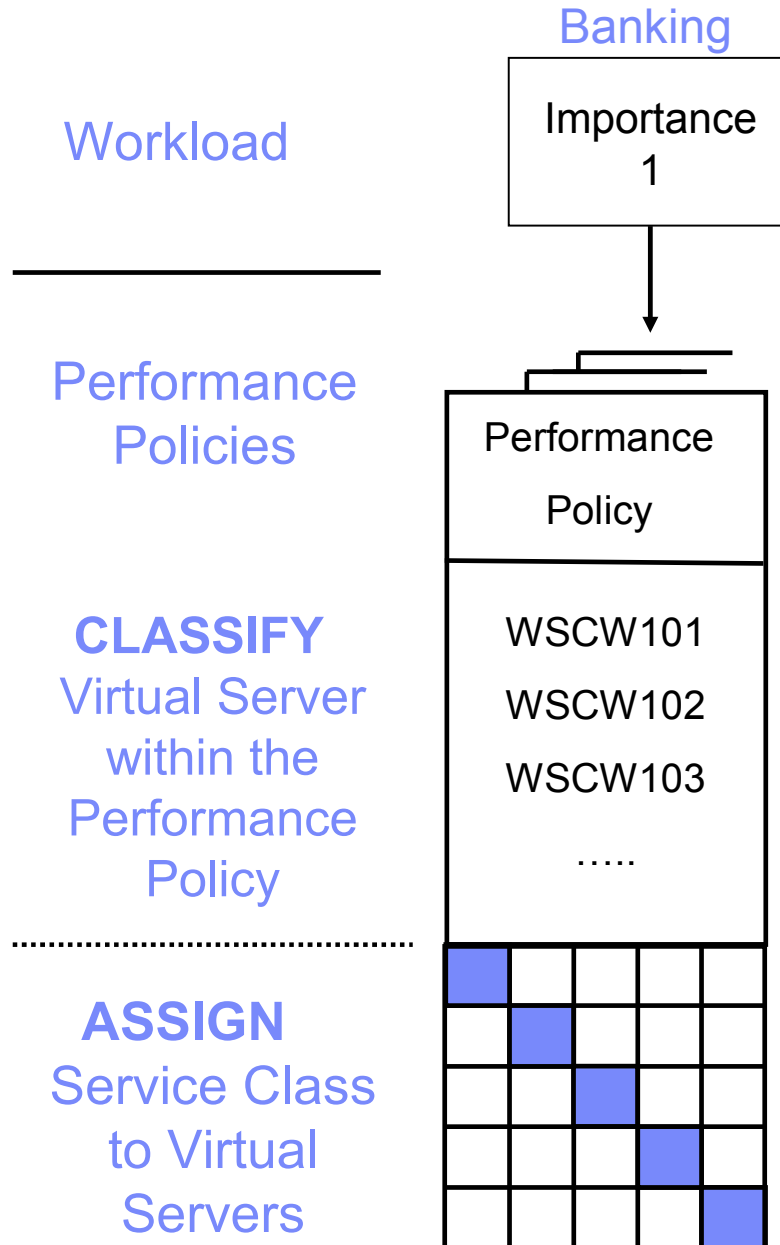| Imp/Velocity	Fastest - 1	Fast - 2	Moderate - 3	Slow - 4	Slowest - 5
Highest - 1	Group11	Group12	Group13	Group14	Group15
High - 2	Group21	Group22	Group23	Group24	Group25
Medium - 3	Group31	Group32	Group33	Group34	Group35
Low - 4	Group41	Group42	Group43	Group44	Group45
Lowest - 5	Group51	Group52	Group53	Group54	Group55

PPM Workflow

The following steps will be taken in order when defining work with PPM

1. Define a workload with a name, ie. Banking

2. Define the virtual servers in zEnterprise and assign to the workload

3. Define a performance policy to manager the virtual servers, or edit the default performance policy

4. Determine which virtual servers will belong to which service class

5. Define necessary service classes and assign virtual servers to appropriate service class

Graphical Example

Banking

Workload

Importance 1

Performance Policies

Performance Policy

CLASSIFY Virtual Server within the Performance Policy

WSCW101

WSCW102

WSCW103

…..

ASSIGN Service Class to Virtual Servers

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Customer Example

- Customer has a new banking workload to be implemented on a zEnterprise zBX system
  - ▶ Step 1 define workload called "BANKING" on HMC
- Sizing has already been done to determine best placement of each virtual server
  - ▶ Step 2 define virtual servers below on the HMC and assign them to the BANKING workload

zBX Node	zBX Chassis	Blade Number	Function	Virtual Server
Node1	B.1	1	HTTP	WSCW101
		2	HTTP	WSCW102
		3	HTTP	WSCW103
		4	HTTP	WSCW104
		5	WAS	ATAIX100
			WAS	ATTAIX10
			WAS	ATPAIX20
		6	WAS	ATAIX200
			WAS	ARPTX100
			WAS	ATMIX304

Performance Policy Service Class Classifications

- Step 3 – Define new policy in BANKING workload called 'STANDARD'

- Step 4 – Determine which virtual servers belong to which service class

  ▶ Importance and Velocity Goals are only relevant within the boundaries of one blade. No need to differentiate GROUP22 on different blades

  ▶ Part 1 – Blades with a single virtual server. Assign virtual server to Group11

    • Protects performance of virtual server in the event additional servers are added to blade

    • Can change group if necessary

  ▶ Part 2 – Set relative importance/velocity for each virtual server on each blade

    • May need to reassign service class if virtual server is moved from one blade to another

Service Class Assignments

- Using previous Rules, Service Class Assignments are below
  - ▶ Internal business discussions will need to be completed in order to determine relative importance of virtual servers that are sharing resources

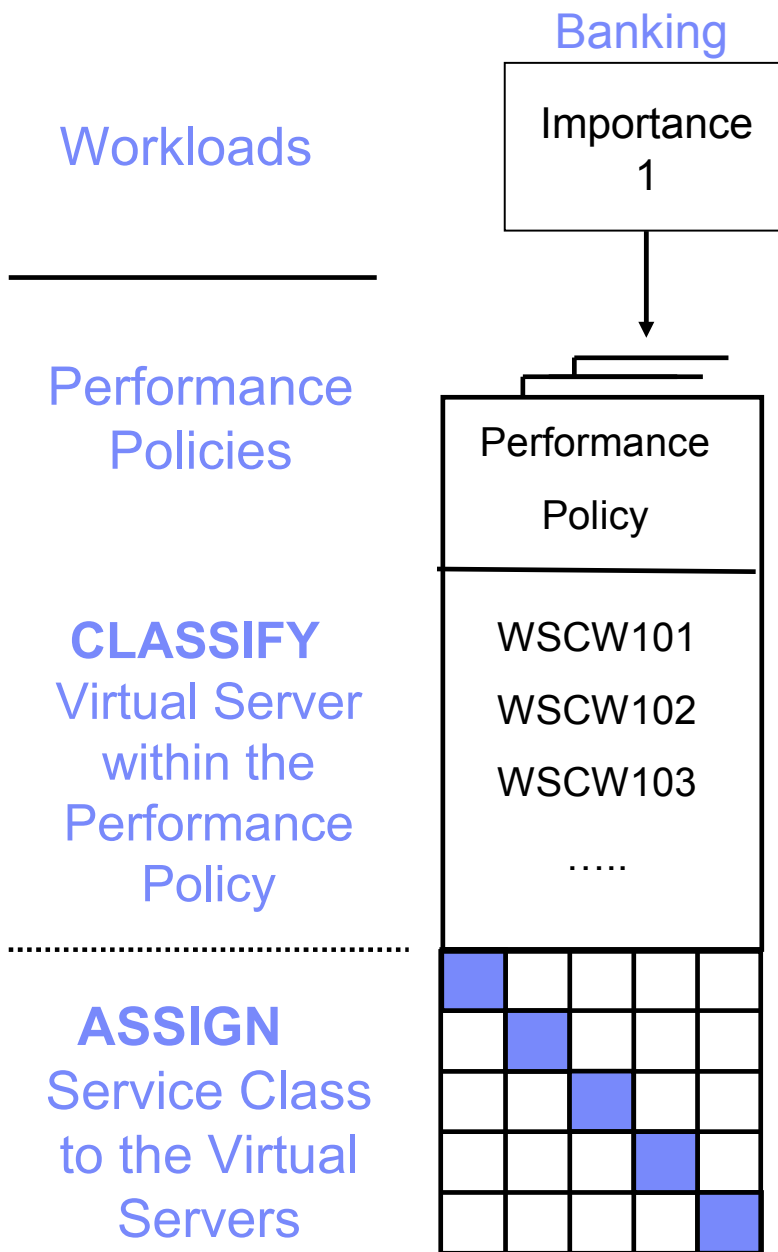| zBX Node	zBX Chassis	Blade Number	Virtual Server	Service Class
Node1	B.1	1	WSCW101	GROUP11
		2	WSCW102	GROUP11
		3	WSCW103	GROUP11
		4	WSCW104	GROUP11
		5	ATAIX100	GROUP11
			ATTAIX10	GROUP55
			ATPAIX20	GROUP33
		6	ATAIX200	GROUP11
			ARPTX100	GROUP33
			ATMIX304	GROUP55

Grouping Servers by Service Class

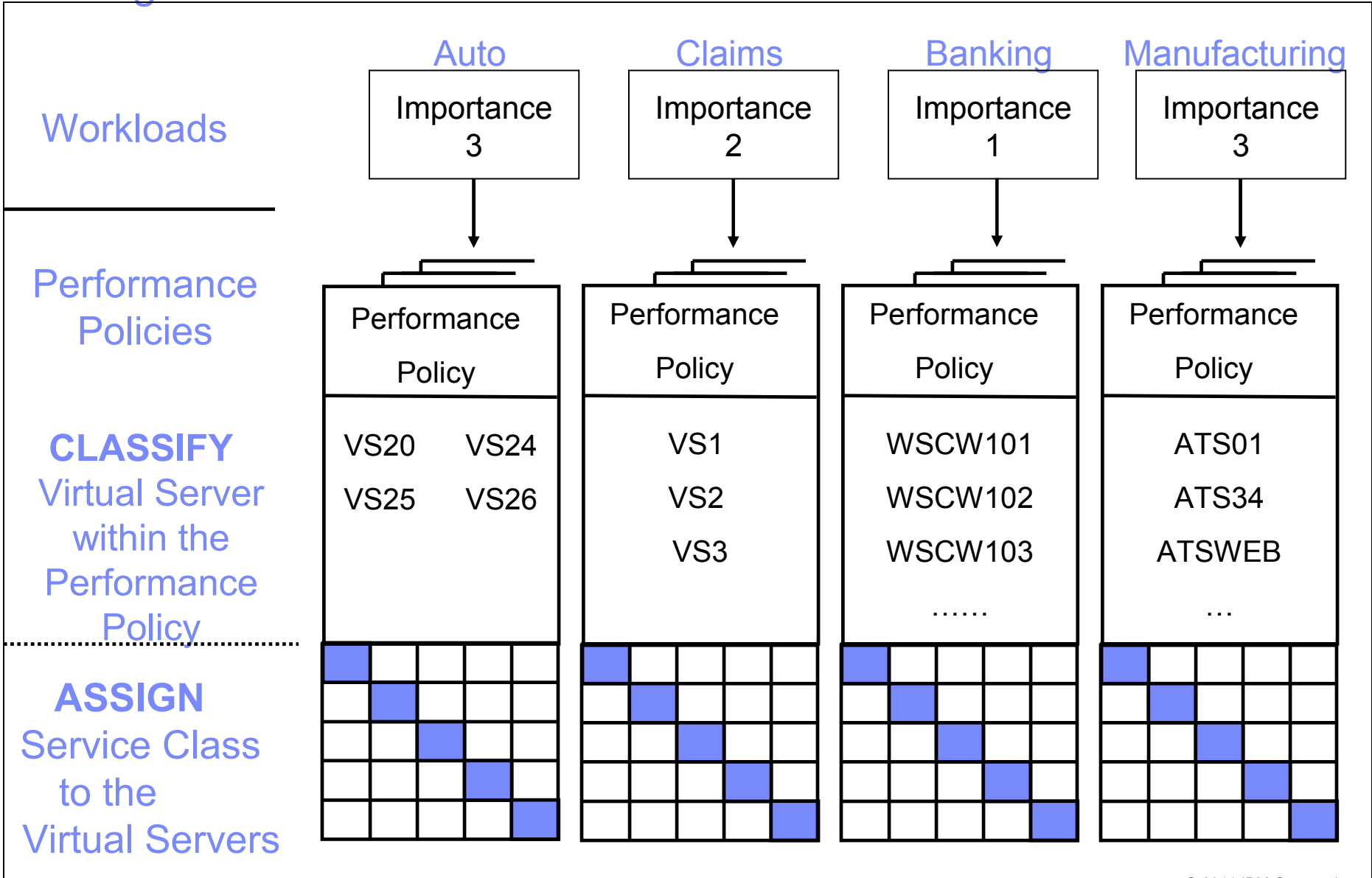- Step 5 - Define necessary service classes and assign virtual servers to appropriate service class

Workload	Policy	Service Class	Virtual Server
Banking	Standard	Group11	WSCW101, WSCW102, WSCW103, WSCW104, ATAIX100, ATAIX200
		Group33	ATPAIX20, ARPTX100
		Group55	ATTAIX10, ATMIX304

- Optional Additional Step – Repeat steps 3 through 5 for additional policies if different performance goals are needed at different times
  - ▶ Ie. define policy 'Weekend' if test servers can get high importance and velocity goals then

Example

Banking

Workloads

Importance 1

Performance Policies

Performance Policy

CLASSIFY
Virtual Server within the Performance Policy

WSCW101

WSCW102

WSCW103

.....

ASSIGN
Service Class to the Virtual Servers

Adding Additional Workloads

| Workloads	Auto Importance 3	Claims Importance 2	Banking Importance 1	Manufacturing Importance 3
Performance Policies	Performance Policy	Performance Policy	Performance Policy	Performance Policy
CLASSIFY Virtual Server within the Performance Policy	VS20 VS24 VS25 VS26	VS1 VS2 VS3	WSCW101 WSCW102 WSCW103 ……	ATS01 ATS34 ATSWEB …
ASSIGN Service Class to the Virtual Servers				

ARM and the Performance Policy

- The PPM Performance Policy is only managing the velocity of the virtual servers

- ARM provides information only for overall transaction response times

  ▶ Cannot specify any response time goal for transactions

- If transactions are running too long, and CPU is the constraint, then velocity goals of individual servers will need to be adjusted

- Similarity in z/OS to having response time goals for CICS/IMS transactions, but managing the regions to the region velocity goal

Assigning Virtual Servers to Multiple Workloads

- It is possible to assign a virtual server to multiple workloads

- Server will be managed to most aggressive goal

- Example – Web server acts as front end to multiple applications
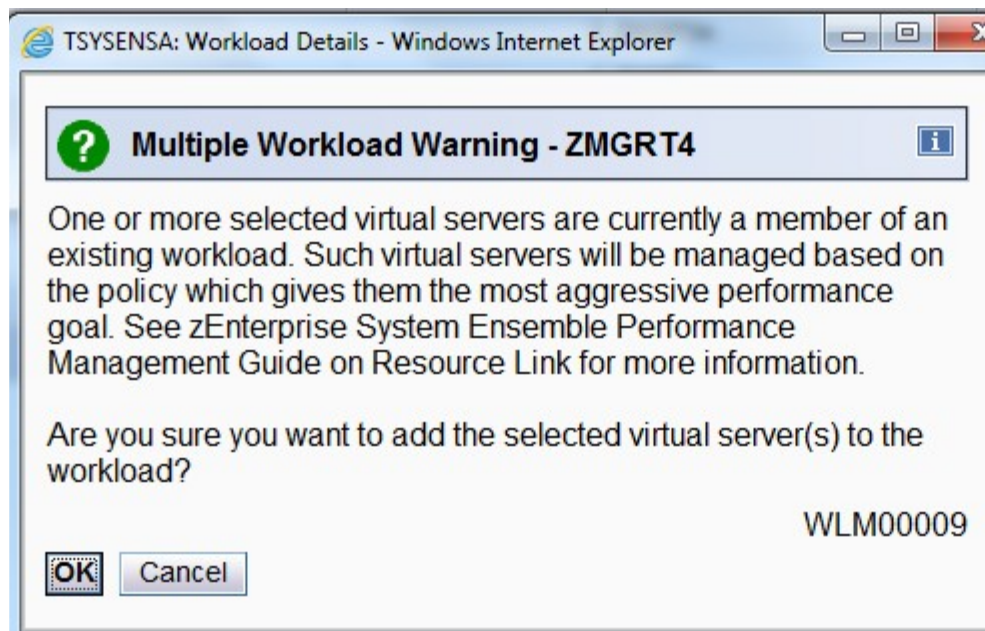
z/OS Workload Manager Classification

- **Work coming into z/OS from within the zEnterprise <u>CAN</u> be classified using EWLM rules**
  - ▶ Requires ARM and GPMP to be implemented since the correlator contains information needed for classification

- **Uses name of PPM service class for classification**
  - ▶ PPM workload and service class names can be up to 64 characters long
    - Is case sensitive
  - ▶ z/OS WLM will use first 32 characters only for classification
    - Will need to use sub-rules when service class names are longer than 8 charracters
    - <u>Be sure FOLD Qualifier names is set to NO</u> (makes naming case sensitive)
    - EWLM Service Class must be a single period response time goal

- **<u>PPM cannot make any changes to z/OS environment</u>. z/OS WLM Service Class goal will need to be set appropriately**
  - ▶ ARM and GPMP allow reports to show how much time is being spent in z/OS as well as rest of zEnterprise

z/OS WLM Classification Example

- Done either through WLM ISPF application, or through z/OS MF

- From WLM Classification rules, edit EWLM rules

```
  ----------------------------------------------------------------
              Subsystem Type Selection List for Rules    Row 1 to 15 of 18
  Command ===> _____

  Action Codes: 1=Create, 2=Copy, 3=Modify, 4=Browse, 5=Print, 6=Delete,
                /=Menu Bar
                                                ----- Class -----
  Action   Type     Description                 Service  Report
    ___    ASCH     APPC scheduled trans programs  _____  _____
    ___    CB       Component Broker requests      _____  _____
    ___    CICS     CICS transaction level rules   _____  _____
    ___    DB2      DB2 Parallel Query transactions _____  _____
    ___    DDF      Distributed DDF work           DDFDEF    _____
    3_     EWLM     EWLM Rules for PPM             PPMDEFLT  _____
    ___    IMS      IMS transaction level rules    _____  _____
    ___    IWEB     Scalable WebServer Transactions _____  _____
    ___    JES      JES classification rules       BAT_MED   RBAT_MED
    ___    LSFM     Lan Server for MVS rules        _____  _____
    ___    MQ       MQ Series Workflow requests    _____  _____
    ___    OMVS     Unix System Services requests  UNIX      _____
```

z/OS Classification Rules Cont.

- ESC is the only Qualifier Type

- Qualifier name is name of performance policy Service Class
  - ▶ Sub-rules needed for Service Classes longer than eight characters

- As with all classification rules, a default can be used
  - ▶ May not want to use if need to let incoming work use other (ie. DDF) classification rules

```
                Modify Rules for the Subsystem Type        Row 1 to 8 of 14
Command ===>  _____    Scroll ===> CSR


Subsystem Type . : EWLM         Fold qualifier names?   N   (Y or N)
Description  . . . EWLM Rules for PPM


Action codes:    A=After      C=Copy       M=Move       I=Insert rule
                 B=Before     D=Delete row R=Repeat      IS=Insert Sub-rule
                                                               More ===>
            --------Qualifier-------                   ------Class-------
Action   Type        Name      Start             Service       Report
                                         DEFAULTS: PPMDEFLT     _____
____     1  ESC       GROUP11   1                 DDFPROD       _____
                                                          _
```

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z/OS Classification Rules with Multiple Workloads

- Possible for multiple workloads to have applications that access z/OS but have different performance requirements on z/OS

- For example Banking and Manufacturing both access DB2 on z/OS, and transactions are coming from servers that are assigned to GROUP33

- Need to differentiate between GROUP33 for Banking and GROUP33 for Manufacturing

- In this case, add suffix to group names to allow for differentiation between workloads

  ▶ GROUP33-BANKING

  ▶ GROUP33-MANUFACTURING

Classification Rules

- Classification Rules with Suffixes

```
                Modify Rules for the Subsystem Type      Row 1 to 8 of 16
Command ===> _____   Scroll ===> CSR

Subsystem Type . : EWLM        Fold qualifier names?   N   (Y or N)
Description  . . . EWLM Rules for PPM

Action codes:    A=After      C=Copy       M=Move       I=Insert rule
                 B=Before     D=Delete row R=Repeat     IS=Insert Sub-rule
                                                                 More ===>
         --------Qualifier--------                   -------Class--------
Action    Type        Name      Start             Service      Report
                                         DEFAULTS: PPMDEFLT    _____

____    1  ESC        GROUP11   1                  DDFPROD     _____
____    1  ESC        GROUP33-  1                              _____
____       2  ESC        BANKING   9               DDFPROD     _____
____    1  ESC        GROUP33-  1                  _____   _____
____       2  ESC        MANUFACT  9               GRP33MAN _  _____
```

Summary

- ARM allows for the reporting of application transaction performance

- Platform Performance Management uses a workload policy to monitor and manage the performance of virtual servers

- Combination of the two allow for excellent reporting of response time and performance of applications running on zEnterprise

- z/OS Workload Manager can use performance policy classifications to classify incoming work in z/OS

  ▶ If no EWLM classification rules match, then will default to standard classification rules

Thank You