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zManager:
Platform Performance Manager

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IBM
March 14, 2012
10658

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Agenda:

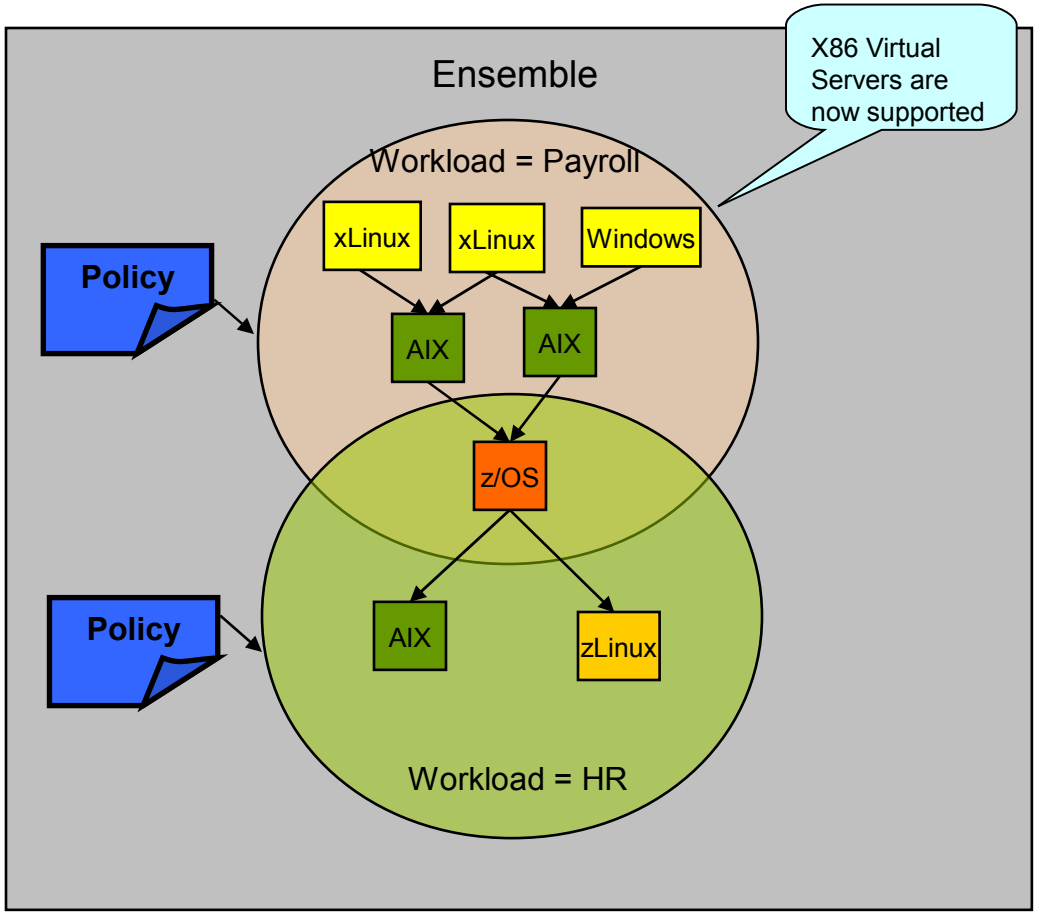
1	**Platform Performance Manager Overview**
2	**Workload Monitoring**
3	**PPM GPMP Support**
4	**WLM and PPM relationship**
5	**Dynamic Processor Management**
6	**SASP Load Balancing Support**

zEnterprise Platform Performance Manager

- Platform management component responsible for goal-oriented resource monitoring, management, and reporting across the zEnterprise Ensemble
- Common approach to monitoring / management of platform resources across zEnterprise
- Orchestration of autonomic management of resources across virtual servers
  - Provide Intelligent Resource Director like function across the zEnterprise
  - Pushes management directives to the SE, Hypervisors, and OS agents as required across the zEnterprise
- Load Balancing recommendation to SASP enabled switches/routers
- Functionality integrated into the Unified Resource Manager

Platform Workload

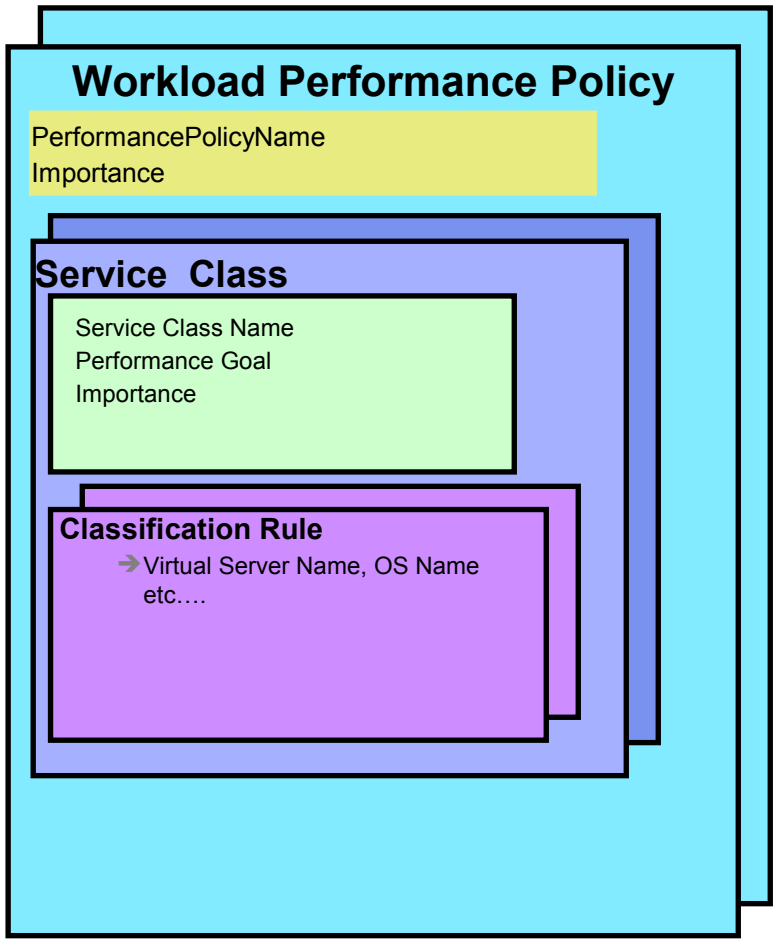
- **A Platform Workload is a grouping mechanism and "management view" of virtual servers supporting a business function**
- **Provides the context within which associated platform resources are presented, monitored, reported, and managed**
- **Management policies are associated to Platform Workload**
  - Performance Policy
- **Workload can be defined by an administrator**
  - Requires 'Automate' level enabled
  - Requires appropriate role



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:
  - A Workload can have multiple performance policies associated with it
  - Single policy is active at a given time
  - Can dynamically change the policy that is active
    - Through the UI
    - Through a timed based schedule
      - *Example: Day shift policy / night shift policy*

Workload Performance Policy…



- Policy structure:
  - Policy contains a set of service classes
  - Classification rules map each virtual server within the workload to a service class
  - A service class assigns a performance goal and importance
- HMC as console for policy creation and editing
  - Wizard for policy creation
  - Repository for policies under development and saved policies
  - Links to Workload based performance reporting

Workload Monitoring

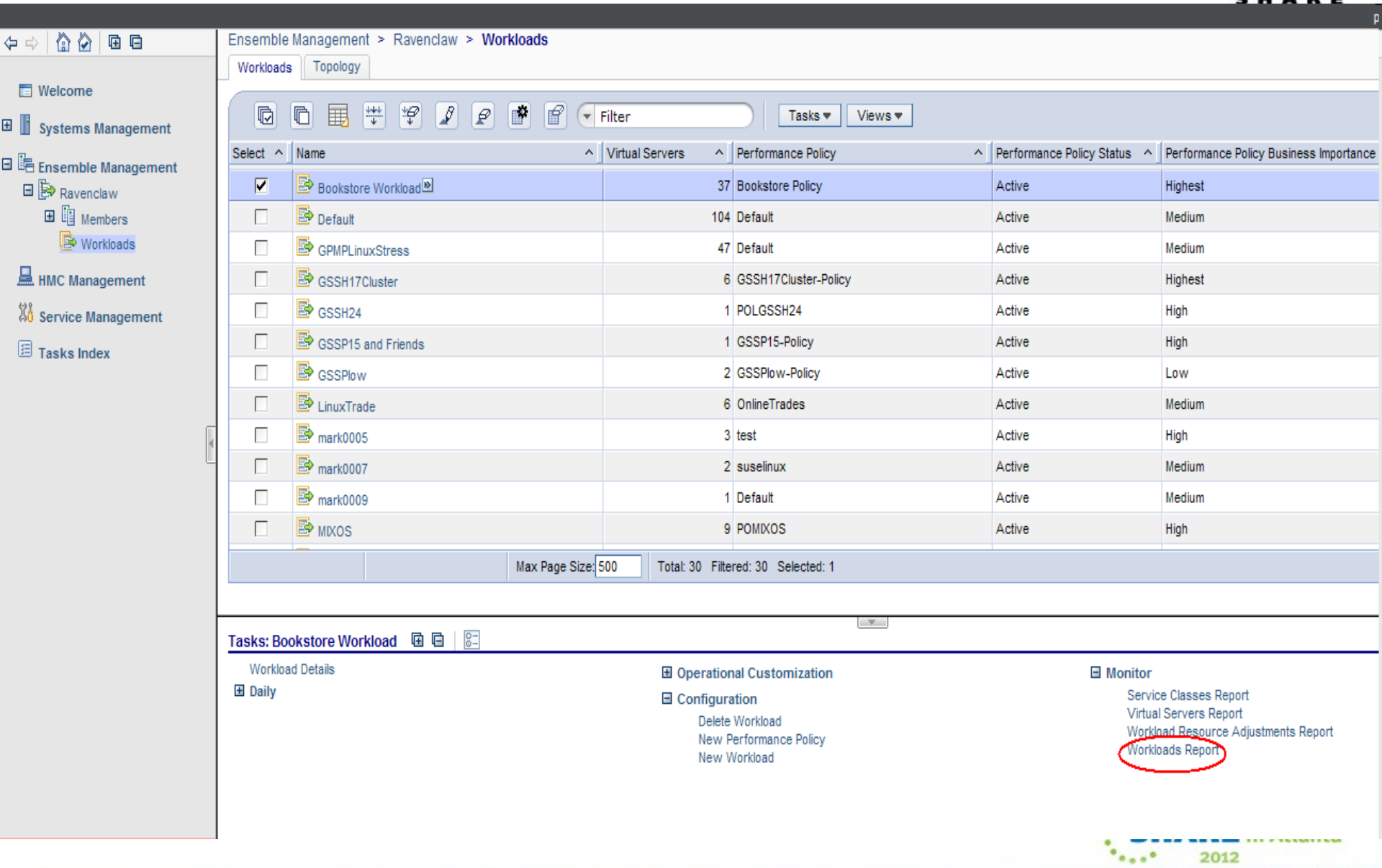
Workload Based Monitoring and Reporting

- Provide reporting capability that shows usage of platform resources in a Workload context within a zEnterprise Ensemble scope
  - Across virtual servers / partitions supporting the Workload
- Workload goal vs actual reporting
- Drill down from overall Workload “performance health” view to contributions of individual virtual server
- Graphical views
  - Topology, trending graphs, etc
- Links to Monitor Dashboard to show hardware utilization views
- Reporting is limited to platform level resources, not trying to replicate tools that report on intra-OS resources and performance
- Reporting data can be extracted by zManager APIs, for example
  - POST /api/ensembles/*{ensemble-id}*/performance-management /operations/generate-workload-resource-groups-report

Workload Based Monitoring and Reporting

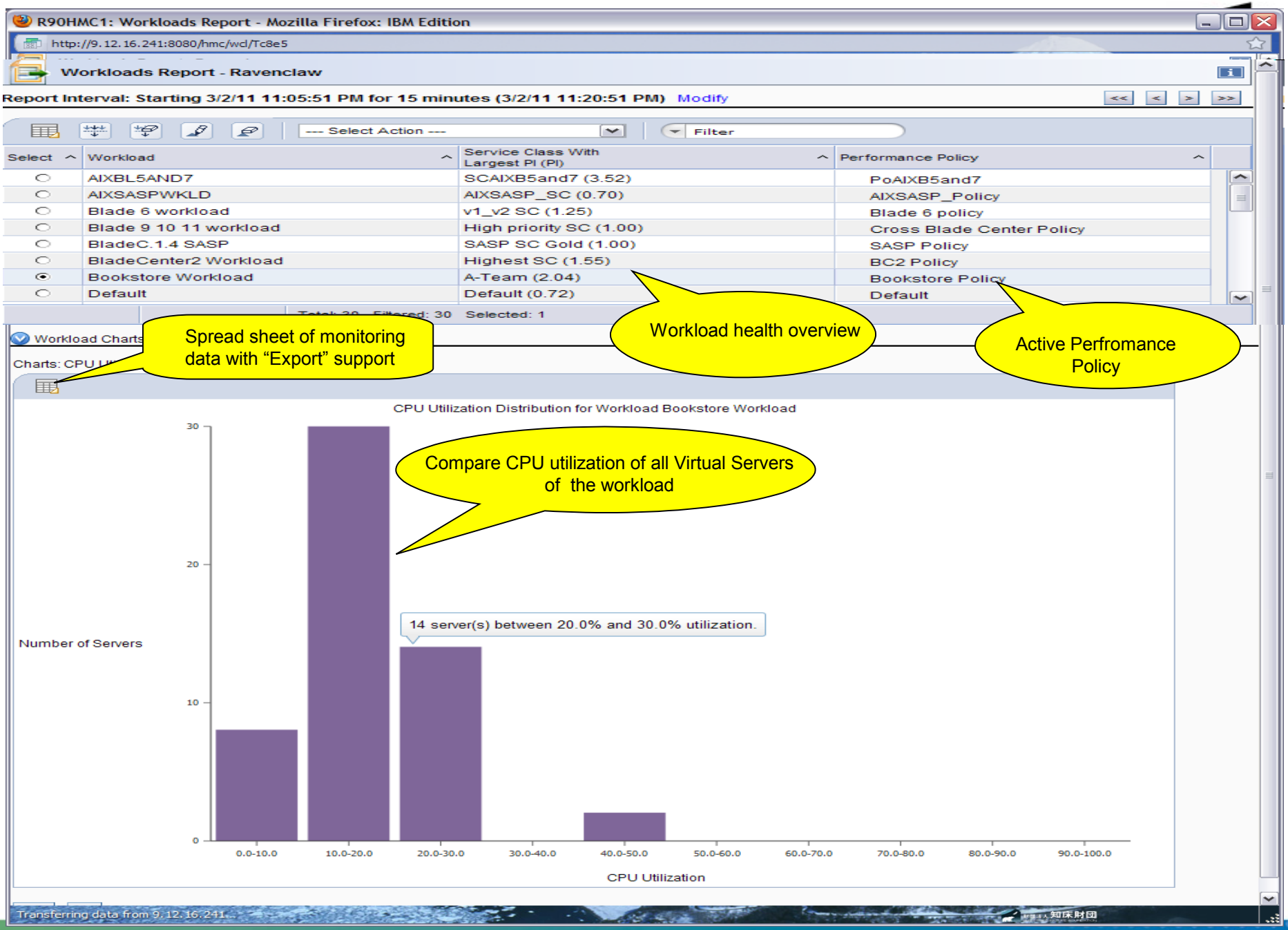
- Display of current data and fairly recent history
  - Up to 36 hours of history
  - Interval of data displayed is user selectable
  - Granularity of data kept in repository changes over time
    - 1 minute granularity kept for most recent hour
    - 15 minute interval data kept after first hour

Workload Monitoring Overview



Workload Report

- Workload Report
  - Display high level view of “performance health” of each Workload
  - Indication if a Workload contains service class missing goals
  - Worst performing service class / performance index
  - Details of specific Workloads
    - Graph of PI of worst performing service class
      - *Option to graph other service classes*
    - Bar graph of virtual server utilization distribution
      - *Visualize view of workload overall load*
  - Drill down to Workload’s service class report


R90HMC1: Workloads Report - Mozilla Firefox: IBM Edition
http://9.12.16.241:8080/hmc/wcl/Tc8e5
Workloads Report - Ravenclaw
Report Interval: Starting 3/2/11 11:05:51 PM for 15 minutes (3/2/11 11:20:51 PM) Modify
--- Select Action ---
Filter
Select
Workload
Service Class With Largest PI (PI)
Performance Policy
AIXBL5AND7
SCAIXB5and7 (3.52)
PoAIXB5and7
AIXSASPWKLD
AIXSASP_SC (0.70)
AIXSASP_Policy
Blade 6 workload
v1_v2 SC (1.25)
Blade 6 policy
Blade 9 10 11 workload
High priority SC (1.00)
Cross Blade Center Policy
BladeC.1.4 SASP
SASP SC Gold (1.00)
SASP Policy
BladeCenter2 Workload
Highest SC (1.55)
BC2 Policy
Bookstore Workload
A-Team (2.04)
Bookstore Policy
Default
Default (0.72)
Default
Selected: 1
Workload Charts
Charts: CPU Ut
Spread sheet of monitoring data with “Export” support
Workload health overview
Active Perfromance Policy
CPU Utilization Distribution for Workload Bookstore Workload
Compare CPU utilization of all Virtual Servers of the workload
14 server(s) between 20.0% and 30.0% utilization.
Number of Servers
30
20
10
0
0.0-10.0
10.0-20.0
20.0-30.0
30.0-40.0
40.0-50.0
50.0-60.0
60.0-70.0
70.0-80.0
80.0-90.0
90.0-100.0
CPU Utilization
Transferring data from 9.12.16.241...

Service Class Report

- Service Class Report
  - High-level view of each service class in Workload's performance policy
    - Goal and importance
    - Actual performance
    - Indication if monitoring event is established for service class and event is triggered
    - Service class details
      - *Graph of service class performance index*
    - Drill down to virtual server report for Workload

R90HMC1: Workloads Report - Mozilla Firefox: IBM Edition

http://9.12.16.241:8080/hmc/wcl/Te81f

Service Classes Report - Bookstore Workload

Interval can be adjusted

Report Interval: Starting 2/26/11 8:02:01 PM for 15 minutes (2/26/11 8:17:01 PM) Modify

--- Select Action --- Filter

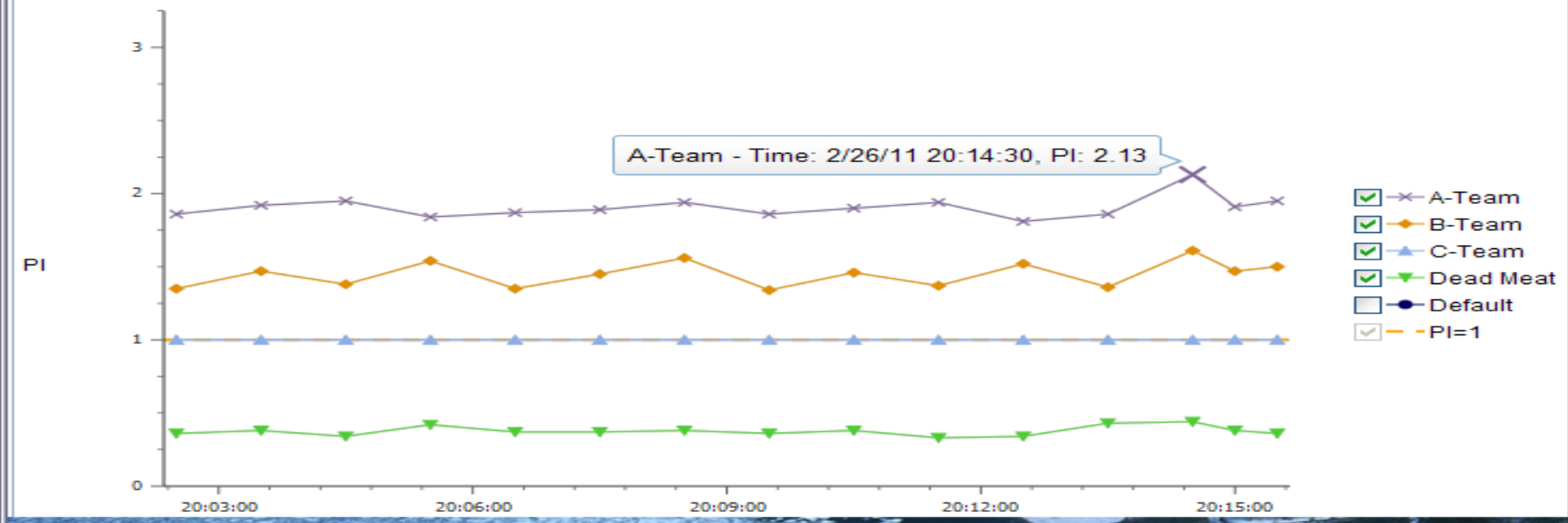
Select	Service Class	Performance Policy	Current Performance	PI	Goal	Business importance
◉	A-Team	Bookstore Policy	Moderate	1.90	Velocity - Fast	High
○	B-Team	Bookstore Policy	Slow	1.46	Velocity - Moderate	Medium
○	BuyNode	Bookstore Policy			Velocity - Fastest	Highest
○	C-Team	Bookstore Policy	Slow	1.00	Velocity - Slow	Low
○	Dead Meat	Bookstore Policy	Slow	0.37	Velocity - Slowest	Lowest
○	Default	Bookstore Policy	Fastest	0.40	Velocity - Moderate	Medium

Total: 6 Filtered: 6 Selected: 1

Service Class Charts

Spread sheet of monitoring data with “Export” support

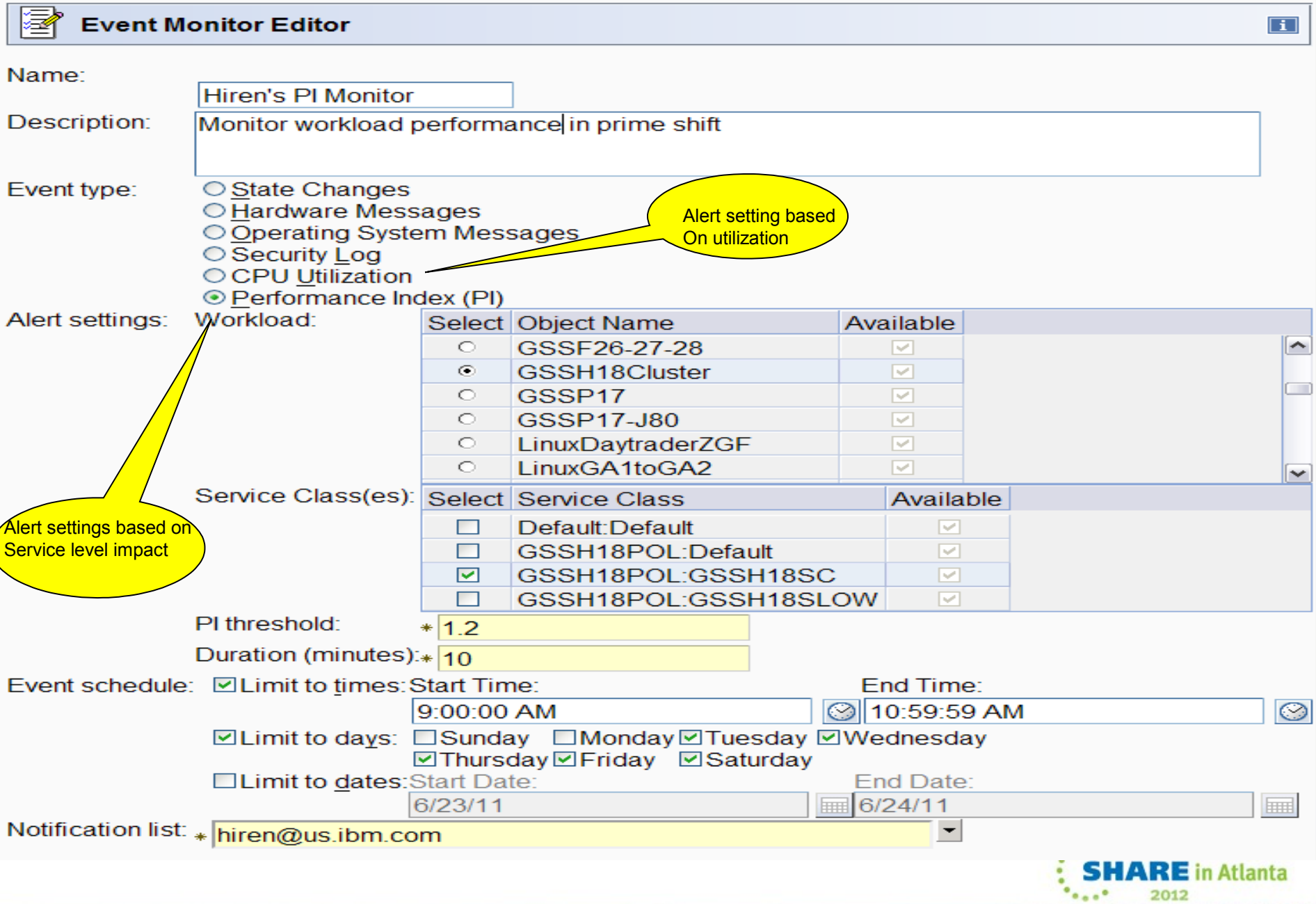
Service Class Performance Index (PI) for Workload Bookstore Workload

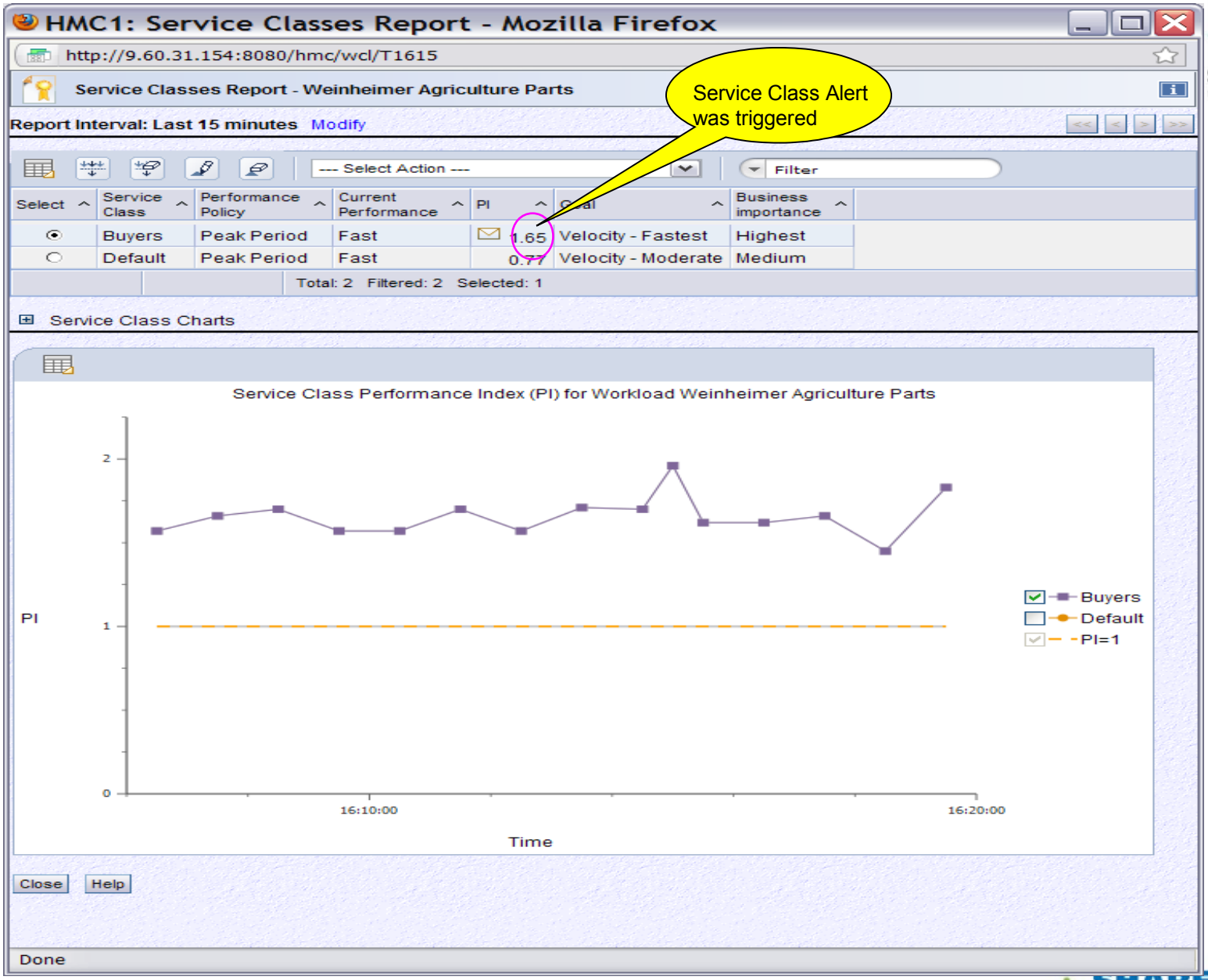


Read 9.12.16.241

Monitoring Events

- Monitoring Events (Alerts)
  - Leverage HMC event monitoring
  - Send e-mail when selected metrics reach threshold
    - Service Class PI threshold
    - Virtual Server CPU Utilization threshold


Event Monitor Editor
Name:
Hiren's PI Monitor
Description:
Monitor workload performance in prime shift
Event type:
State Changes
Hardware Messages
Operating System Messages
Security Log
CPU Utilization
Performance Index (PI)
Alert setting based On utilization
Alert settings:
Workload:
Select
Object Name
Available
GSSF26-27-28
GSSH18Cluster
GSSP17
GSSP17-J80
LinuxDaytraderZGF
LinuxGA1toGA2
Service Class(es):
Alert settings based on Service level impact
Select
Service Class
Available
Default:Default
GSSH18POL:Default
GSSH18POL:GSSH18SC
GSSH18POL:GSSH18SLOW
PI threshold:
1.2
Duration (minutes):
10
Event schedule:
Limit to times:
Start Time:
9:00:00 AM
End Time:
10:59:59 AM
Limit to days:
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Limit to dates:
Start Date:
6/23/11
End Date:
6/24/11
Notification list:
hiren@us.ibm.com



SHARE in Atlanta 2012

Virtual Server Report

- Virtual server report
  - List of virtual servers associated with the workload
    - Virtual server Service class PI
    - Resource usage
      - *Physical CPU utilization*
      - *OS view of CPU utilization*
      - *Physical memory used*
    - Hypervisor delay percentage
  - CPU Utilization trend for the selected interval
  - Launch Monitor dashboard
    - Provides hardware utilization data

Report Interval: Starting 3/9/12 1:39:13 PM for 15 minutes (3/9/12 1:54:13 PM) Modify

Resource utilized by VS

--- Select Action --- Filter

Select	Virtual Server	Hypervisor	Hypervisor Type	OS Name	OS Type	OS Level	Hostname	Virtual Proce...	Allocated Memory (MB)	Physical CPU Utilization...	Hypervisor CPU Delay (%)	Idle Time (%)	Other Time (%)	Service Class (PI)	OS Proces... Total CPU Using Samples (%)
○	GSSF23	VML1	z/VM	GSSF23	Red Hat Enterprise Linux Server	5.5	GSSF23	1	821	0.7	0.0	99.3	0.0	SrvClsForModer	0.0
○	GSSF24	VML1	z/VM	GSSF24	SUSE Linux Enterprise Server	10.4	GSSF24	1	667	20.6	0.5	77.4	0.0	SrvClsForFastes	4.0
○	r93f2c1b03v5	C.1.03	x Hyp	r93f2c1b03v5	SUSE Linux Enterprise Server	11.1	r93f2c1b03v5	2	4,096	4.0	0.3			SrvClsForxLinux	0.0
○	r93f2c1b03v6	C.1.03	x Hyp	r93f2c1b03v6	SUSE Linux Enterprise Server	11.1	r93f2c1b03v6	2	4,096	4.6	0.3			SrvClsForxLinux	0.0
◉	r93f2c1b06v5	C.1.06	PowerVM	r93f2c1b06v5	AIX	7.1.0.2	r93f2c1b06v5.pokprv.st	2	4,096	53.3	4.6			Default (0.42)	43.7
○	r93f2c1b06v6	C.1.06	PowerVM	r93f2c1b06v6	AIX	7.1.0.2	r93f2c1b06v6.pokprv.st	2	4,096	1.2	2.6			Default (0.42)	8.8
○	r93f2c1b07v1	C.1.07	PowerVM	r93f2c1b07v1	AIX	6.1.6.3	r93f2c1b07v1.pokprv.st	2	3,072	20.4	6.0			SrvClsForFastes	27.5
○	r93f2c1b07v2	C.1.07	PowerVM	r93f2c1b07v2	AIX	6.1.6.3	r93f2c1b07v2.pokprv.st	2	4,096	45.0	6.0			SrvClsForFastHi	41.3

Page 1 of 1 ... Filtered: 27 Displayed: 27 Selected: 1

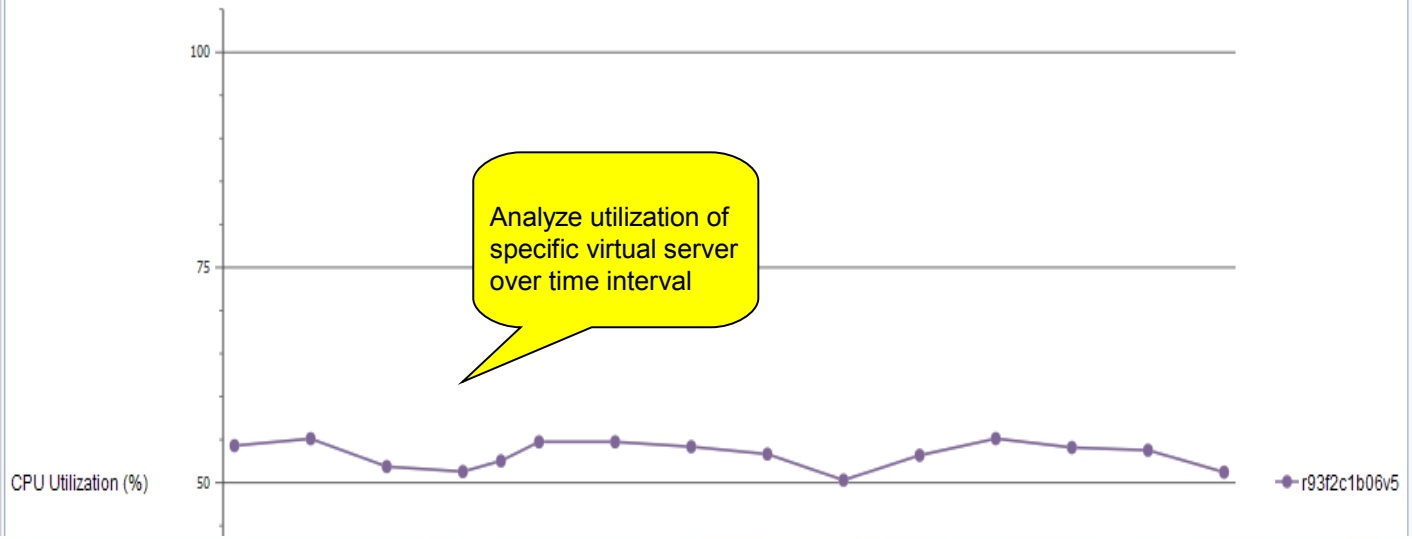
New support for x86 blade

Monitoring data provided by GPMP running on VS

Virtual Server Charts

CPU Utilization for Virtual Server r93f2c1b06v5

Analyze utilization of specific virtual server over time interval



Hypervisor Report

- Hypervisor report
  - Hypervisor resource utilization
  - List of all virtual servers on hypervisor
    - Virtual server Resource allocations (e.g. Memory, CPU)
    - Virtual server current Resource usage
      - *Physical CPU utilization*
      - *Physical memory used*
    - Hypervisor delay percentage
  - Resource adjustment report
    - Resource adjustment actions taken over report interval

Hypervisor Report - r93f2c1b09v1

Report Interval: Starting 6/23/11 6:04:09 PM for 15 minutes (6/23/11 6:19:09 PM) Modify

Hypervisor Details:

Hypervisor:	C.1.09	Processor count:	8	Total memory allocated for virtual servers:	31,232 MB
Hypervisor type:	PowerVM	Total CPU consumption:	89.4%	Total memory:	32,768 MB
Total allocated processing units:	7.96				

Hypervisor Resource Allocation and utilization

Virtual Servers:

--- Select Action --- Filter

Virtual Server	Processor Management Status	Processor Management Reason	Virtual Processors	Min Virtual Processors	Max Virtual Processors	Consumed Processors	Hypervisor Processing Unit Delay (%)	Allocated Memory (MB)	Dedicated	Capped	Processing Units	Initial Processing Units	Min Processing Units	Max Processing Units	Min Memory (MB)	Max Memory (MB)
r93f2c1b09v1	Active	None	2	1	7	0.03	2.2	2,560	--	--	0.34	0.70	0.10	7.00	2,048	4,096
r93f2c1b09v10	Active	None	2	1	7	1.19	24.3	2,560	--	--	0.58	0.70	0.10	7.00	1,024	4,096
r93f2c1b09v2	Active	None	2	1	7	0.10	8.0	2,560	--	--	0.72	0.72	0.10	7.00	1,024	4,096
r93f2c1b09v3	Active	None	2	1	7	0.99	3.9	2,560	--	--	1.81	0.72	0.10	7.00	1,024	4,096
r93f2c1b09v4	Active	None	2	1	7	0.94	20.8	2,560	--	--	0.59	0.72	0.10	7.00	1,024	4,096
r93f2c1b09v5	Active	None	2	1	7	1.19	20.8	2,560	--	--	0.59	0.72	0.10	7.00	1,024	4,096
r93f2c1b09v6	Active	None	2	1	7	1.18	19.9	4,096	--	--	0.61	0.72	0.10	7.00	4,096	4,096
r93f2c1b09v7	Active	None	2	1	7	1.20	19.5	2,560	--	--	0.62	0.72	0.10	7.00	1,024	4,096
r93f2c1b09v8	Active	None	2	1	7	0.03	1.7	2,560	--	--	0.59	0.72	0.10	7.00	1,024	4,096
r93f2c1b09v9	Active	None	2	1	7	0.03	0.2	2,560	--	--	0.71	0.72	0.10	7.00	1,024	4,096

Page 1 of 1 Total: 10 Filtered: 10 Displayed: 10

Difference due to Dynamic CPU mgmt

Benefits of GPMP

- Guest Platform Management Provider (GPMP) is a lightweight component of PPM that provides additional monitoring data
- GPMP shipped as firmware component, installed from HMC for zLinux, AIX, xLinux and Windows Operating systems. z/OS ships GPMP as part of OS
- Allows virtual server to be classified with additional attributes such as HostName, SystemName, OS Level etc.
- With instrumented middleware support, GPMP provides metrics that allows detailed transaction topology as transaction hops through heterogeneous platforms in zEnterprise
- Provides instrumentation to support SASP Load Balancing (AIX, Linux, Windows)

Workload Monitoring with GPMP

Transaction Hops and topology report

- Different hops involved in processing of business transaction
  - Based on OpenGroup ARM Standard instrumentation
  - Middleware instrumentation to ARM APIs
  - Guest Platform Management Provider (GPMP) collects the transaction statistics
  - Provides detail view of resources consumed by instrumented applications

Hops and Topology report with GPMP active

Hops Report - Blade46Medium in Workload WkldForBlade4and6

Report Interval: Starting 6/23/11 5:41:43 PM for 15 minutes (6/23/11 5:56:43 PM) Modify

Details for Blade46Medium:

Workload:	WkldForBlade4and6*	Performance goal:	Velocity - Moderate	PI:	0.75
Performance policy:	Blade46Po	Business importance:	Medium	Performance:	Fast

--- Select Action --- Filter

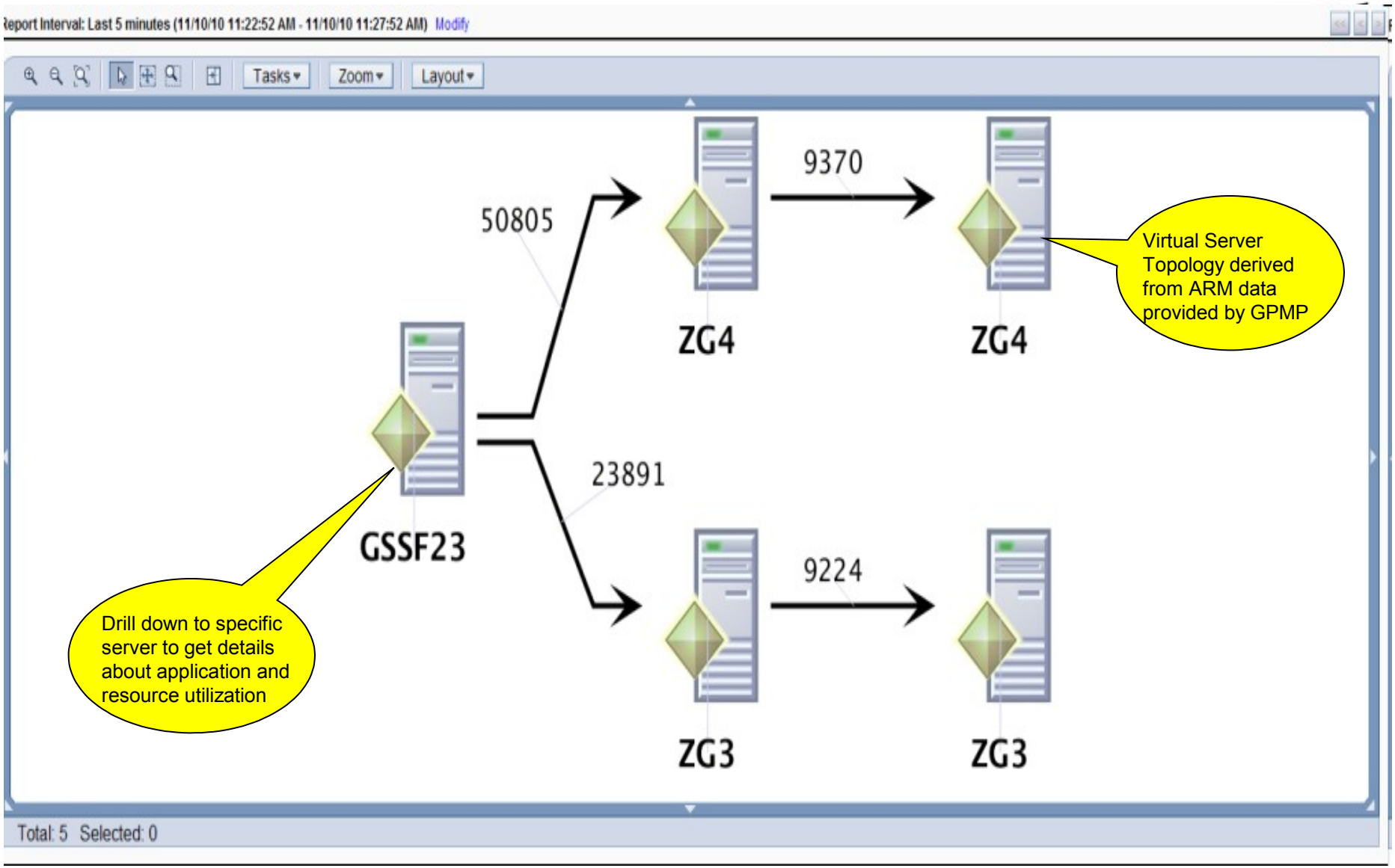
Name	Hop Number	Group Name	Successful Transactions	Failed Transactions	Stopped Transactions	Inflight Transactions	Queue Time (s)	Execution Time (s)	Successful Average Response Time (s)	Inflight Average Response Time (s)
Hop 0	0		57,744	0	0	230	0.000000	0.000260	3.742155	1.862512
IBM DB2 Universal Database	0	db2inst1	126	0	0	0	0.000000	0.000047	0.000047	0.000000
IBM Webserving Plugin	0	IBM_HTTP_Server	57,618	0	0	230	0.000000	0.000261	3.750339	1.862512
r93f2c1b06v2	0		57,618	0	0	230	0.000000	0.000261	3.750339	1.862512
Hop 1	1		4,175	0	0	45	0.000000	0.005133	0.710093	0.582881
WebSphere:APPLICATION_SERVER	1	server1	4,175	0	0	45	0.000000	0.005133	0.710093	0.582881
r93f2c1b06v1	1		4,175	0	0	45	0.000000	0.005133	0.710093	0.582881
Hop 2	2		63,408	0	0	2	0.000000	0.000579	0.000579	0.003900
IBM DB2 Universal Database	2	db2inst1	63,408	0	0	2	0.000000	0.000579	0.000579	0.003900
r93f2c1b06v1	2		63,408	0	0	2	0.000000	0.000579	0.000579	0.003900

Page 1 of 1 Total: 10 Filtered: 10 Displayed: 10

Detail hop report with transaction avg response time

Do we have any failure?

How much time it took for transaction execution?


Report Interval: Last 5 minutes (11/10/10 11:22:52 AM - 11/10/10 11:27:52 AM) Modify
Tasks
Zoom
Layout
50805
9370
ZG4
ZG4
Virtual Server Topology derived from ARM data provided by GPMP
GSSF23
23891
9224
ZG3
ZG3
Drill down to specific server to get details about application and resource utilization
Total: 5 Selected: 0

View Statistics - ZNTC25

Report Interval: Starting 6/22/11 3:50:14 PM for 15 minutes (6/22/11 4:05:14 PM)

Virtual Server Statistics:

Physical CPU utilization: 25.2% Hypervisor CPU delay: 27.3%
Idle time: 32.2% Other time: 0.0%

OS Processes Totals:

CPU using samples: 7.0% CPU delay samples: 92.9%
Page delay samples: 0.0% I/O delay samples: 0.0%

Application Environment Server Response Time Data:

--- Select Action --- Filter

Application Environment	Group Name	Successful Transactions	Failed Transactions	Stopped Transactions	Inflight Transactions	Queue Time (s)	Execution Time (s)	Successful Average Response Time (s)	Inflight Average Response Time (s)
IBM Webserving Plugin	Apache/2.2.3 (Linux/SUSE)	409,359	6,034	18,728	0	0.000000	0.000494	0.000494	0.000000

Total: 1 Filtered: 1

Application Environment Server Utilization:

--- Select Action --- Filter

Application Environment	Group Name	CPU Time (s)	CPU Using Samples (%)	CPU Delay Samples (%)	Page Delay Samples (%)	I/O Delay Samples (%)
IBM Webserving Plugin	Apache/2.2.3 (Linux/SUSE)	0.000000	0.0	0.0	0.0	0.0
IBM Webserving Plugin	Apache/2.2.3 (Linux/SUSE)	445.264282	7.9	91.0	0.0	1.2

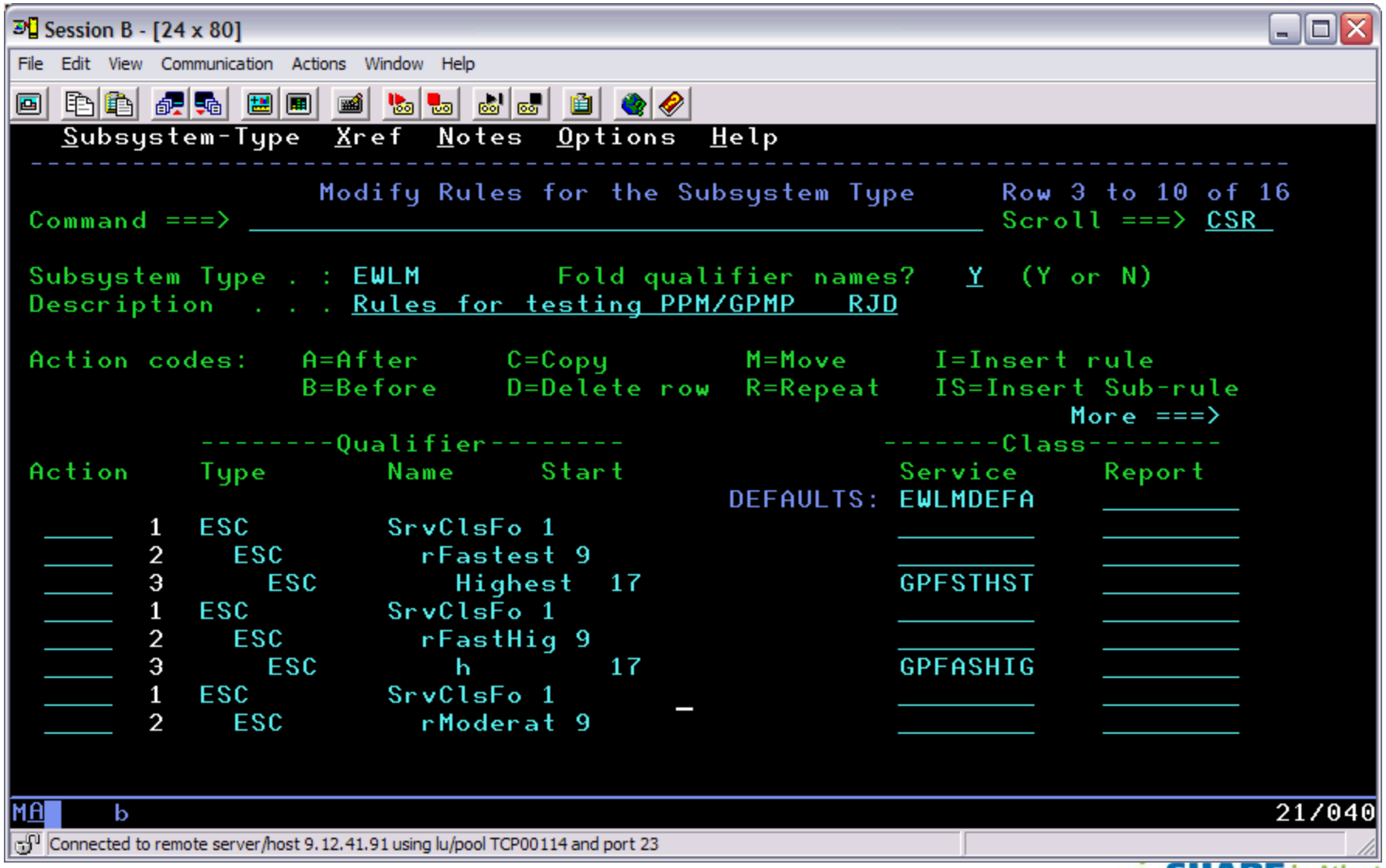
Total: 2 Filtered: 2

CPU Time used by Apache

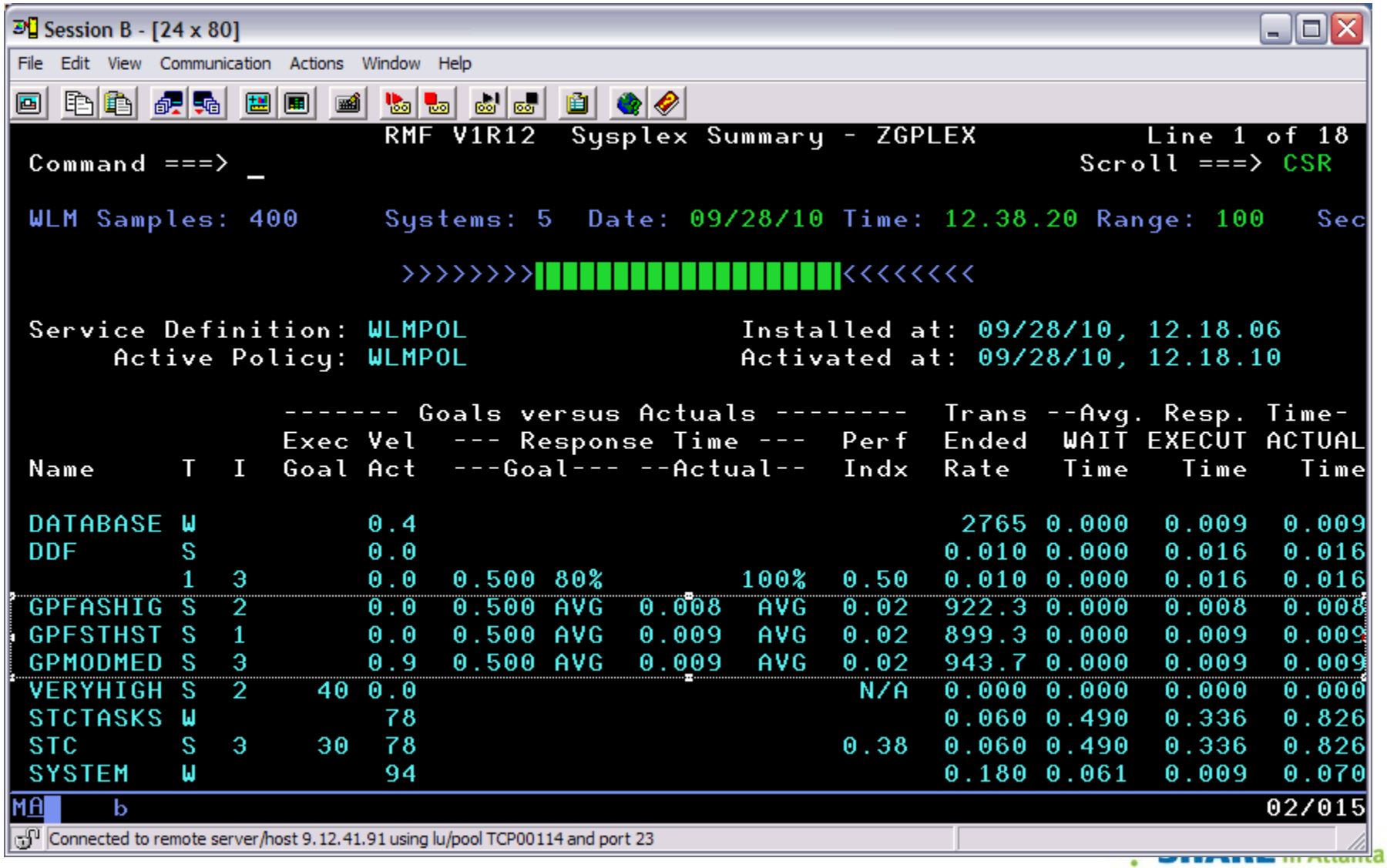
Co-operative management with z/OS WLM

- z/OS provides differentiated service to PPM classified work
- Requirements:
  - GPMP must be running on z/OS
  - Transaction coming to z/OS needs to be ARM instrumented
  - WLM service definition needs to map PPM service classes to z/OS WLM service classes
- PPM service class associated with transaction is used by WLM to classify work unit to a different WLM service class.
- WLM manages the resources based on the goal assigned to this specific service class.

Setup for co-operative mgmt with z/OS WLM

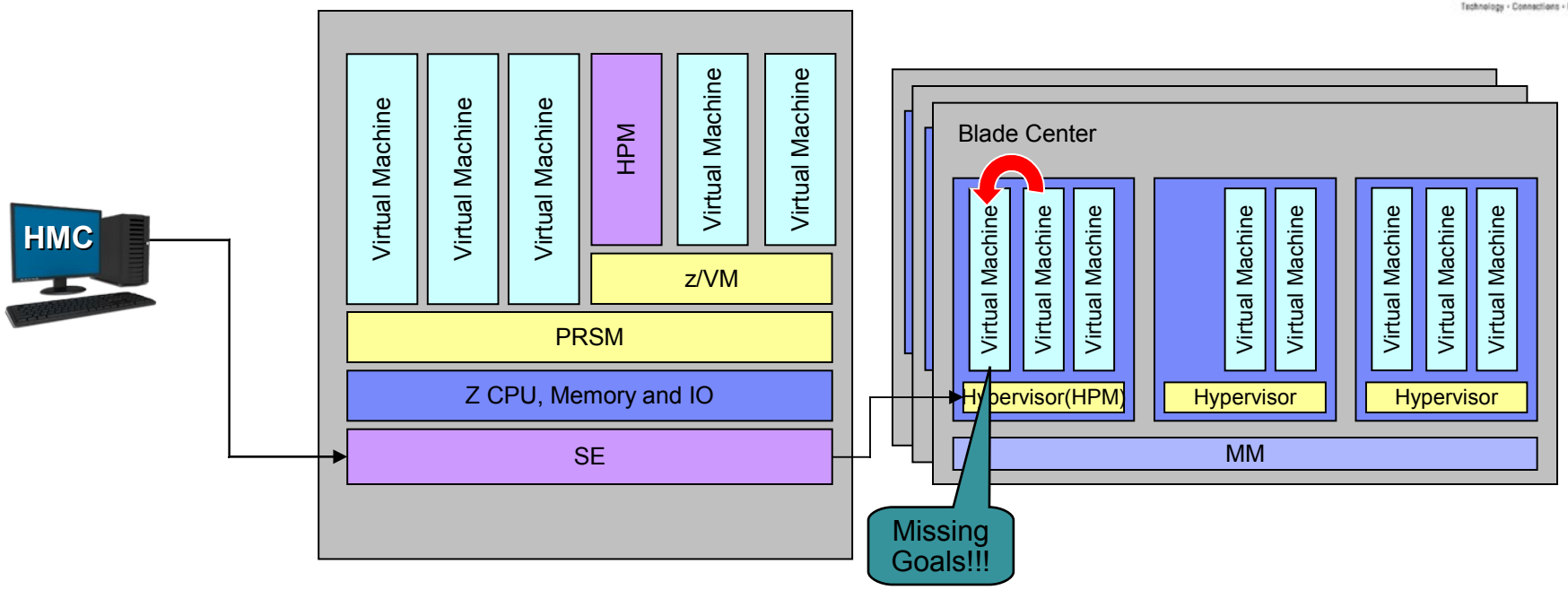


Monitoring with RMF



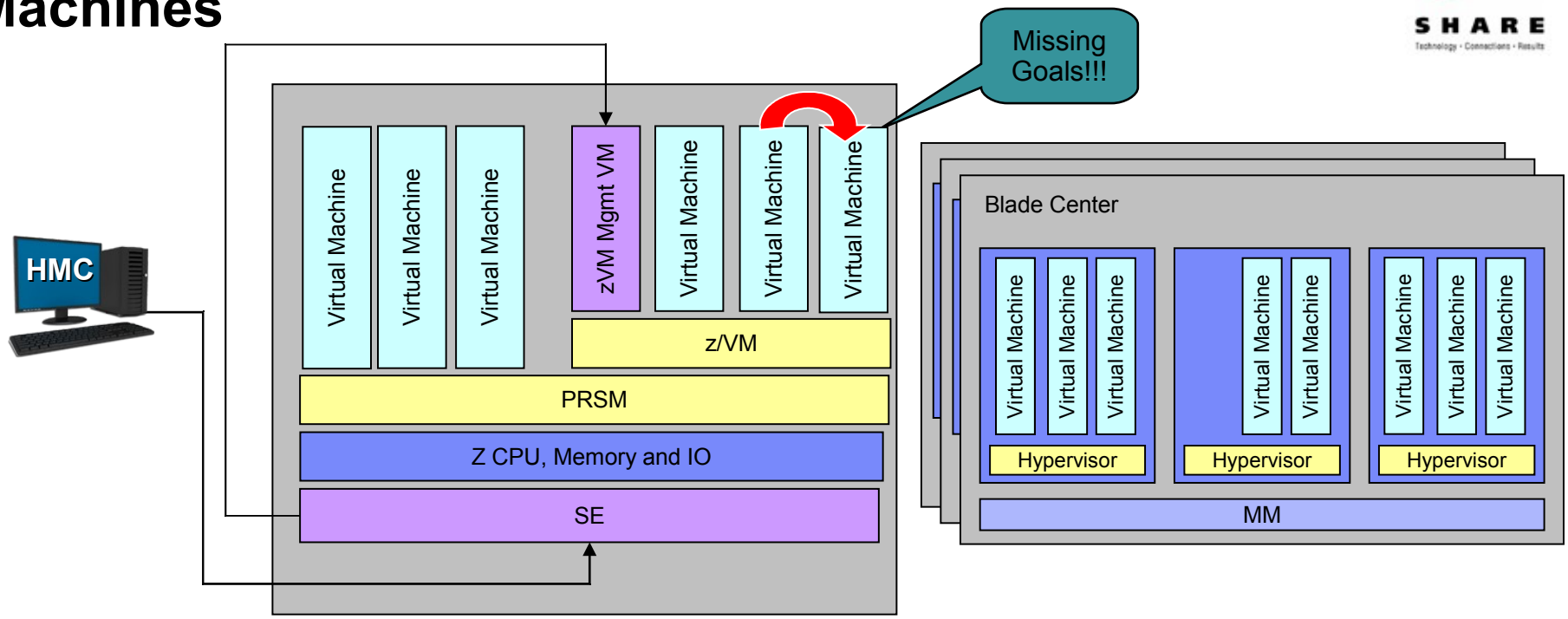
Management Functions

Managing Resources across Virtual Servers on Power Blade



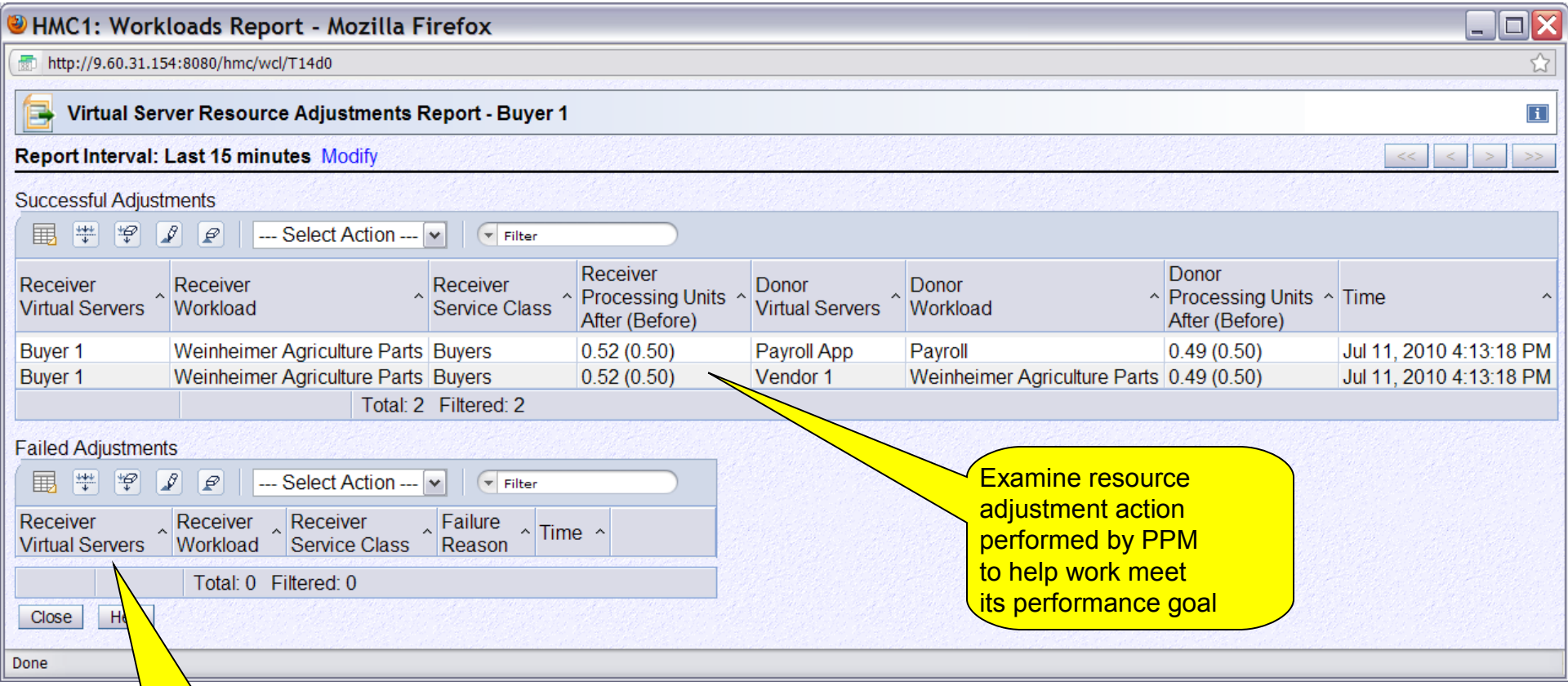
- Manage processor resources across virtual servers to achieve workload goals
  - Detect that a virtual server is part of Workload not achieving goals
  - Determine that the virtual server performance can be improved with additional resources
  - Project impact on all effected Workloads of moving resources to virtual server
  - If good trade-off based on policy, redistribute processor resources

Managing Resources across z/VM Virtual Machines



- Manage processor resources across z/VM virtual machines
  - Detect that a virtual machine that is part of Workload is not achieving goals
  - Determine that the virtual machine performance can be improved with additional resources
  - Project impact on all effected Workloads of moving resources to virtual machine
  - If good trade-off based on policy, redistribute processor resources

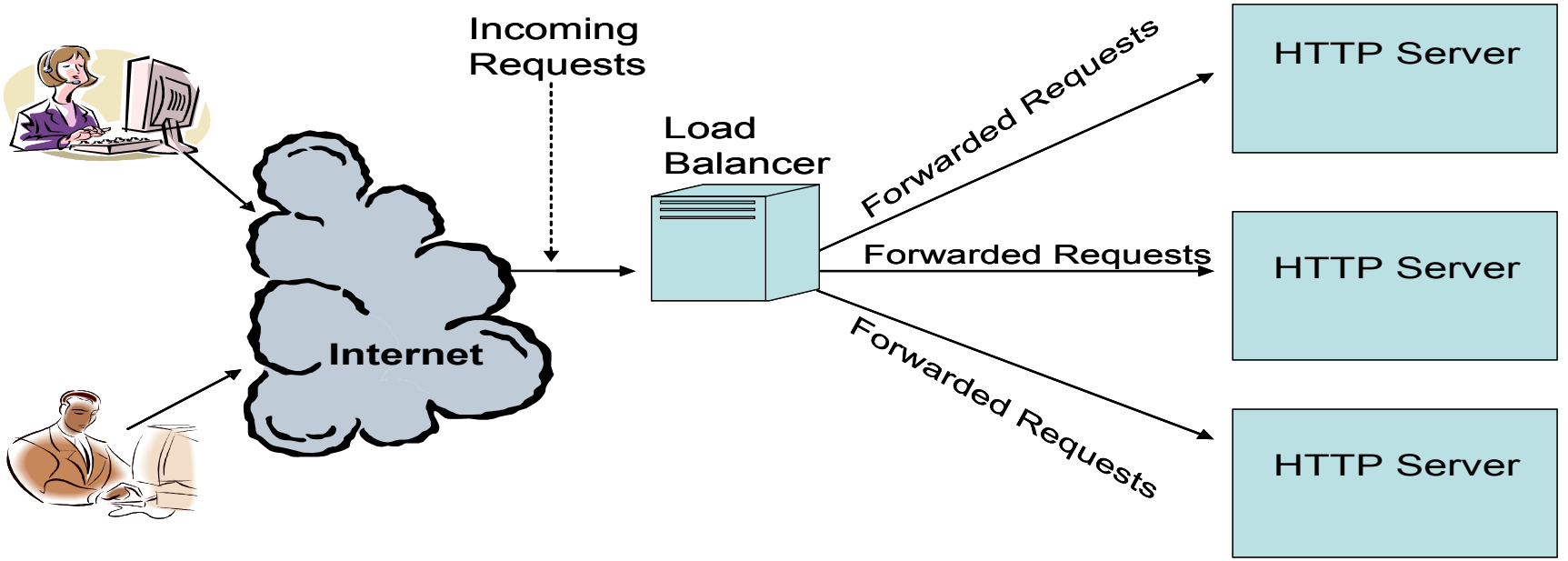
Resource Adjustment Report



Examine resource adjustment action performed by PPM to help work meet its performance goal

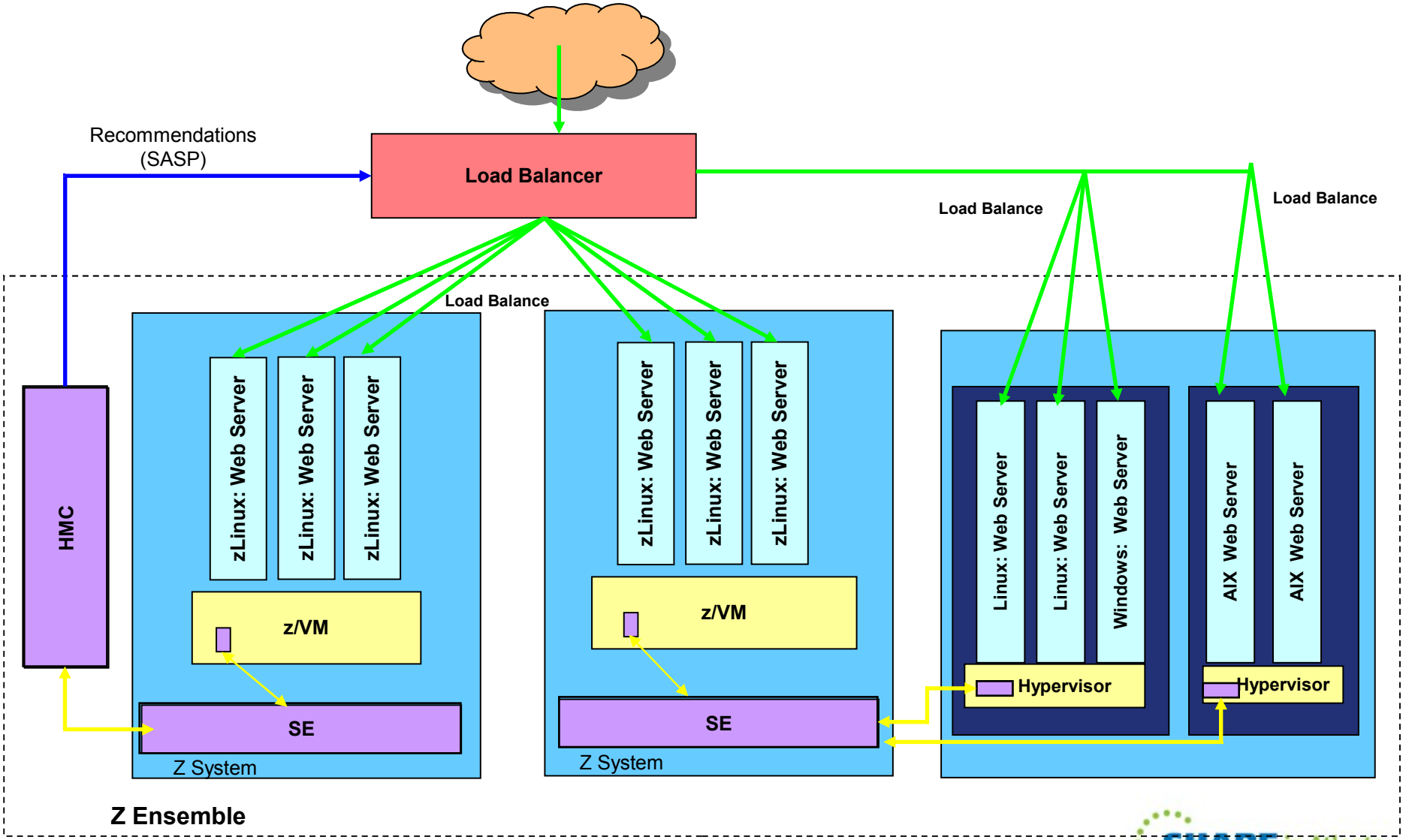
Explains why resource adjustment action was not performed

What is Load Balancing?



- Distributes incoming workload among a group of machines with similar functionality.
  - factoring in the availability of server resources,
  - avoiding over-utilized servers, where possible,
  - factoring in the *business importance* of the work (potential future consideration)
  - estimating the likelihood of meeting objectives, (potential future consideration)

Ensemble Workload Balancing



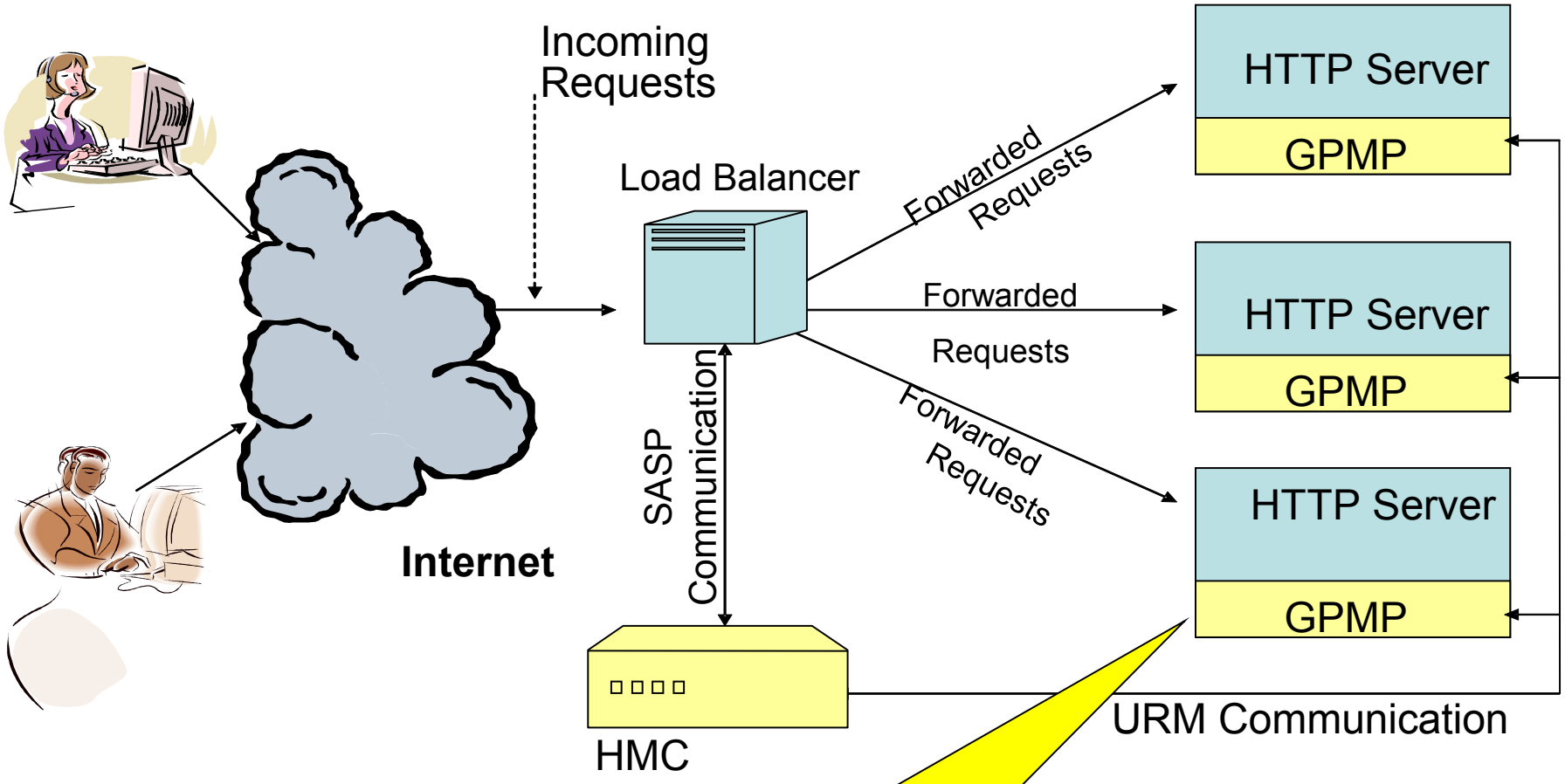
Motivation for PPM to provide recommendation

- Objective: Influence workload balancing decisions across a System z Ensemble
  - Use SASP protocol to make recommendations for workload balancers (e.g. IP switches / routers that load balance)
  - HMC hosts SASP function
  - Scope of recommendations is non-z/OS virtual servers within the ensemble
    - z/OS Load Balancing Advisor (LBA) provides SASP recommendations for z/OS
    - Same SASP client code can interact with both LBA and HMC SASP implementations to provide complete coverage of z environment
      - *Client code needs to be configured to different SASP server for z/OS (LBA) and non z/OS (HMC)*
  - HMC recommendations based on the platform performance manager's understanding of the current performance of the members of a load balancing group
    - Recommendation based on overall utilization and delays experienced by virtual servers
    - If IP address and port are used to register members of a load balancing group, port is used to determine application availability on each member of load balancing group. Weight of 0 given to members where port is not open

The New Server/Application State Protocol (SASP)

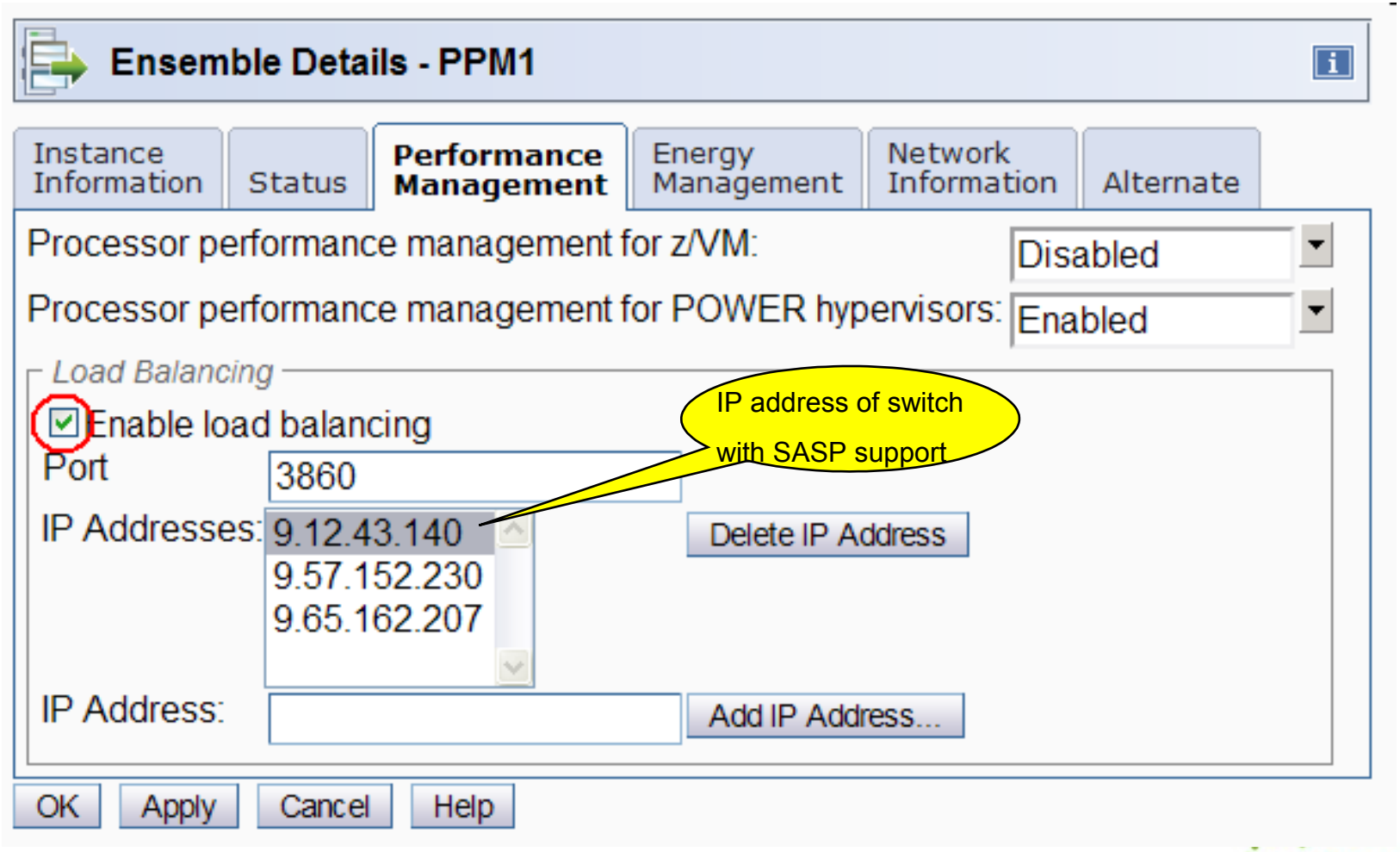
- Protocol Characteristics
  - TCP/IP Binary protocol
  - Open protocol documented in RFC4678:
    - http://www.faqs.org/rfcs/rfc4678.html
- Load Balancers can connect to URM for the following purposes:
  - Register Groups and Members
  - Deregister Groups and Members
  - Set quiesced/active state of Members
  - Set Load Balancer configuration parameters
    - Have weights pushed to LB
    - Allow members to register/deregister themselves
    - Don’t send weights if there was no change
  - Get current weights

How will URM perform load balancing?



- GPMP samples system statistics
- GPMP knows whether application (HTTP Server) is currently running or not
- URM utilizes these metrics from GPMP to provide recommendations to load balancer

Enable Load Balancing support



Platform Performance Manager Summary

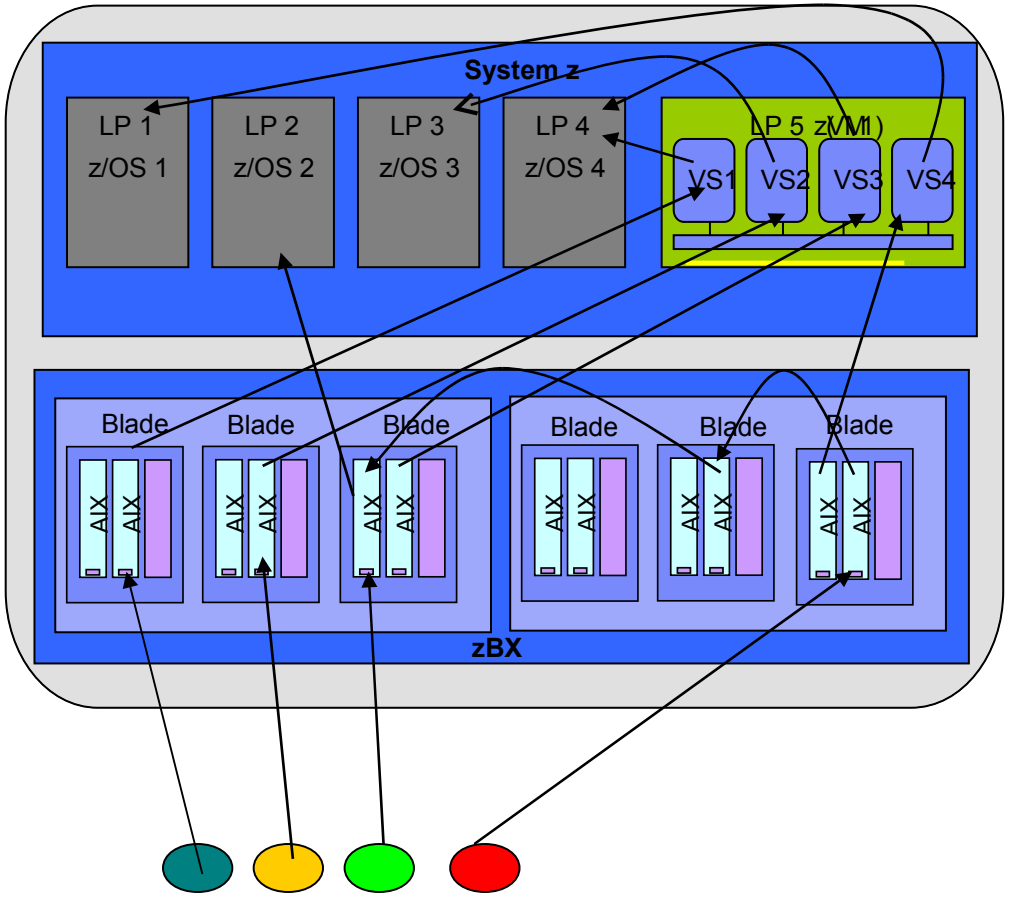
- Extend z/OS goal oriented workload management concepts across zEnterprise mixed processors environment
- Integrated function of zEnterprise Unified Resource Manager firmware
- Workload based goal oriented policy definition
- Monitoring and reporting in context of Workload and associated performance policy
- Goal oriented resource management
- Load Balancing recommendation to SASP enabled routers.

Back up

- Back up

Benefits of Middleware instrumentation

- Transaction response time reporting
- Multi-tiered work request flow across environments
- Relationship to server resources being consumed
- Same reasoning lead to instrumentation of z/OS subsystems (CICS, IMS, DB2, etc) for z/OS WLM
- OpenGroup Application Response Measurement (ARM) standards based instrumentation.



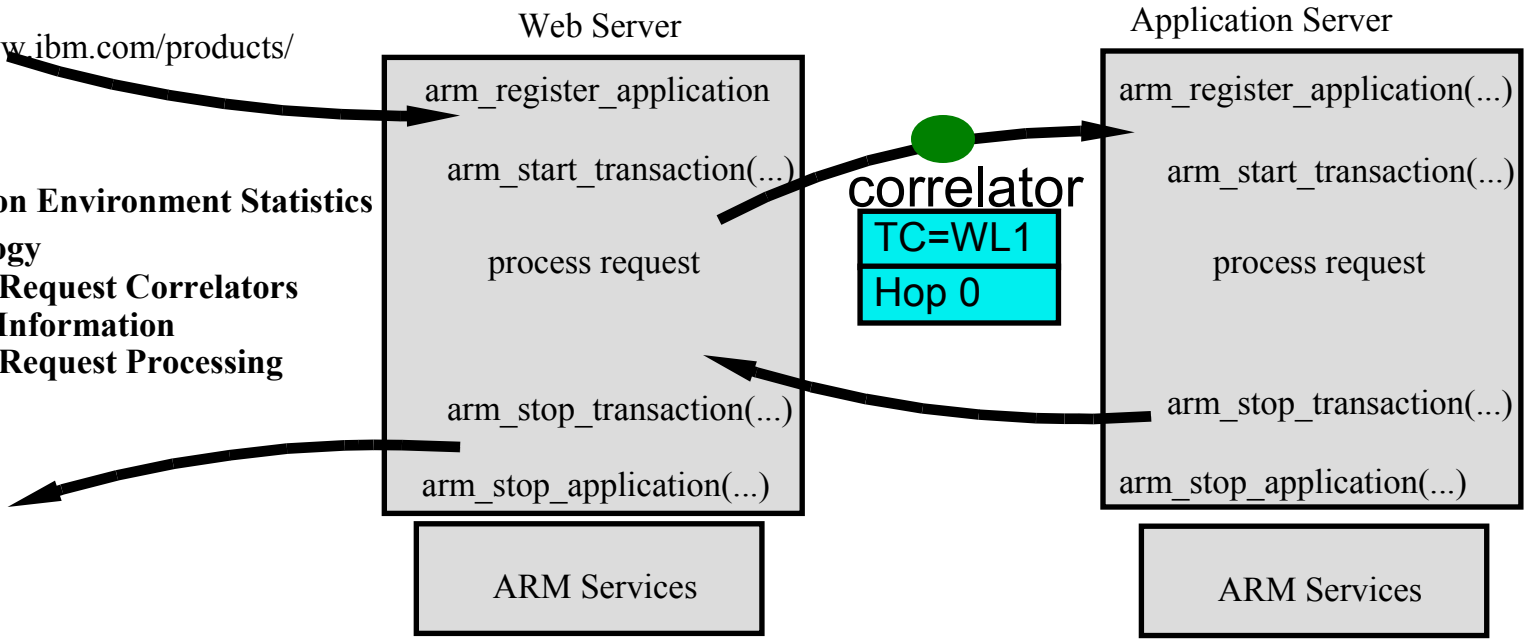
Basic ARM calls

- 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

Application Response Measurement (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

ARM 4.0 Instrumented Middleware

- Web Server support:
  - WebSphere provided plugin
    - IHS/Apache
    - IIS
    - Domino
    - iPlanet
- WebSphere Application Server
  - WAS 6.0, WAS 7.0
- DB2 Universal Database

Enable ARM Services on Middleware Applications

- Ensure Guest Platform Management Provider status in HMC
- Ensure that user account under which the application will run is authorized to the ARM services
- Enable ARM services on the middleware application
- Verify that ARM is enabled
  - “lsarm –a” command