Performance Tuning for WebSphere Application Server for z/OS - Practical Advice

Speaker Name H. Michael Everett
Speaker Company IBM Corporation

Date of Presentation March 1, 2011
Session Number 8378
<table>
<thead>
<tr>
<th>Room</th>
<th>Day</th>
<th>Time</th>
<th>Title</th>
<th>Speaker</th>
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<tr>
<td>208B</td>
<td>Monday</td>
<td>11:00</td>
<td>Lab</td>
<td>Multi</td>
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<td>201A</td>
<td>Monday</td>
<td>11:00</td>
<td>The Value of the WebSphere Application Server Job Manager</td>
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<td>205A</td>
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<td>WebSphere Application Server for z/OS -- I am No Longer a Dummy but...</td>
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<td>205B</td>
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<td>9:30</td>
<td>Performance Tuning for WebSphere Application Server for z/OS - Practical Advice</td>
<td>Everett</td>
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<td>205A</td>
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<td>WebSphere Application Server for z/OS: Tools and Tricks (Potpourri)</td>
<td>Loos and Co.</td>
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<td>205A</td>
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<td>WebSphere Application Server for z/OS: Helping Customers Help Themselves</td>
<td>Stephen</td>
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<td>Securing WebSphere Application Server for z/OS</td>
<td>Kearney</td>
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<td>206B</td>
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<td>Application Improvement and Savings Through Simplification</td>
<td>McCorkle</td>
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<td>WebSphere Application Server for z/OS: Batch</td>
<td>Bagwell</td>
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<td>WebSphere Application Server 101</td>
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<td>WebSphere Application Server for z/OS: Availability Considerations</td>
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<td>WebSphere Application Server: z/OS Exploitation/Differentiation</td>
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<td>206B</td>
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<td>4:30</td>
<td>Performance Tuning for WebSphere Application Server for z/OS - WAS and WLM Interactions and Concepts</td>
<td>Follis</td>
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</table>
Agenda

- The purpose of z/OS WLM
- The elements of a WLM policy
  - Workload Manager Configuration Panels
- How WebSphere affects your WLM strategy
  - Classification XML Files
- Bringing these concepts together in the real world
  - RMF Reports
- References to specific monitoring, tuning, and workload topics
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The Purpose of z/OS WLM

What is "Workload Management" on z/OS?

It is controlled access to system resources coordinated by a function that keeps watch over all the elements of the system:

- z/OS Functions
- Middleware Functions
- Online Programs
- User Sessions
- Batch Programs

Access to the System Resources

Controls access based on defined goals

zWLM

Keeps track of what's being requested

CPU

Memory

I/O Units

Keeps track of how much is being used

There is a tight integration between the System z hardware, the z/OS operating system with WLM having an exclusive view of it all.
The Purpose of z/OS WLM

Work is automatically balanced within a system to complete high priority work according to stated business goals.

New WebSphere servers are started to accommodate spikes; they will be quiesced when no longer needed.

If a given system is overloaded it will be temporarily bypassed in favor of less busy systems.

If a system is unavailable it will not receive new work.

If a system fails other systems will take over the work and the system will be recovered.

If the Sysplex is running at capacity, resources will be adjusted to favor the more important workloads.

*The Sysplex is designed to run heterogeneous workloads ... it can run WebSphere and traditional OLTP/DB applications simultaneously, at 100% utilization.*
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The elements of the WLM Policy

From SDSF.LOG issue D WLM command, we can see many things

RESPONSE=S12 ↪ current system name
IWMO2SI 12.45.29 WLM DISPLAY 200

ACTIVE WORKLOAD MANAGEMENT SERVICE POLICY NAME: CBPTILE ↪ service policy
ACTIVATED: 2010/12/08 AT: 17:42:04 BY: OROSCO FROM: S11 ↪ when it was activated
DESCRIPTION: CB trans w/short percentile goal
RELATED SERVICE DEFINITION NAME: CBPTILE ↪ current service definition
WLM VERSION LEVEL: LEVEL025
WLM FUNCTIONALITY LEVEL: LEVEL011
WLM CDS FORMAT LEVEL: FORMAT 3
STRUCTURE SYSZWLM_WORKUNIT STATUS: CONNECTED
STRUCTURE SYSZWLM_7B352817 STATUS: CONNECTED
STATE OF GUEST PLATFORM MANAGEMENT PROVIDER (GPMP): INACTIVE
### The elements of the WLM Policy

**Service definition and Service policy**

- From D WLM output, notice the mention of a POLICY and SERVICE DEFINITION

<table>
<thead>
<tr>
<th>Service definition</th>
<th>A logical high level container for your WLM artifacts, only one can be active</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service policy</td>
<td>One or many logical containers in the service definition, only one can be active. Having many policies allows us to switch among them easily. WLM exploits system automation products to issue the commands necessary to switch among policies.</td>
</tr>
</tbody>
</table>

**Service Definition Sysplex wide**

**Service policy (1-n)**
The elements of the WLM Policy

• Two Questions
  • How do we define or change a Service Definition?
    • Use the WLM ISPF panels
  • How do we see our existing Service Definition in its entirety?
    • Print it to the ISPF log for your TSO userid

Step 1: ISPF Option 6 use the command IWMARIN0
Step 2: Press the ENTER key to get past the Copyright page
The elements of the WLM Policy

Step 1: ISPF Option 6 use the command IWMARIN0 (complete)
Step 2: Press the ENTER key to get past the Copyright page (complete)
Step 3: There may be a warning asking if you are above z/OS1.6 pick yes
Step 4: Choose where to get the WLM policy from

In general, it is safest to extract the definition from WLM so that work does not get overlaid.

How do we define or change a Service Definition? (continued)
The elements of the WLM Policy

Step 1: ISPF Option 6 use the command IWMARIN0 (complete)
Step 2: Press the ENTER key to get past the Copyright page (complete)
Step 3: There may be a warning asking if you are above z/OS1.6 pick yes (complete)
Step 4: Choose where to get the WLM policy from (complete)
Step 5: The WLM Panels
The elements of the WLM Policy
Items in the WLM Panels

- Now that we have seen how to get to the panels what are the items we can mess with?

| Service definition | A logical high level container for your WLM artifacts, only one can be active |
| Service policy     | One or many logical containers in the service definition, only one can be active. Having many policies allows us to switch among them easily. WLM exploits system automation products to issue the commands necessary to switch among policies. |
| Service class      | The definition of a goal for a particular type of work |
| Classification rule| A link between a particular address space and service or report classes |
| Workloads          | Groups of items you want WLM to report on as a single unit |
| Report classes     | Separate items that get reported for clarity |
| Coefficient        | Settings that determine how WLM performs resource adjustments for CPU, I/O, paging, dispatching, etc. |
The elements of the WLM Policy
Items in the WLM Panels

Service Definition

- **Service policy**
  - For a type of **workload** (TSO, STC, OMVS, CB, etc…)
  - Define a **service class** to define the goal for a type of workload
  - Tie an address space(s) to a service class with a **classification rule**

- **Address Space**
- **Server1**
The elements of the WLM Policy

Two Questions

- How do we define or change a Service Definition?
  - Use the WLM ISPF panels

- How do we see our existing Service Definition in its entirety?
  - Print it to the ISPF log for your TSO userid

NOTE: when you log off, make sure to keep your ISPF log
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How WebSphere affects your WLM Policy

- Multiple types of work or workloads run in a WebSphere Address Space

WebSphere Servant Address Space

Server1
STC workload
  During startup
  For JSP compiles
  A bit of SMF work

CB workload
  After the first web request happens
  Almost all work here

OMVS workload
  applyPTF.sh script
How WebSphere affects your WLM Policy

• Multiple definitions in the Service Policy for WebSphere Address Spaces

• CB
  • The CB workload is ‘java work’ and each piece is run under an enclave in WLM. We will define what goals (service class) and what reporting (report class) our address space will use.

• STC
  • The STC workload is ‘started task work’ and this is items like garbage collection, spooling output, and initial startup. We will also tell the STC workload what goals (service class) and what reporting (report class) our address space will use.

• OMVS
  • The OMVS workload is a special case of running shell scripts from within the address space, specifically during startup. If you default OMVS service class is not aggressive enough and WebSphere has to run applyPTF.sh, startup could take a while.

• In the FAKE REAL WORLD EXAMPLE at the end we will see this again.
How WebSphere affects your WLM Policy

• What if I want to get more granular, deeper than the address space, with my goals?

• Using the Classification XML File
  • InfoCenter, search on rrun_wlm_tclass_sample for a sample
How WebSphere affects your WLM Policy – classification XML file

Step 1: create your classification document

```xml
<InboundClassification type="iiop" schema_version="1.0" default_transaction_class="A0">
    <iiop_classification_info transaction_class="A1"
        application_name="IIOPStatelessSampleApp"
        module_name="StatelessSample.jar"
        component_name="Sample20"
        description="Sample20 EJB Classification">
    </iiop_classification_info>
    <iiop_classification_info transaction_class=""
        method_name="echo"
        description="No TCLASS for echo()" />
    <iiop_classification_info transaction_class="A1B"
        method_name="ping"
        description="Ping method" />
</InboundClassification>
```

Step 2: In the WebSphere Administrative Console specify the location of the file

Step 3: Create a classification rule using a TCLASS value

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<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualifier</td>
<td>Class</td>
<td>Action</td>
<td>Type</td>
<td>Name</td>
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<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
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<tr>
<td>DEFAULTS:</td>
<td>CBCLASS RWASDEF</td>
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<td></td>
<td></td>
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<tr>
<td>1</td>
<td>CN</td>
<td>P5SR01*</td>
<td>1</td>
<td>CBCLASS</td>
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<tr>
<td>1</td>
<td>TC</td>
<td>A0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>TC</td>
<td>A1</td>
<td></td>
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<tr>
<td>1</td>
<td>TC</td>
<td>A1B</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
How WebSphere affects your WLM Policy – classification XML file

How it Works

The file supplies a set of criteria to match requests to transaction class names, which then match with rules in the CB subsystem type

Environment
- Virtual hosts
- Update global Web server plug-in configuration
- WebSphere variables
- Shared libraries
- Replication domains
- URI Groups

Scope to cell or node
server scope for classification deprecated

General Properties
+ Name
  wlm_classification_file
+ Value
  /etc/myclass/classify.xml

From that we get goals and importance based on specific transactions based on criteria in the classification XML file
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A Fake Real World Example

- Imagine a fictional bank, MoneyHouse.

- This bank buys another bank, LenderStreet, and wants all new applications to use a common code base but be physically segregated on z/OS WebSphere servers. This is a typical real-world scenario.

- All requests for MoneyHouse only touch MoneyHouse resources and all requests for LenderStreet only touch LenderStreet resources on the same Sysplex.
A Fake Real World Example

- **Other items to segregate**

- There are hundreds of items that may need to be segregated in this scenario. It all depends on the business rules of the parent company. Some examples follow.
  - **TSO:** You may set up TSO user IDs or branch numbers, so that the users IDs correspond to a specific branch.
  - **JES:** You must have unique batch classes or account numbers by branch.
  - **CICS:** You may have unique CICS regions for each branch.
  - **IMS:** You must have a separate IMS/VS resource lock manager (IRLM), IMS control region, and IMS message processing region (MPR) for each workload.
**A Fake Real World Example**

- **CB Service classes**

  We mentioned earlier that you could define some rules in your service class rather than using a single default rule for all work. Below is an example of one way that such rules could be defined.

```
<table>
<thead>
<tr>
<th>Action</th>
<th>Type</th>
<th>Name</th>
<th>Start</th>
<th>Service</th>
<th>Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>-------</td>
<td>------</td>
<td>--------</td>
<td>-------</td>
<td>---------</td>
<td>--------</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>CN</td>
<td>W*</td>
<td></td>
<td>WASCLASS WASCB</td>
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<tr>
<td></td>
<td>1</td>
<td>TN</td>
<td>MHAS1</td>
<td></td>
<td>FAST    MHR1</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>TN</td>
<td>MHAS2</td>
<td></td>
<td>FAST    MHR2</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>TN</td>
<td>MHAS3</td>
<td></td>
<td>FAST    MHR3</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>TN</td>
<td>LSAS1</td>
<td></td>
<td>FASTER  LSR1</td>
</tr>
<tr>
<td></td>
<td>1</td>
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<td>LSAS2</td>
<td></td>
<td>FASTER  LSR2</td>
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<tr>
<td></td>
<td>1</td>
<td>TN</td>
<td>LSAS3</td>
<td></td>
<td>FASTER  LSR3</td>
</tr>
</tbody>
</table>

------------------------ BOTTOM OF DATA ------------------------
```
A Fake Real World Example

• **STC Service classes**
  - In this example there is a single service class, CBSTC, for the started tasks, with a velocity goal of 90.
  - For the STC subsystem, there are two rules. All job names starting with MH* and LS* will run under the CBSTC service class with a reporting class of MHSTC and LSSTC, respectively.

<table>
<thead>
<tr>
<th>Action</th>
<th>Type</th>
<th>Name</th>
<th>Start</th>
<th>Service</th>
<th>Report</th>
</tr>
</thead>
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<td>RSTC</td>
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<td></td>
<td>TN</td>
<td>MH*</td>
<td></td>
<td>CBSTC</td>
<td>MHSTC</td>
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<tr>
<td></td>
<td>TN</td>
<td>LS*</td>
<td></td>
<td>CBSTC</td>
<td>LSSTC</td>
</tr>
</tbody>
</table>

************ BOTTOM OF DATA ************
RMF Reports

- The WLM policy has 2 different major responsibilities:
  - the most important being classifying workload goals
  - the second being granularity of reporting when gathering SMF 70-79 records.

- With SMF 70 through 79 records you can quickly see:
  - CPU usage
  - transactions per second
  - system paging
  - whether WLM is meeting its goals for WebSphere enclave work.
RMF Report example of 1 interval

1 END/S  Transaction Rate – number of transactions per second
2 APPL% CP  CPU Percentage – currently using less than 1 CPU at 94%
3 PAGE-IN RATES  Paging – there is no paging in this example
RMF Report example of 1 interval

4 EXECUTION DELAYS %

CPU – we are delayed and want more CPU 15.6% of the time
maybe the current WLM policy is not aggressive enough
QMPL – there is some work sitting on the WLM queues
I/O – small amount of I/O
UNKN – delays caused by products outside of the 70:79 records

5 GOAL – 95% of the work in 0.5 seconds is pretty aggressive, WLM will not
kill the system trying to meet an unrealistic goal
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References

• WebSphere Application Server and z/OS Workload Manager
  http://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101740

• An Explanation of the Workload Management Policy with respect to
  WebSphere on z/OS
  http://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101754

• Diagnosing Performance Problems with WebSphere Application Server on
  z/OS
  http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP100678

• IBM manual: z/OS MVS Planning: Workload Management SA22-7602
  http://publibz.boulder.ibm.com/epubs/pdf/iea2w1a0.pdf

• Redbook: OS/390 Workload Manager Impl and Exploitation SG24-5326
  http://publib-b.boulder.ibm.com/cgi-bin/searchsite.cgi?query=SG24-5326
References

- The following is a list of documents from the TechDocs Library at the following URL
  http://www-03.ibm.com/support/techdocs/atsmastr.nsf/Web/Techdocs
- WebSphere Application Server and z/OS Workload Manager
  http://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101740
- Performance Engineering & Tuning for WebSphere on z/OS
  http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/PRS2494
- Workload Manager Configuration & Advanced Topics for WebSphere Application Server z/OS
  http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/PRS3317
- WLM Configuration & Advanced Topics for WebSphere Application Server z/OS - Session 1458
  http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/TC000013
- Understanding the HFS and EXCP Counts in RMF and SDSF
  http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/TD102069
- Classify the Application Control Region in WLM OMVS rules
  http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/TD102730
- Managing CPU-Intensive Work on Uniprocessor LPARs
  http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP100925
- WebSphere z/OS - The Value of Co-Location
  http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101476
- **WSC REVIEWS THE RMF CPU ACTIVITY REPORT**
  http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/TC000014
Thank You

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