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<table>
<thead>
<tr>
<th>Trademark</th>
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<tbody>
<tr>
<td>AlphaBlox*</td>
<td>GDPS*</td>
<td>RACF*</td>
</tr>
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<td>APPN*</td>
<td>HiperSockets</td>
<td>Redbooks*</td>
</tr>
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<td>CICS*</td>
<td>HyperSwap</td>
<td>Resource Link</td>
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<td>RETAIN*</td>
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<td>REXX</td>
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<td>DB2*</td>
<td>IBM logo*</td>
<td>RMF</td>
</tr>
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<td>DFSMS</td>
<td>IMS</td>
<td>S/390*</td>
</tr>
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<td>DFSMSshsm</td>
<td>Language Environment*</td>
<td>Scalable Architecture for Financial Reporting</td>
</tr>
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<td>DFSMSrmr</td>
<td>Lotus*</td>
<td>Sysplex Timer*</td>
</tr>
<tr>
<td>DirMaint</td>
<td>Large System Performance Reference™ (LSPR™)</td>
<td>Systems Director Active Energy Manager</td>
</tr>
<tr>
<td>DRDA*</td>
<td>Multiprise*</td>
<td>System/370</td>
</tr>
<tr>
<td>DS6000</td>
<td>MV5</td>
<td>System p*</td>
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<tr>
<td>DS8000</td>
<td>OMEGAMON*</td>
<td>System Storage</td>
</tr>
<tr>
<td>ECKD</td>
<td>Parallel Sysplex*</td>
<td>System x*</td>
</tr>
<tr>
<td>ECON*</td>
<td>Performance Toolkit for VM</td>
<td>System z</td>
</tr>
<tr>
<td>FICON*</td>
<td>PowerPC*</td>
<td>System z9*</td>
</tr>
<tr>
<td>FlashCopy*</td>
<td>PR/SM</td>
<td>System z10</td>
</tr>
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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.
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

- 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

Web Server
- arm_register_application
- arm_start_transaction(...)
- process request
- arm_stop_transaction(...)
- arm_stop_application(...)

Application Server
- arm_register_application(...)
- arm_start_transaction(...)
- process request
- arm_stop_transaction(...)
- arm_stop_application(...)

ARM Services

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

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
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.

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

Workload

<table>
<thead>
<tr>
<th>Performance Policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLASSIFY</td>
</tr>
<tr>
<td>Virtual Server</td>
</tr>
<tr>
<td>within the Performance Policy</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>ASSIGN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Class to Virtual Servers</td>
</tr>
</tbody>
</table>

Banking

Importance 1

<table>
<thead>
<tr>
<th>Performance Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>WSCW101</td>
</tr>
<tr>
<td>WSCW102</td>
</tr>
<tr>
<td>WSCW103</td>
</tr>
<tr>
<td>.....</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>zBX Node</th>
<th>zBX Chassis</th>
<th>Blade Number</th>
<th>Function</th>
<th>Virtual Server</th>
</tr>
</thead>
<tbody>
<tr>
<td>Node1</td>
<td>B.1</td>
<td>1</td>
<td>HTTP</td>
<td>WSCW101</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>HTTP</td>
<td>WSCW102</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>HTTP</td>
<td>WSCW103</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>HTTP</td>
<td>WSCW104</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>WAS</td>
<td>ATAIX100</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>WAS</td>
<td>ATTAIX10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>WAS</td>
<td>ATPAIX20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>WAS</td>
<td>ATAIX200</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>WAS</td>
<td>ARPTX100</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>WAS</td>
<td>ATMIX304</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>zBX Node</th>
<th>zBX Chassis</th>
<th>Blade Number</th>
<th>Virtual Server</th>
<th>Service Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Node1</td>
<td>B.1</td>
<td>1</td>
<td>WSCW101</td>
<td>GROUP11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>WSCW102</td>
<td>GROUP11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>WSCW103</td>
<td>GROUP11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>WSCW104</td>
<td>GROUP11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>ATAIIX100</td>
<td>GROUP11</td>
</tr>
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<td></td>
<td></td>
<td>ATAIIX10</td>
<td>GROUP55</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ATPAIX20</td>
<td>GROUP33</td>
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<td></td>
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<td>6</td>
<td>ATAIIX200</td>
<td>GROUP11</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>ARPTX100</td>
<td>GROUP33</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ATMIX304</td>
<td>GROUP55</td>
</tr>
</tbody>
</table>
Grouping Servers by Service Class

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

<table>
<thead>
<tr>
<th>Workload</th>
<th>Policy</th>
<th>Service Class</th>
<th>Virtual Server</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banking</td>
<td>Standard</td>
<td>Group11</td>
<td>WSCW101, WSCW102, WSCW103, WSCW104,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ATAIX100, ATAIX200</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Group33</td>
<td>ATPAIX20, ARPTX100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Group55</td>
<td>ATTAIX10, ATMIX304</td>
</tr>
</tbody>
</table>

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

Workloads

Performance Policies

CLASSIFY
Virtual Server within the Performance Policy

ASSIGN
Service Class to the Virtual Servers

Banking

Importance 1

Performance Policy

WSCW101
WSCW102
WSCW103

…..
Adding Additional Workloads

**Workloads**

- **Auto**
  - Importance 3

- **Claims**
  - Importance 2

- **Banking**
  - Importance 1

- **Manufacturing**
  - Importance 3

**Performance Policies**

**CLASSIFY**
Virtual Server within the Performance Policy

**ASSIGN**
Service Class to the Virtual Servers

<table>
<thead>
<tr>
<th>Workloads</th>
<th>Auto</th>
<th>Claims</th>
<th>Banking</th>
<th>Manufacturing</th>
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<td>2</td>
<td>1</td>
<td>3</td>
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</table>

<table>
<thead>
<tr>
<th>Performance Policy</th>
<th>Performance Policy</th>
<th>Performance Policy</th>
<th>Performance Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>VS20 VS24</td>
<td>VS1 VS2 VS3</td>
<td>WSCW101 WSCW102</td>
<td>ATS01 ATS34</td>
</tr>
<tr>
<td>VS25 VS26</td>
<td></td>
<td>WSCW103</td>
<td>ATSWEB</td>
</tr>
</tbody>
</table>
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 can 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 characters
    - Be sure FOLD Qualifier names is set to NO (makes naming case sensitive)
    - EWLM Service Class must be a single period response time goal

- PPM cannot make any changes to z/OS environment. 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**

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
<th>Type</th>
<th>Report</th>
<th>Service</th>
<th>Class</th>
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<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td>__ __</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 ASCH</td>
<td>APPC scheduled trans programs</td>
<td>__</td>
<td>__</td>
<td>__</td>
<td>__</td>
</tr>
<tr>
<td>__ CB</td>
<td>Component Broker requests</td>
<td>__</td>
<td>__</td>
<td>__</td>
<td>__</td>
</tr>
<tr>
<td>__ CICS</td>
<td>CICS transaction level rules</td>
<td>__</td>
<td>__</td>
<td>__</td>
<td>__</td>
</tr>
<tr>
<td>__ DB2</td>
<td>DB2 Parallel Query transactions</td>
<td>__</td>
<td>__</td>
<td>__</td>
<td>__</td>
</tr>
<tr>
<td>__ DDF</td>
<td>Distributed DDF Work</td>
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<td>__</td>
<td>__</td>
<td>__</td>
</tr>
<tr>
<td>3 __</td>
<td>EWLM Rules for PPM</td>
<td>__</td>
<td>__</td>
<td>__</td>
<td>__</td>
</tr>
<tr>
<td>__ IWF</td>
<td>IMS transaction level rules</td>
<td>__</td>
<td>__</td>
<td>__</td>
<td>__</td>
</tr>
<tr>
<td>__ IWEB</td>
<td>Scalable WebServer Transactions</td>
<td>__</td>
<td>__</td>
<td>__</td>
<td>__</td>
</tr>
<tr>
<td>__ JES</td>
<td>JES classification rules</td>
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<td>__</td>
<td>__</td>
<td>__</td>
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<tr>
<td>__ LSFM</td>
<td>Lan Server for MVS rules</td>
<td>__</td>
<td>__</td>
<td>__</td>
<td>__</td>
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<tr>
<td>__ MQ</td>
<td>MQ Series Workflow requests</td>
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<td>__</td>
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<td>__</td>
</tr>
<tr>
<td>__ OMVS</td>
<td>Unix System Services requests</td>
<td>__</td>
<td>__</td>
<td>__</td>
<td>__</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Action codes:</th>
<th>A=After</th>
<th>C=Copy</th>
<th>M=Move</th>
<th>I=Insert rule</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B=Before</td>
<td>D=Delete row</td>
<td>R=Repeat</td>
<td>IS=Insert Sub-rule</td>
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<th>Service</th>
<th>Report</th>
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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

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<tr>
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</table>

Modify Rules for the Subsystem Type

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 ==>
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