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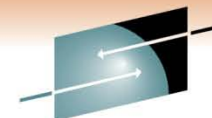
Performance Tuning for WebSphere Application Server for z/OS - Practical Advice

Speaker Name H. Michael Everett
Speaker Company IBM Corporation

Date of Presentation March 1, 2011
Session Number 8378



WebSphere Application Server Sessions



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Room	Day	Time	Title	Speaker
208B	Monday	11:00	Lab	Multi
201A	Monday	11:00	The Value of the WebSphere Application Server Job Manager	Loos
205A	Monday	4:30	WebSphere Application Server for z/OS -- I am No Longer a Dummy but...	Loos
205B	Tuesday	9:30	Performance Tuning for WebSphere Application Server for z/OS - Practical Advice	Everett
205A	Wednesday	4:30	WebSphere Application Server for z/OS: Tools and Tricks (Potpourri)	Loos and Co.
205A	Wednesday	6:00	WebSphere Application Server for z/OS: Helping Customers Help Themselves	Stephen
206B	Thursday	8:00	Securing WebSphere Application Server for z/OS	Kearney
206B	Thursday	9:30	Application Improvement and Savings Through Simplification	McCorkle
206B	Thursday	11:00	WebSphere Application Server for z/OS: Batch	Bagwell
206A	Thursday	12:15	WebSphere Application Server 101	Stephen
206B	Thursday	1:30	WebSphere Application Server for z/OS: Availability Considerations	Bagwell
206B	Thursday	3:00	WebSphere Application Server: z/OS Exploitation/Differentiation	Follis
206B	Thursday	4:30	Performance Tuning for WebSphere Application Server for z/OS - WAS and WLM Interactions and Concepts	Follis

Agenda



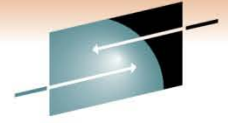
- The purpose of z/OS WLM
- The elements of a WLM policy
 - Workload Manager Configuration Panels
- How WebSphere affects your WLM strategy
 - Classification XML Files
- Bringing these concepts together in the real world
 - RMF Reports
- References to specific monitoring, tuning, and workload topics

Agenda



- **The purpose of z/OS WLM**
- The elements of a WLM policy
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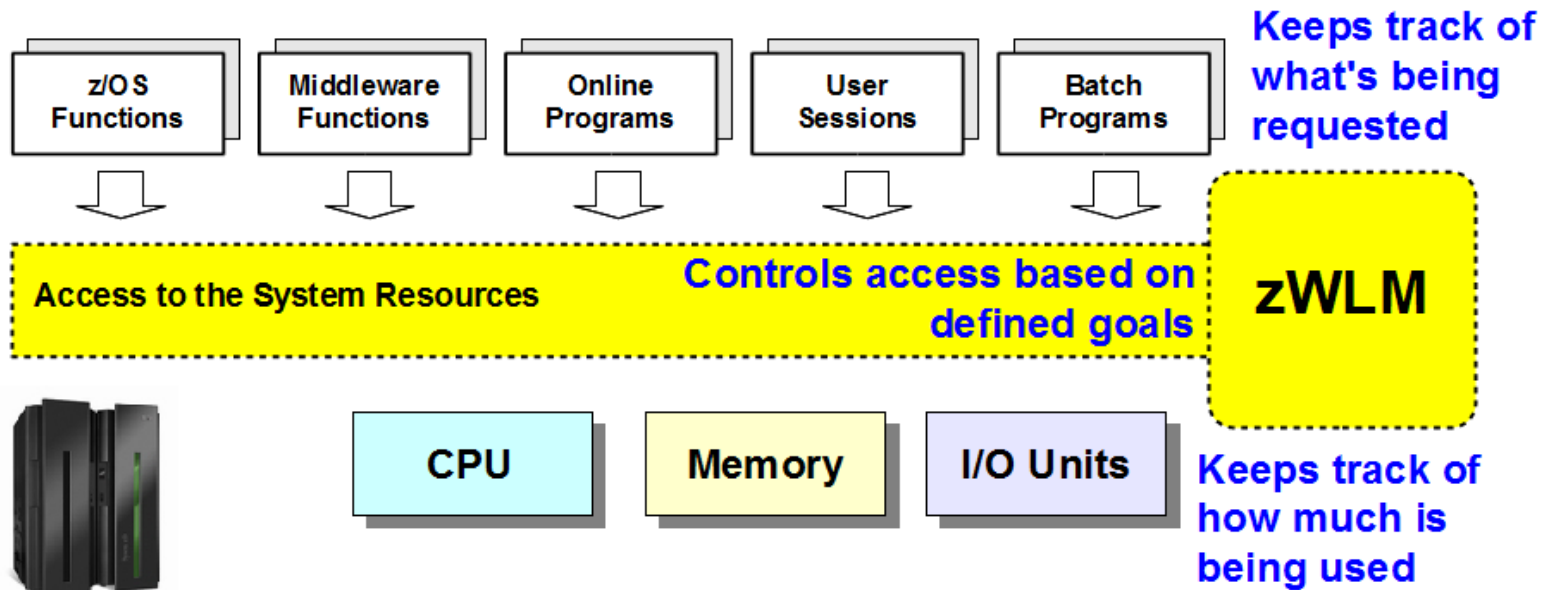
The Purpose of z/OS WLM



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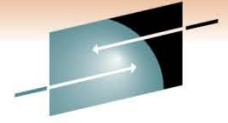
What is "Workload Management" on z/OS?

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



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



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

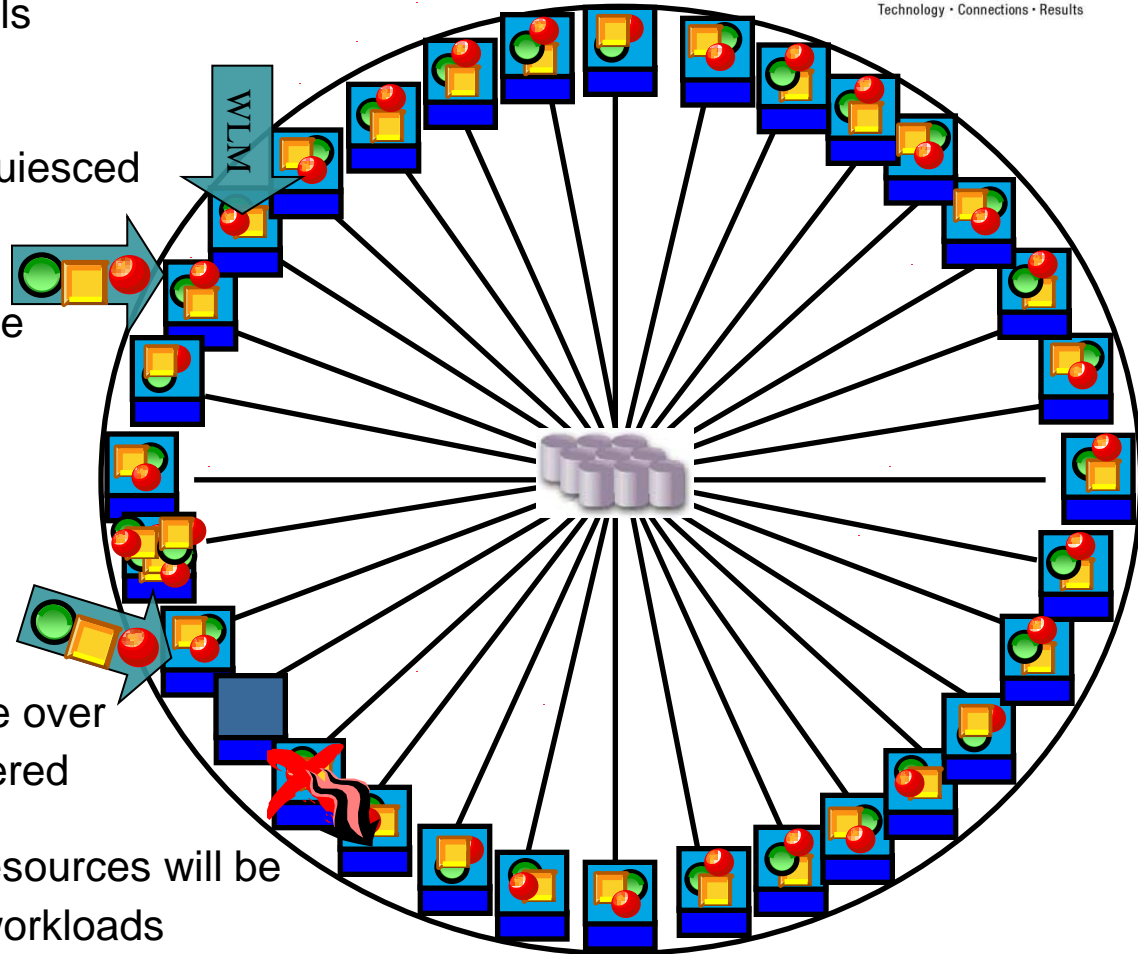
New WebSphere servers are started to accommodate spikes; they will be quiesced when no longer needed

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.

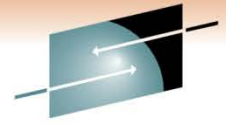
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Agenda



- The purpose of z/OS WLM
- **The elements of a WLM policy**
 - **Workload Manager Configuration Panels**
- How WebSphere affects your WLM strategy
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The elements of the WLM Policy



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

RESPONSE=S12 ← **current system name**

IWM025I 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**

INSTALLED: 2010/12/08 AT: 17:41:39 BY: OROSCO FROM: S11 ← **implies sysplex wide**

WLM VERSION LEVEL: LEVEL025

WLM FUNCTIONALITY LEVEL: LEVEL011

WLM CDS FORMAT LEVEL: FORMAT 3

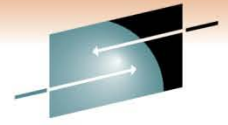
STRUCTURE SYSZWLM_WORKUNIT STATUS: CONNECTED

STRUCTURE SYSZWLM_7B352817 STATUS: CONNECTED

STATE OF GUEST PLATFORM MANAGEMENT PROVIDER (GPMP): INACTIVE

The elements of the WLM Policy

Service definition and Service policy

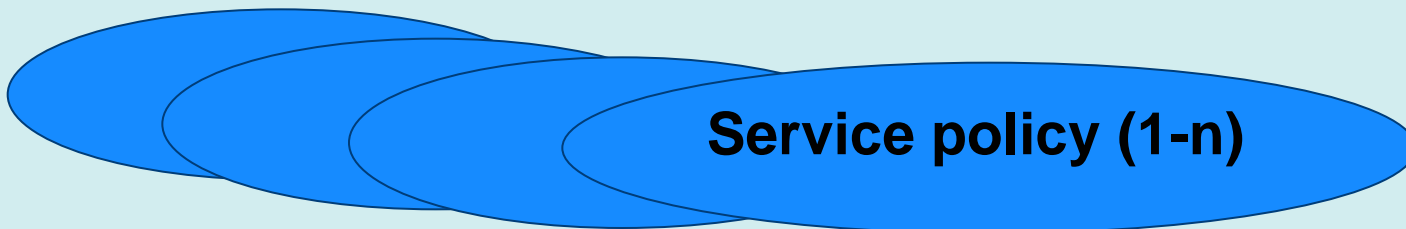


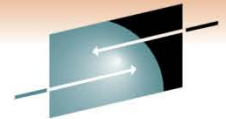
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- From D WLM output, notice the mention of a POLICY and SERVICE DEFINITION

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 Definition Sysplex wide





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

```
Menu List Mode Functions Utilities Help
                                ISPF Command Shell
Enter TSO or Workstation commands below:

===> iwmarin0

Place cursor on choice and press enter to Retrieve

=> SETROPTS RACLIST(SERVER) GENERIC(SERVER) REFRE
=> PERMIT CB.WRCSR11.BBOC001.WRCELL CLASS(SERVER)
```

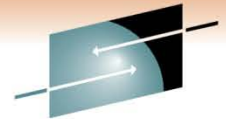
```
W W L M M
W W L MM MM
W W W L M M M
WW WW L M M
W W LLLLL M M

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All rights reserved.

ENTER to continue
```

The elements of the WLM Policy



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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

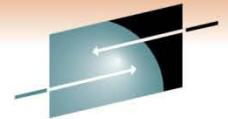
```
Choose Service Definition

Select one of the following options.
— 1. Read saved definition
    2. Extract definition from WLM
      couple data set
    3. Create new definition
```

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



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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

```
File Utilities Notes Options Help
-----
Functionality LEVEL011          Definition Menu          WLM Appl LEVEL025
Command ==> _____

Definition data set . . . : none

Definition name . . . . . CBPTILE (Required)
Description . . . . . Perf Definition for CB

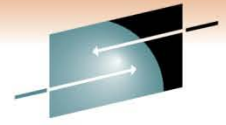
Select one of the
following options. . . . . 1
1. Policies
2. Workloads
3. Resource Groups
4. Service Classes
5. Classification Groups
6. Classification Rules
7. Report Classes
8. Service Coefficients/Options
9. Application Environments

Service definition was extracted. (IWMAM036) Provider
```



The elements of the WLM Policy

Items in the WLM Panels



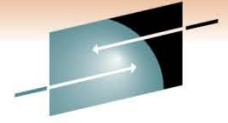
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- Now that we have seen how to get to the panels what are the items we can mess with?

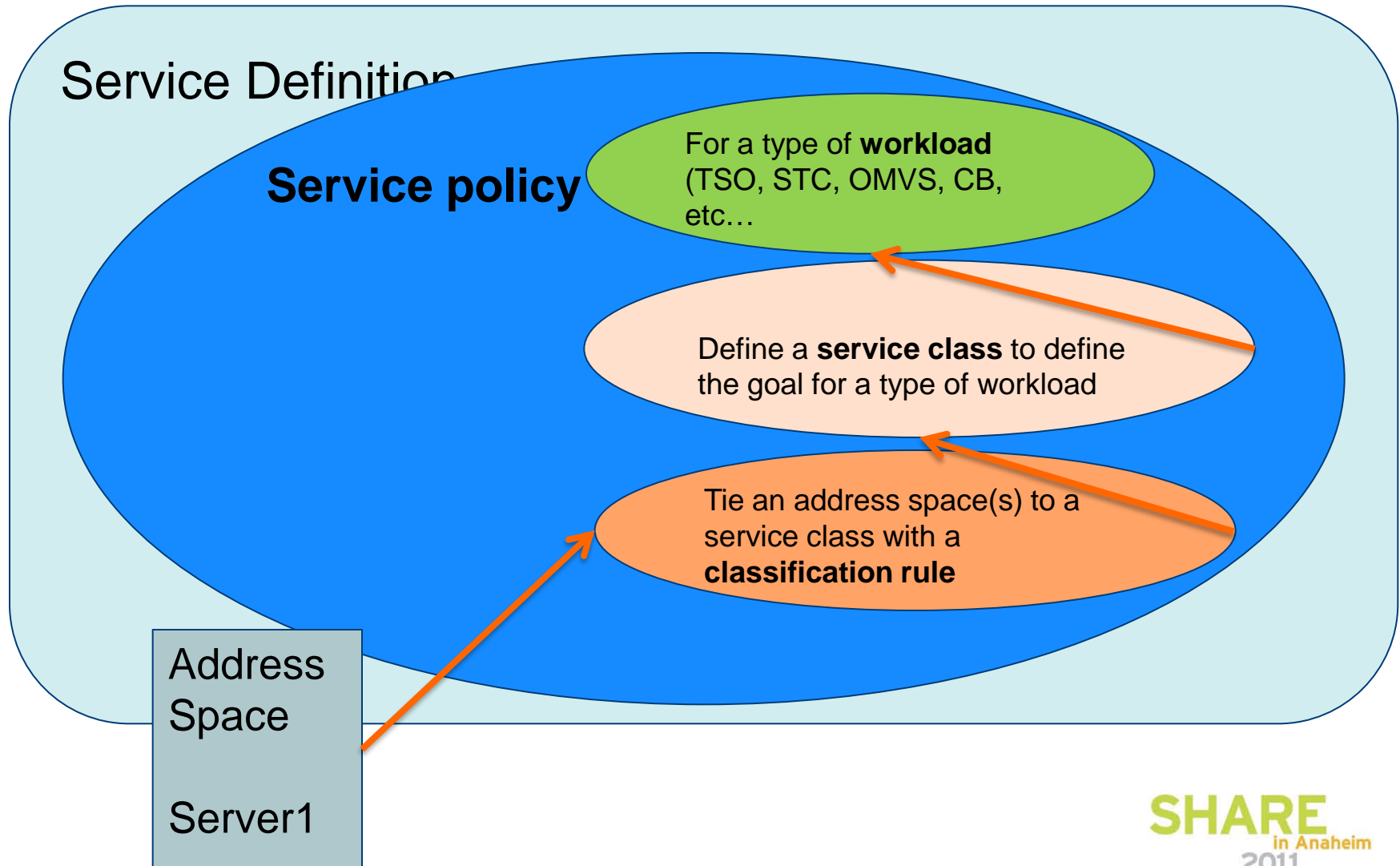
Service definition	A logical high level container for your WLM artifacts, only one can be active
Service policy	One or many logical containers in the service definition, only one can be active. Having many policies allows us to switch among them easily. WLM exploits system automation products to issue 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.

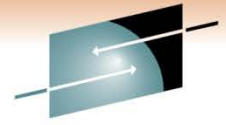
The elements of the WLM Policy

Items in the WLM Panels



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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

```
File Utilities Notes Options Help
-----
- 1. New
  2. Open
  3. Save
  4. Save as
  5. Print
  6. Print as GML
  7. Cancel
  8. Exit

Definition Menu
-----
. : none
. . CBPTILE (Required)
. . Perf Definition for CB

following options. . . . . 1. Policies
                           2. Workloads
```

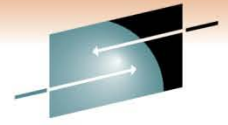
NOTE: when you log off, make sure to keep your ISPF log

Agenda



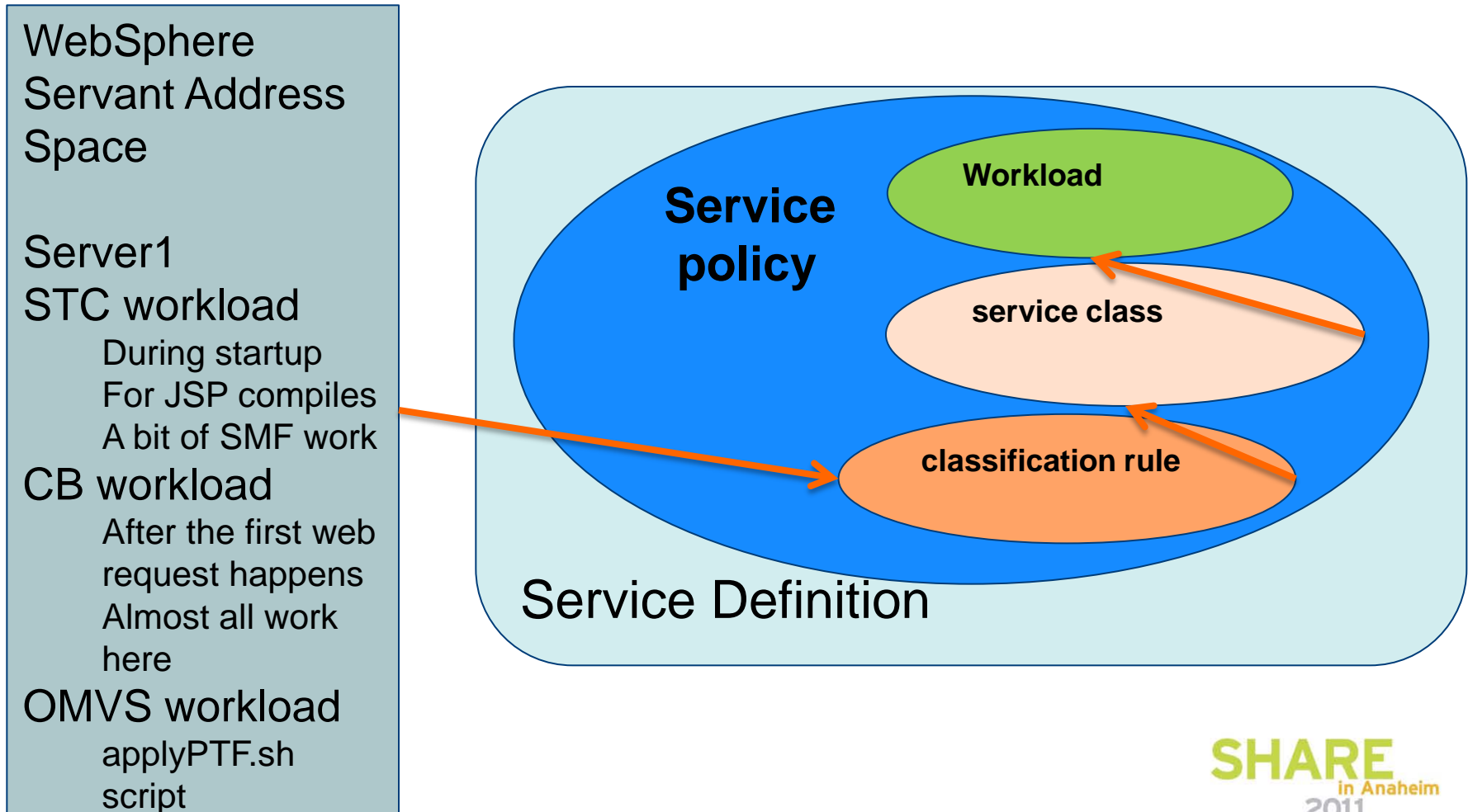
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How WebSphere affects your WLM Policy



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



How WebSphere affects your WLM Policy



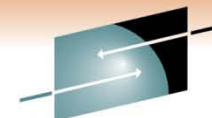
- Multiple definitions in the Service Policy for WebSphere Address Spaces
- CB
 - The CB workload is 'java work' and each piece is run under an enclave in WLM. We will define what goals (service class) and what reporting (report class) our address space will use.
- STC
 - The STC workload is 'started 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



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Step 1: create your classification document

```
<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 transaction_class=""
    method_name="echo"
    description="No TCLASS for echo()" />
  <iiop_classification_info transaction_class="A1B"
    method_name="ping"
    description="Ping method" /> .....
```

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

Step 3: Create a classification rule using a TCLASS value

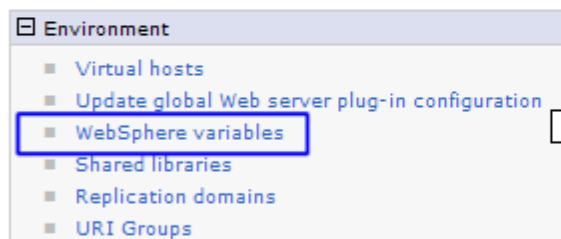
Qualifier	Class	Action	Type	Name	Start	Service	Report
_____ 1	CN	P5SR01*	1	DEFAULTS:		CBCLASS	RWASDEF
_____ 1	TC	A0	_____			CBCLASS	RTP5CLUS
_____ 1	TC	A1	_____			CBHUTCH	RP5A0
_____ 1	TC	A1B	_____			CBHUTCH	RP5A1
_____ 1	TC					CBHUTCH	RP5A1B

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



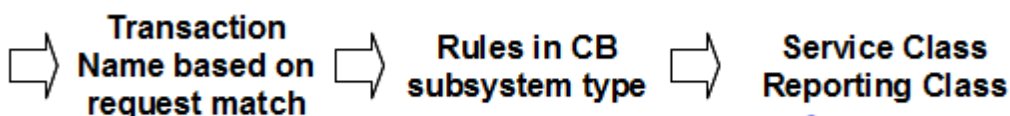
Scope to cell or node
server scope for classification deprecated

General Properties

* Name
wlm_classification_file

Value
/etc/myclass/classify.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE Classification SYSTEM "Classification.dtd" >
<Classification schema_version="1.0">
:
  <InboundClassification type="iiop" ... >
    (classification information)
  </InboundClassification>
  <InboundClassification type="http" ... >
    (classification information)
  </InboundClassification>
  <InboundClassification type="sip" ... >
    (classification information)
  </InboundClassification>
  <InboundClassification type="mdb" ... >
    (classification information)
  </InboundClassification>
  <InboundClassification type="sib" ... >
    (classification information)
  </InboundClassification>
:
</Classification>
```



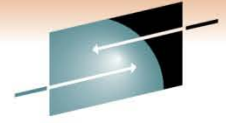
From that we get goals and importance based on specific transactions based on criteria in the classification XML file

Agenda



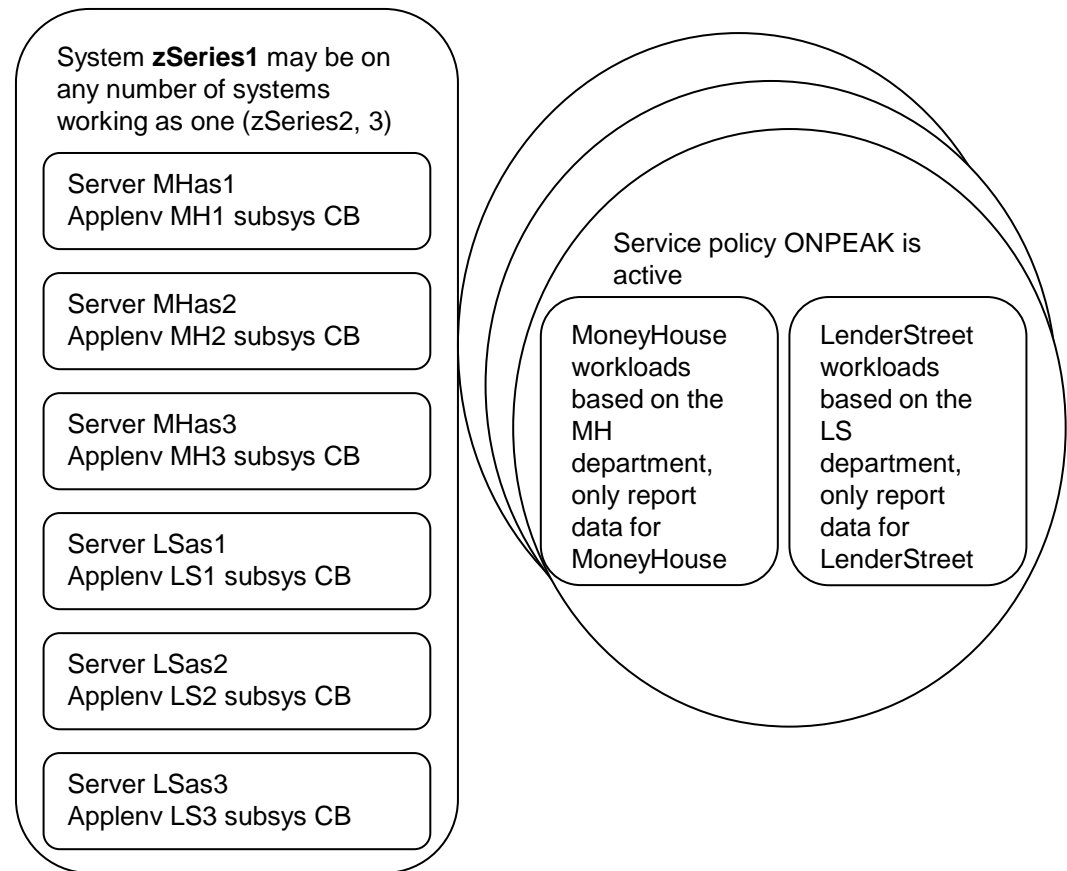
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A Fake Real World Example



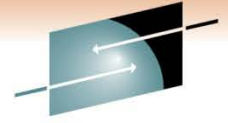
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- Imagine a fictional bank, MoneyHouse.
- This bank buys another bank, LenderStreet, and wants all new applications to use a common code base but be physically segregated on z/OS WebSphere servers. This is a typical real-world scenario.
- All requests for MoneyHouse only touch MoneyHouse resources and all requests for LenderStreet only touch LenderStreet resources on the same Sysplex.



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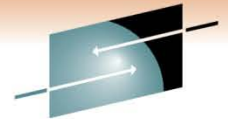
A Fake Real World Example



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- **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.

```

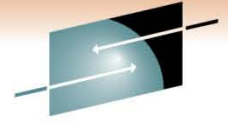
Subsystem-Type Xref Notes Options Help
-----
          Modify Rules for the Subsystem Type          Row 1 to 7 of 7
Command ==> _____ Scroll ==> PAGE

Subsystem Type . : CB          Fold qualifier names? Y (Y or N)
Description . . . MONEYHOUSE & LENDERSTREET ADDED

Action codes:  A=After      C=Copy      M=Move      I=Insert rule
                B=Before    D=Delete row R=Repeat  IS=Insert Sub-rule
                                           More ==>

-----Qualifier-----
Action  Type      Name      Start      Service      Report
-----
                DEFAULTS: WASCLASS
-----
1  CN      W*          _____  WASCLASS    WASCB
1  TN      MHAS1      _____  FAST        MHR1
1  TN      MHAS2      _____  FAST        MHR2
1  TN      MHAS3      _____  FAST        MHR3
1  TN      LSAS1      _____  FASTER      LSR1
1  TN      LSAS2      _____  FASTER      LSR2
1  TN      LSAS3      _____  FASTER      LSR3
***** 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.

Action	Type	Qualifier	Name	Start	Service	Report
					STCLO	RSTC
					SYSSTC	BBOCTL
1	TN		BBOACR*	---	SYSSTC	BBOSRV
1	TN		BBOASR*	---	SYSSTC	WASRGN
1	TN		BBO*	---	SYSSTC	WASRGN
1	TN		W*	---	CBSTC	MHSTC
1	TN		MH*	---	CBSTC	LSSTC
1	TN		LS*	---		

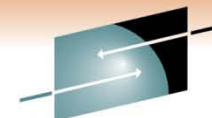
***** BOTTOM OF DATA *****

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



WORKLOAD ACTIVITY

PAGE 15
 z/OS V1R6 SYSPLEX SYSP1 DATE 05/04/2005 INTERVAL 01.00.080 MODE = GOAL
 RPT VERSION V1R5 RMF TIME 15.49.00

POLICY ACTIVATION DATE/TIME 05/04/2005 15.40.55

REPORT BY: POLICY=WLM REPORT CLASS=WASSTC PERIOD=1

HOMOGENEOUS: GOAL DERIVED FROM SERVICE CLASS CBGOAL

TRANS	TIME	H.MM.SS.TTT	-DASD I/O-	-SERVICE-	-SERV TIMES-	PAGE-IN RATES	STORAGE-							
AVG	1.92	ACTUAL	1.018	SSCHRT	209.5	IOC	0	TCB	56.5	SINGLE	0.0	AVG	0.00	
MPL	1.92	EXECUTION	1.017	RESP	1.4	CPU	7553K	SRB	0.0	BLOCK	0.0	TOTAL	0.00	
ENDED	111	QUEUED	1	CONN	1.1	MSO	0	RCT	0.0	SHARED	0.0	CENTRAL	0.00	
END/S	1.85	R/S	AFFINITY	0	DISC	0.0	SRB	0	IIT	0.0	HSP	0.0	EXPAND	0.00
#SWAPS	0	INELIGIBLE	0	Q+PEND	0.3	TOT	7553K	HST	0.0	HSP MISS	0.0			
EXCTD	0	CONVERSION	0	IOSQ	0.0	/SEC	125722	IFA	N/A	EXP SNGL	0.0	SHARED	0.00	
AVG ENC	1.92	STD DEV	1.430					APPL% CP	94.0	EXP BLK	0.0			
REM ENC	0.00							ABSRPTN66K	APPL% IEACP	0.0	EXP SHR	0.0		
MS ENC	0.00							TRXSERV66K	APPL% IFA	N/A				

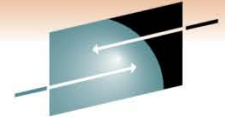
1

2

3

- 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



GOAL: RESPONSE TIME 000.00.00.500 FOR 95%

4

SYSTEM	RESP TIME EX	PERF	AVG	- USING% -			- EXECUTION DELAYS % -			---DLT%---		-CRYPTO%		--CNT%--		%	
	ACTUAL% VEL%	INDX	ADRSP	CPU	IFA	I/O	TOT	CPU	QMPL	I/O	UNKN	IDLE	USG	DLY	USG	DLY	QUIE
SYS1	69.4 71.2	1.1	1.9	45.5	N/A	0.0	19.2	15.6	2.8	0.8	35.3	0.0	0.0	0.0	0.0	0.0	0.0

-----RESPONSE TIME DISTRIBUTION-----

TIME	--NUMBER OF TRANSACTIONS--		-----PERCENT-----	
HH.MM.SS.TTT	CUM TOTAL	IN BUCKET	CUM TOTAL	IN BUCKET
< 00.00.00.500	18	18	16.2	16.2
<= 00.00.00.600	24	6	21.6	5.4
<= 00.00.00.700	34	10	30.6	9.0
<= 00.00.00.800	52	18	46.8	16.2
<= 00.00.00.900	67	15	60.4	13.5
<= 00.00.01.000	77	10	69.4	9.0

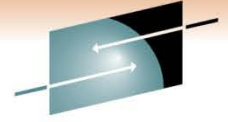
5

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 .5 seconds is pretty aggressive, WLM will not kill the system trying to meet an unrealistic goal

Agenda

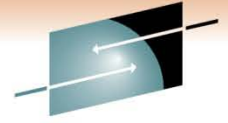


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- The purpose of z/OS WLM
- The elements of a WLM policy
 - Workload Manager Configuration Panels
- How WebSphere affects your WLM strategy
 - Classification XML Files
- Bringing these concepts together in the real world
 - RMF Reports
- **References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

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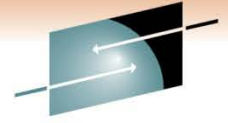
References



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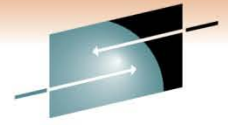
- WebSphere Application Server and z/OS Workload Manager
<http://www.ibm.com/support/techdocs/atmastr.nsf/WebIndex/WP101740>
- An Explanation of the Workload Management Policy with respect to WebSphere on z/OS
<http://www.ibm.com/support/techdocs/atmastr.nsf/WebIndex/WP101754>
- Diagnosing Performance Problems with WebSphere Application Server on z/OS
<http://www-03.ibm.com/support/techdocs/atmastr.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



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



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Thank You

H. Michael Everett
meveret@us.ibm.com

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