Hybrid Management

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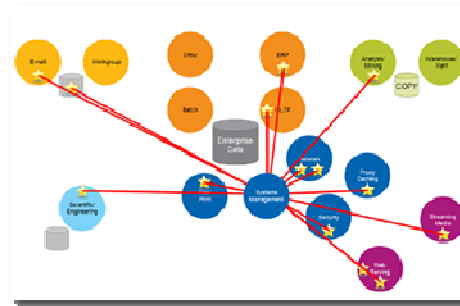October 14, 2010

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Agenda

- System z Hybrid

- zEnterprise Unified Resource Manager

- z/OS Workload Management

- zEnterprise Platform Performance Management
  - Workload based Monitoring
  - Management Functions

System z Hybrid

System z Mainframe

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Integrated Systems Management firmware

- Integrate, monitor, and manage multi-OS resources as a single, logical virtualized system

- Single Workload Management, Security, and System Management interface across all resources
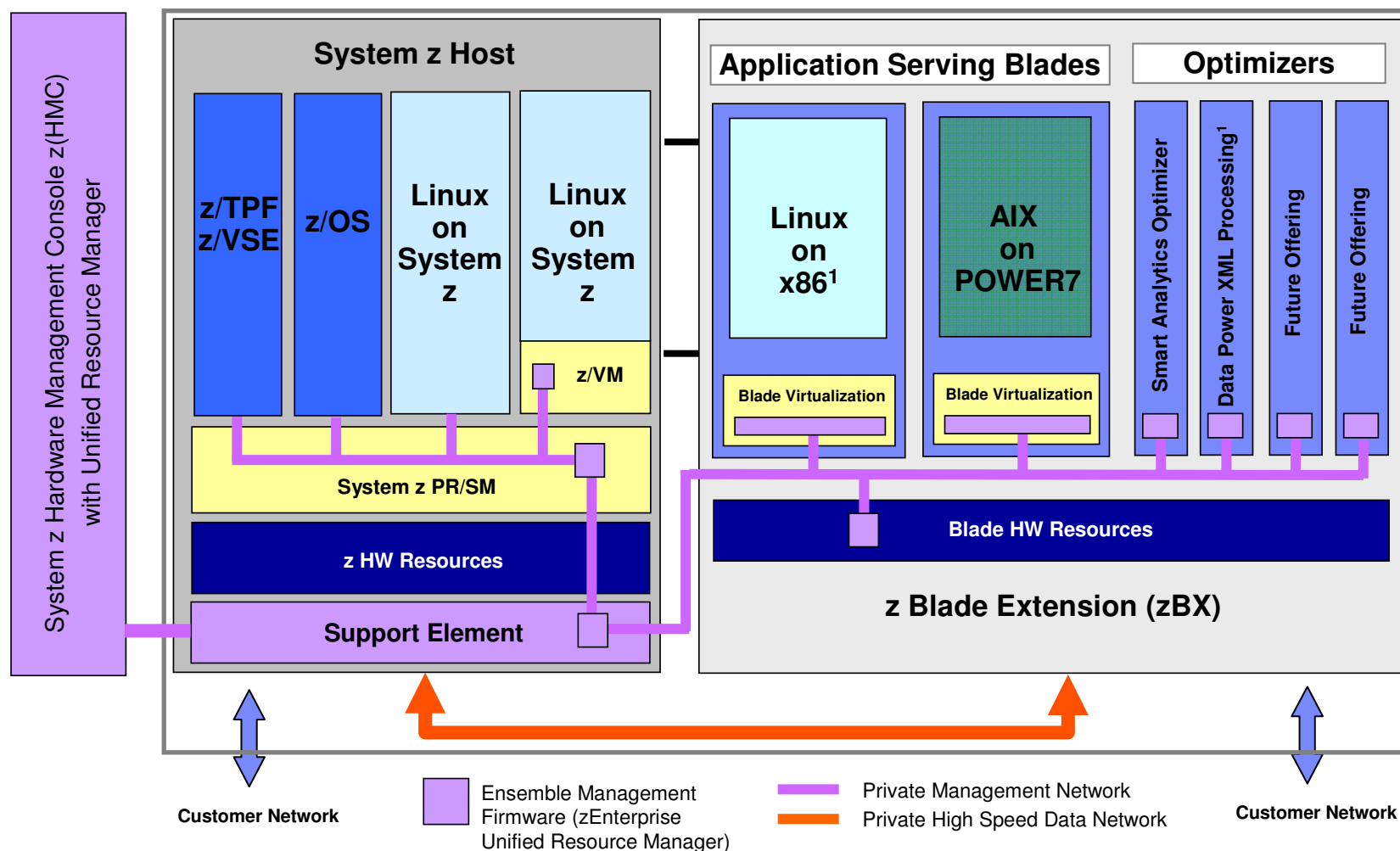
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Optimizers

- Extend and accelerate System z workloads
- Lower cost per transaction while improving application response time for CPU intensive applications

Application Serving Blades

- Logical device integration between System z resources and application serving commodity devices
- Providing competitive price-performance and improved QoS for applications with a close affinity to mainframe data

z196 with zBX (z Blade Extension)

System z Hardware Management Console z(HMC) with Unified Resource Manager

System z Host

- z/TPF z/VSE
- z/OS
- Linux on System z
- Linux on System z
  - z/VM

System z PR/SM

z HW Resources

Support Element

Application Serving Blades

- Linux on x86[1]
- AIX on POWER7
  - Blade Virtualization
  - Blade Virtualization

Optimizers

- Smart Analytics Optimizer
- Data Power XML Processing[1]
- Future Offering
- Future Offering

Blade HW Resources

z Blade Extension (zBX)

Customer Network

Customer Network

■ Ensemble Management Firmware (zEnterprise Unified Resource Manager)

— Private Management Network
— Private High Speed Data Network

[1] All statements regarding IBM future directions and intent are subject to change or withdrawal without notice, and represents goals and objectives only.

zEnterprise Ensembles

- Ensemble
  - A zEnterprise Ensemble is a collection of zEnterprise Nodes managed as a single virtualized pool of server resources
    - Native LPAR and z/VM Virtual Images
    - Power VM Virtual images
    - IBM Smart Analytics Optimizer for DB2
  - A zEnterprise Node can be a member of at most one Ensemble

- zEnterprise Unified Resource Manager
  - allows for the management and optimization of a zEnterprise Ensemble as a single resource pool
  - System z Hardware Management Console (HMC) is management console
  - Ensemble-wide scope of responsibility
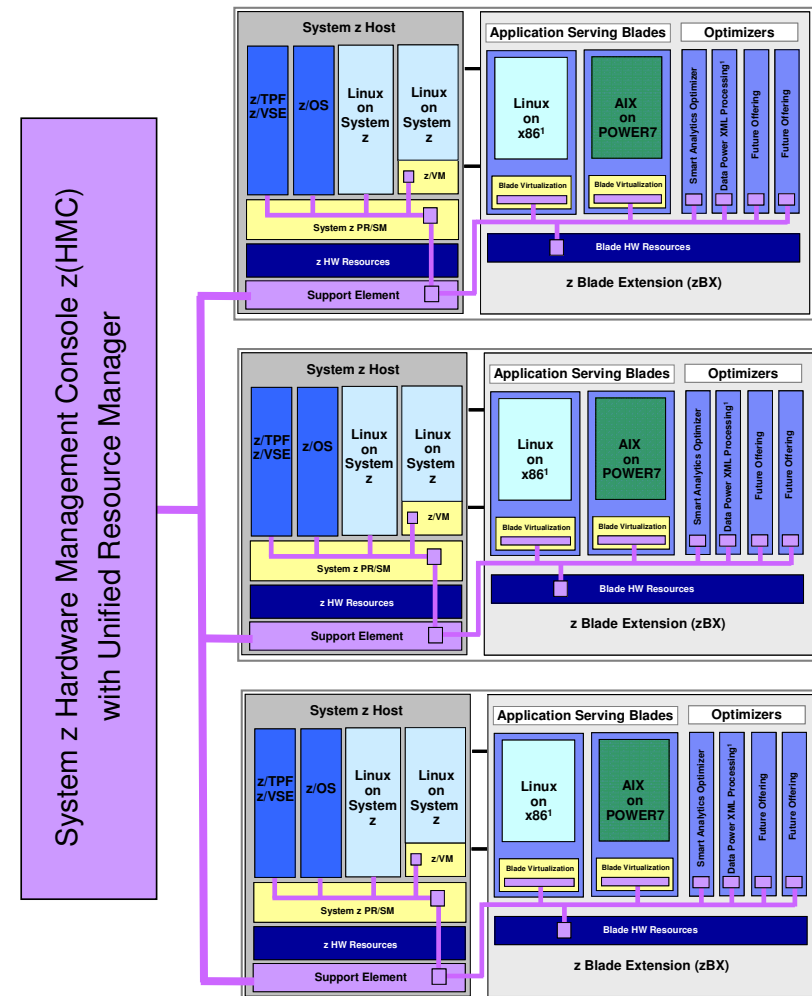
zEnterprise Unified Resource Manager (zManager)

- What is it?

  - Unified Resource Manager provides **workload awareness** to optimize the system resources in accordance with understanding the policies assigned to that particular workload

  - Functions are grouped into two suites of tiered functionality that enable different levels of capability – Manage suite and Automate suite

- How is it different?

  - **Heterogeneous management:** Total systems management across heterogeneous resources

  - **Integration:** Single point of control, common skills for resources, reduced complexity of day to day operations

  - **Monitoring:** New dashboard for CPU resources and energy management

  - **Simplified installation:** Auto discovery and configuration of resources and workloads with single interface

  - **Secure:** Improved network security with lower latency, less hops and less complexity. Improved control of access due to management of hypervisors as firmware

  - **Service and support management:** Virtual machines and blades able to perform hardware problem detection, reporting and call home

zEnterprise Unified Resource Manager (zManager)

Hypervisor Management
- Integrated deployment and configuration of hypervisors
- Hypervisors (except z/VM) shipped and serviced as firmware
- Management and control communication between virtual server operating systems and the hypervisor

Operational Controls
- Auto-discovery and configuration support for new resources
- Cross platform hardware problem detection, reporting and call home
- Physical hardware configuration, backup and restore
- Business management functions including user management, auditing, device status, service network configuration
- Ensemble creation
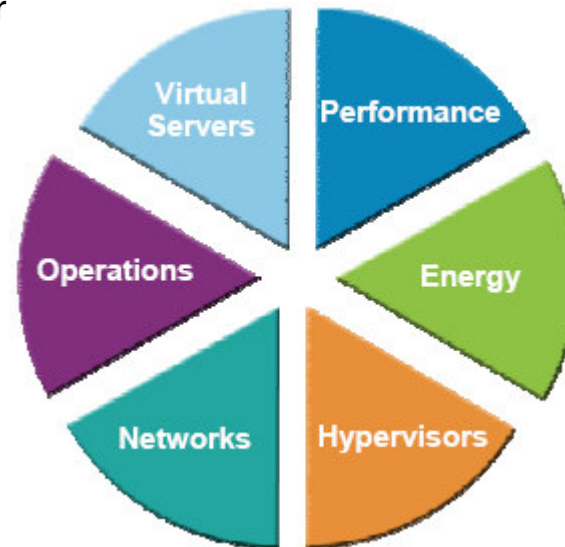
Network Management
- Management of virtual networks including access control

Workload Awareness and Platform Performance Management
- Management of resources in accordance with specified business service level objectives
- HMC provides a single consolidated and consistent view of resources
- Monitor resource use within the context of a business workload
- Define workloads and associated performance policies

Energy Management
- Monitoring and trend reporting of CPU energy efficiency
- Ability to query maximum potential power
- Static power savings

Virtual Server Lifecycle Management
- Single view of virtualization across platforms
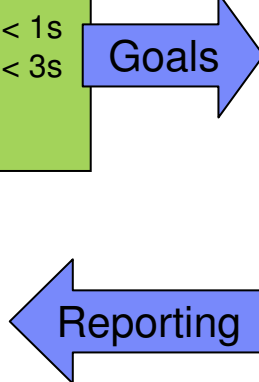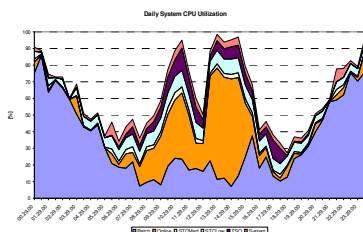- Ability to deploy multiple, cross-platform virtual servers within minutes

(Center diagram segments: Virtual Servers, Performance, Energy, Hypervisors, Networks, Operations)

z/OS Workload Management
Goal oriented workload management since 1994

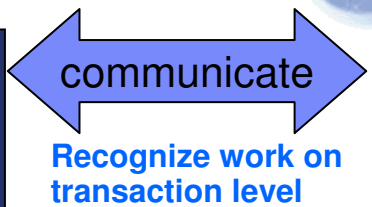**Service Policy**
Service Classes
- CICS, Imp=1, 90% < 0.25s
- DDF, Imp=2, 80% < 0.5s
- TSO, Per=1, Imp=3, 90% < 1s
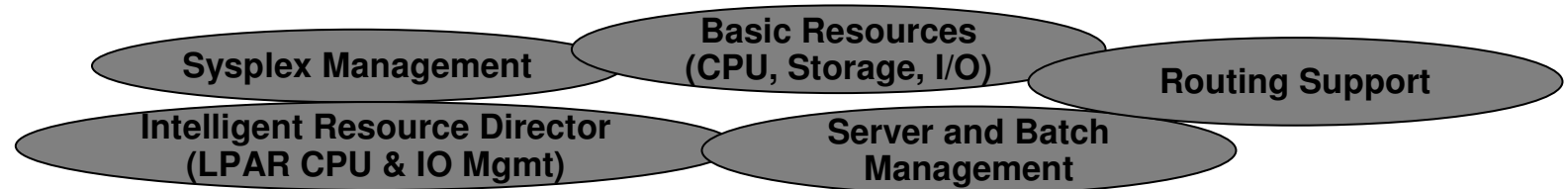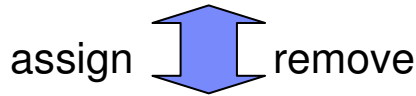- TSO, Per=2, Imp=4, 80% < 3s
- Batch, Imp=5, ExVel=10

➤ Goal oriented approach
➤ Different classes of service
➤ Classification rules
➤ Importance based goal attainment
➤ Subsystems participate

Goals

z/OS Workload Manager (WLM)

communicate

Recognize work on transaction level

Reporting

Daily System CPU Utilization

determine goal achievement

assign **remove**

Sysplex Management

Basic Resources (CPU, Storage, I/O)

Routing Support

Intelligent Resource Director (LPAR CPU & IO Mgmt)

Server and Batch Management

SAP

DB2

CICS

IMS

zEnterprise Platform Performance Manager

- Platform management component responsible for goal-oriented resource monitoring, management, and reporting across the zEnterprise Ensemble
  – Core component responsible for definition and implementation of goal-oriented management policy
  – Workload monitoring and reporting based on management policy
  – Extend goal oriented approach of z/OS WLM to platform managed resources
  – Orchestration of autonomic management of resources across virtual servers
    • Provide Intelligent Resource Director like function across the zEnterprise
    • Management functions will evolve over time
  – Pushes management directives to the Support Element, Hypervisors, and OS agents as required across the zEnterprise

- Integration of HMC console support
  – Integrated UI for monitoring, display of workload topology relationships, status alerts, etc.
  – Definition of Performance Management Goals and Policy Administration

- Functionality integrated into the zEnterprise Unified Resource Manager
  – Code structured and packaged as System z firmware
  – Inter-Component communication over trusted internal platform management network

# zEnterprise Platform Performance Manager
Resource management based on understanding of overall workload flow
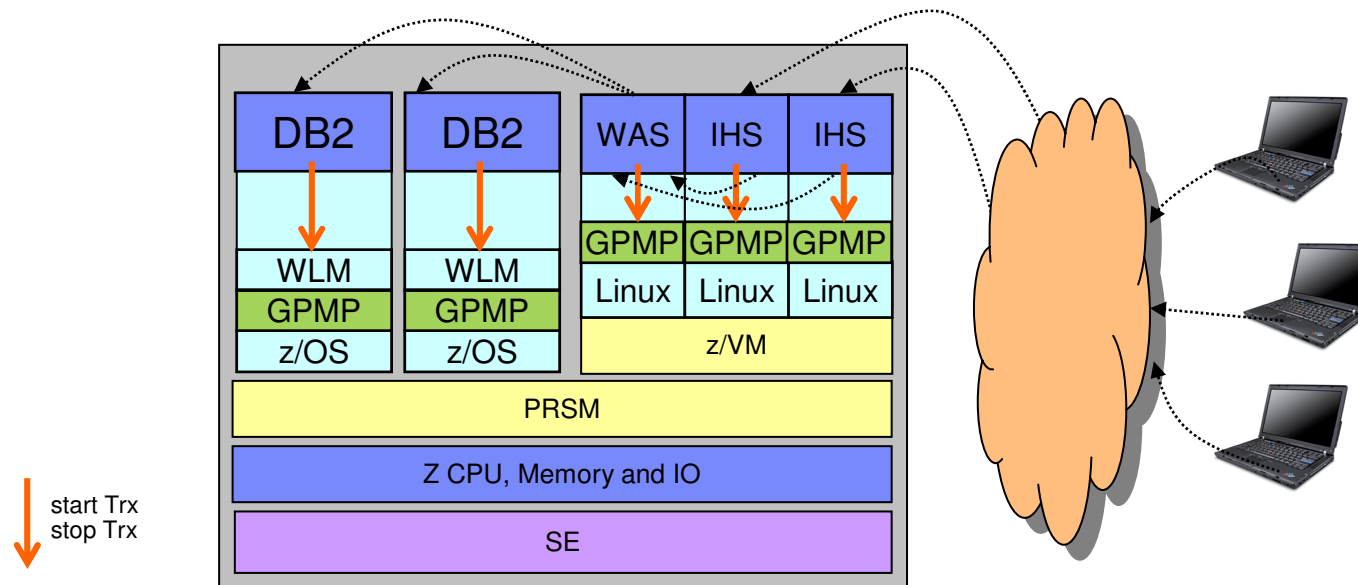
- Applications / middleware has to be instrumented with ARM – Application Response Measurement (Open Group Standard) to collect transaction statistics
  - Enables to monitor the flow of transactions
  - Enables to monitor transaction response times and processing statistics

- OS Agent – guest platform management provider (GPMP)
  - is required to identify individual units of work
  - collects data about processes / address spaces and transactions
  - passes data to Platform Performance Manager
  - On z/OS the data is collected by WLM

zManager Platform Workload Definition

- A Platform Workload is a grouping mechanism and "management view" of virtual servers and optimiziers supporting a business application

- Provides the context within which associated platform resources are presented, monitored, reported, and managed

- Management policies are associated to Platform Workload
 - Currently supports Performance Policy
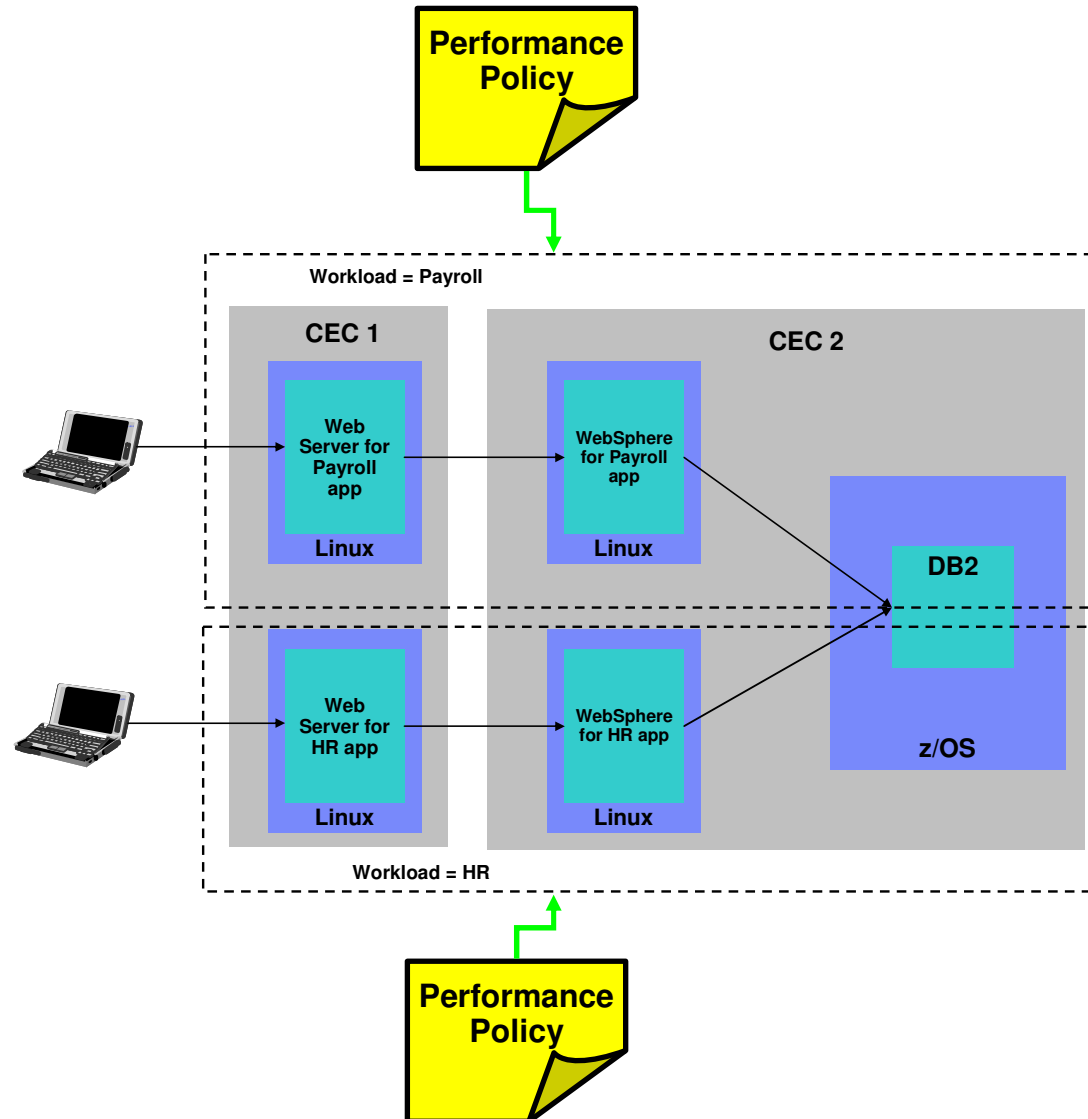
zManager Workload Performance Policy

- 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

Name: Payroll_night_shift
Importance: High

Service Class

Name: Payroll_1
Performance goal: Velocity – Fast
Importance: Very High

Classification Rule

Virtual Server Name = SRV1

Classification Rule

Host Name = sys2.us.ibm.com

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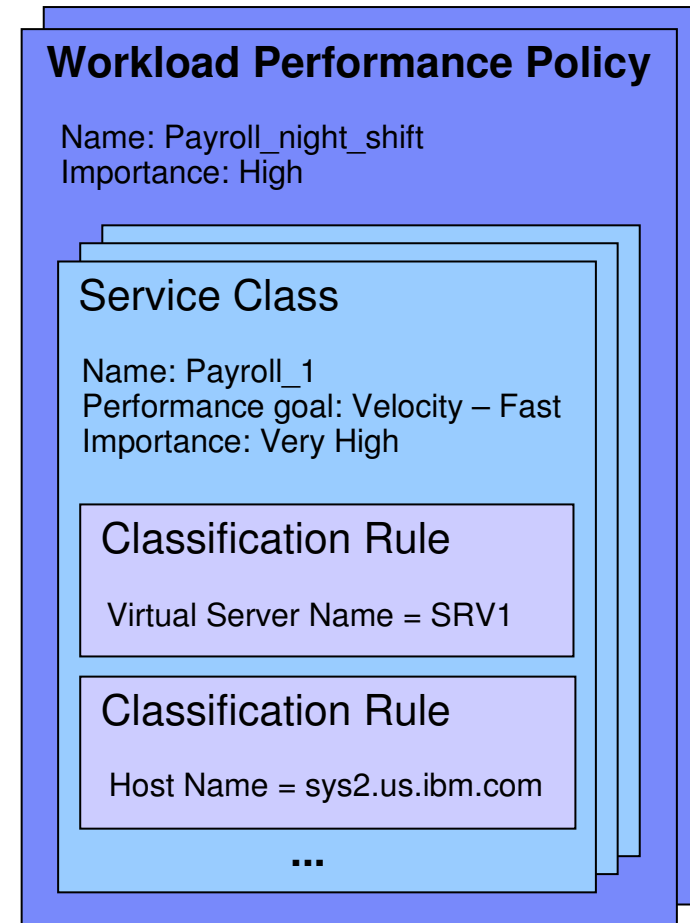
Goal Achievement is Determined via a Performance Index (PI)

- Indicator how well work (service class) is doing
- Independent from business importance
- Basically
  - If PI = 1: service class meets goal
  - If PI > 1: service class is eligible for help
  - If PI < 1: service class is a potential donor

PI

2.0
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
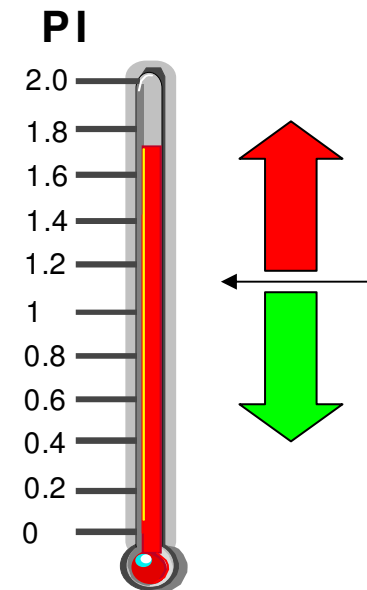
$$\text{Response Time Goal} \quad : \quad PI = \frac{\text{Actual Achieved Response Time}}{\text{Response Time Goal}}$$

$$\text{Execution Velocity Goal} \quad : \quad PI = \frac{\text{Execution Velocity Goal}}{\text{Actual Achieved Execution Velocity}}$$

Workload Management Control Loop

```
                    WHAT HAPPENED?

         LEARNING BY                   GO FOR IT!

         OBSERVATION

 GOALS

         IS A CHANGE          WILL THE CHANGE HURT

         NECESSARY?           SOME OTHER WORKLOAD?

         IS A CHANGE          WILL THE CHANGE HAVE

         POSSIBLE?            A POSITIVE EFFECT?
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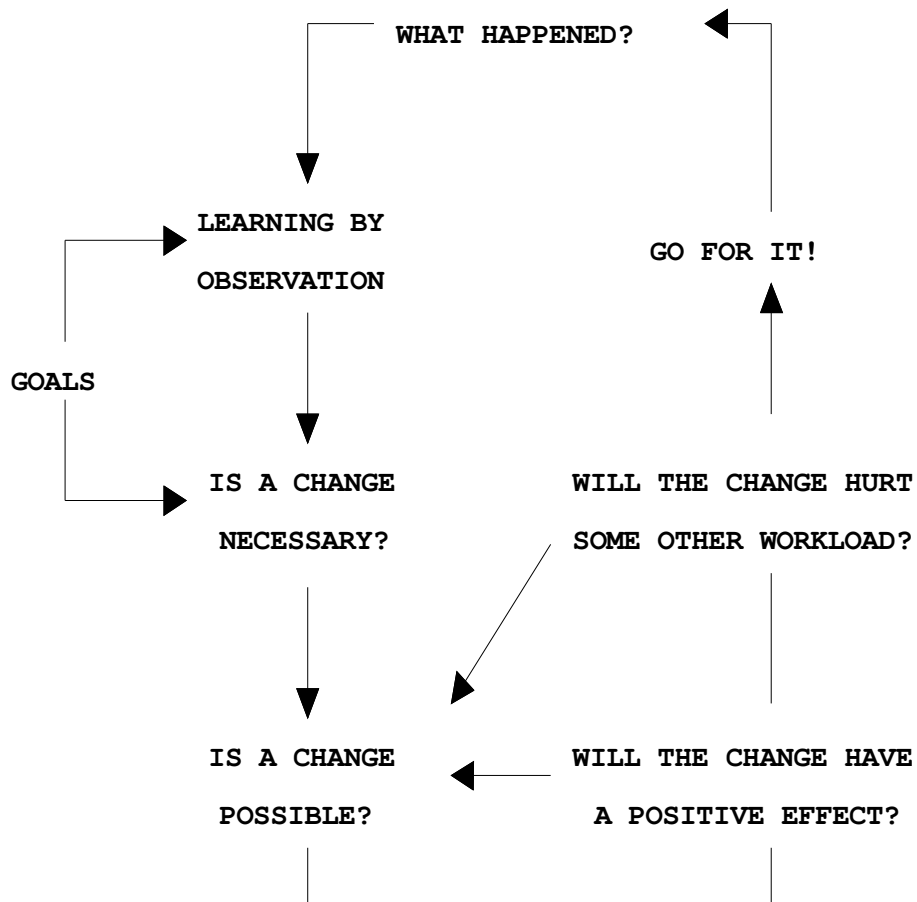
- The Problem
  – Resources must be dynamically adjusted to meet service goals

- Required
  – Seamless adjustment when load changes
  – End user expectations (goals) for important work must always be guaranteed
  – System must be highly utilized (up to 100% for z/OS)

- Solution
  – Periodically measure system state
  – Periodically assess workload state
  – Adjust access of Service Classes to resources (CPU, storage, IO) to help workloads by importance

- In each adjustment cycle resource access is moved from one doner service class to one receiver service class

zManager Workload Based Monitoring and Reporting

- Provide reporting capability that shows usage of platform resources in a Workload context with a zEnterprise Ensemble scope
  - Across virtual servers and optimizers supporting the Workload

- Workload goal vs. actual reporting

- Drill down from overall Workload "performance health" view to contributions of individual virtual server / optimizers

- Graphical views
  - Topology, trending graphs, etc.

- Links to system activity displays to show hardware utilization views

- Reporting limited to platform level resources, not trying to replace tools that report on intra-OS resources and performance
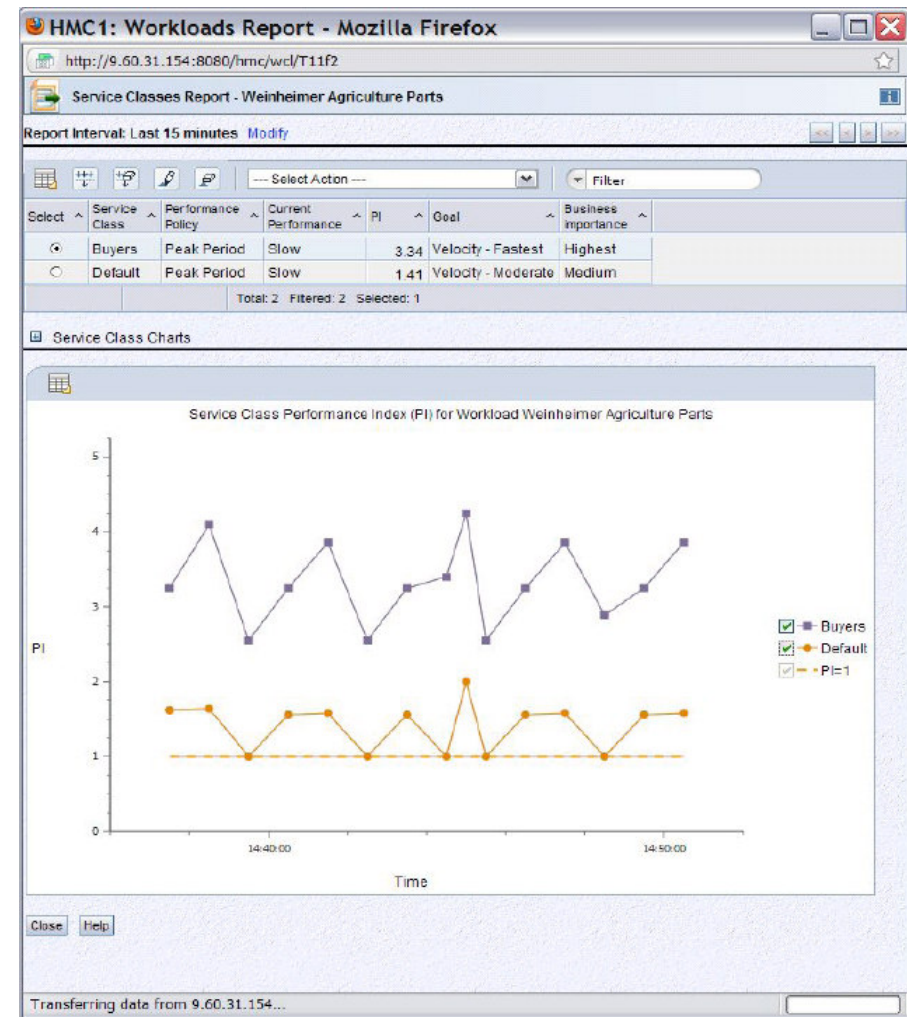
zManager – Workload Virtual Server Report

- Workload Virtual Server Report lists virtual server in a service class
  - Virtual server velocity
  - Physical resource utilization
  - OS view of resource utilization
  - Physical memory used
  - Hypervisor delay percentage
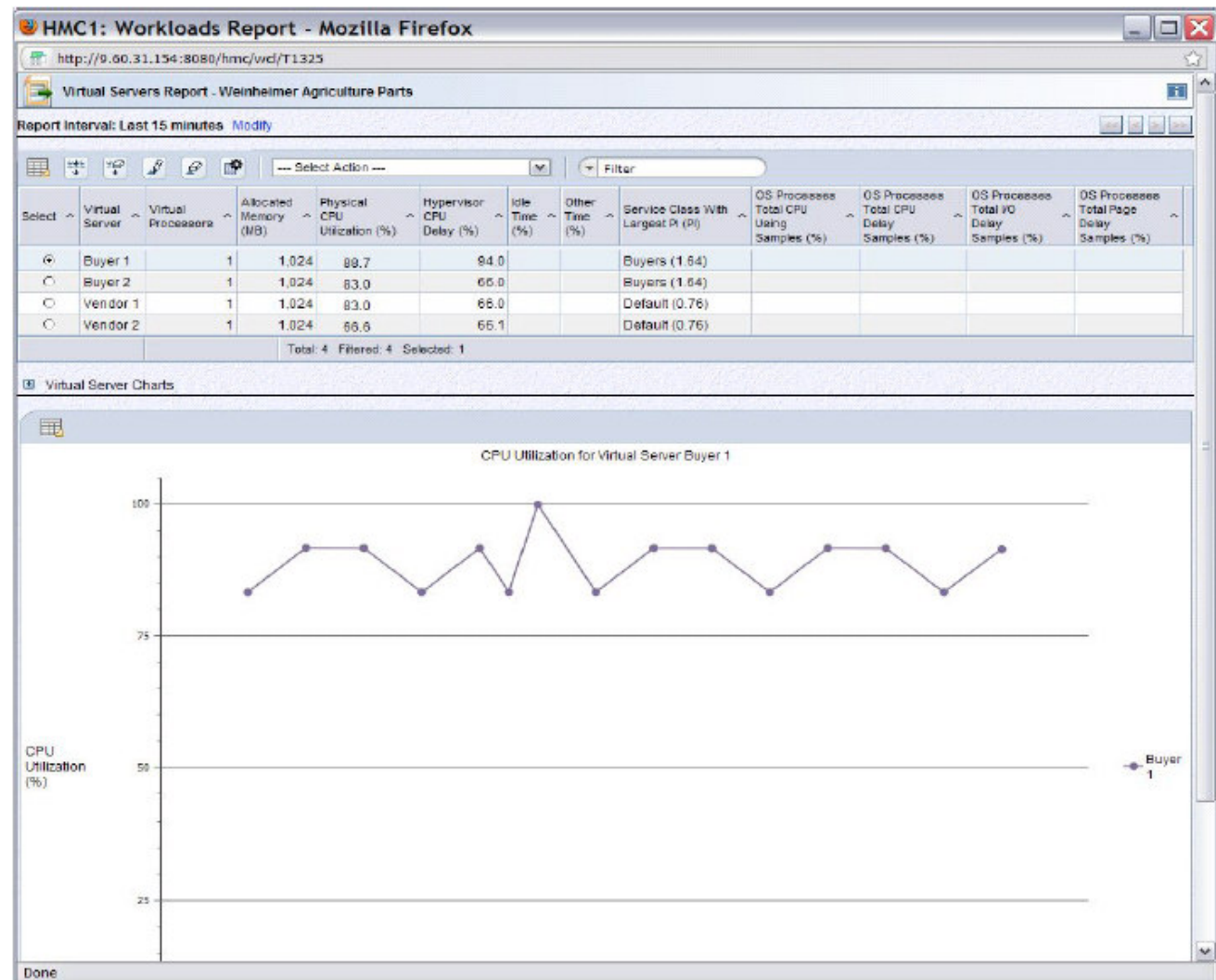
zManager – Transaction Topology and Hops Report

- Topology of virtual servers

- Transaction statistics

zManager – Managing Resources across Virtual Servers on P7 Blade and z/VM Virtual Machines
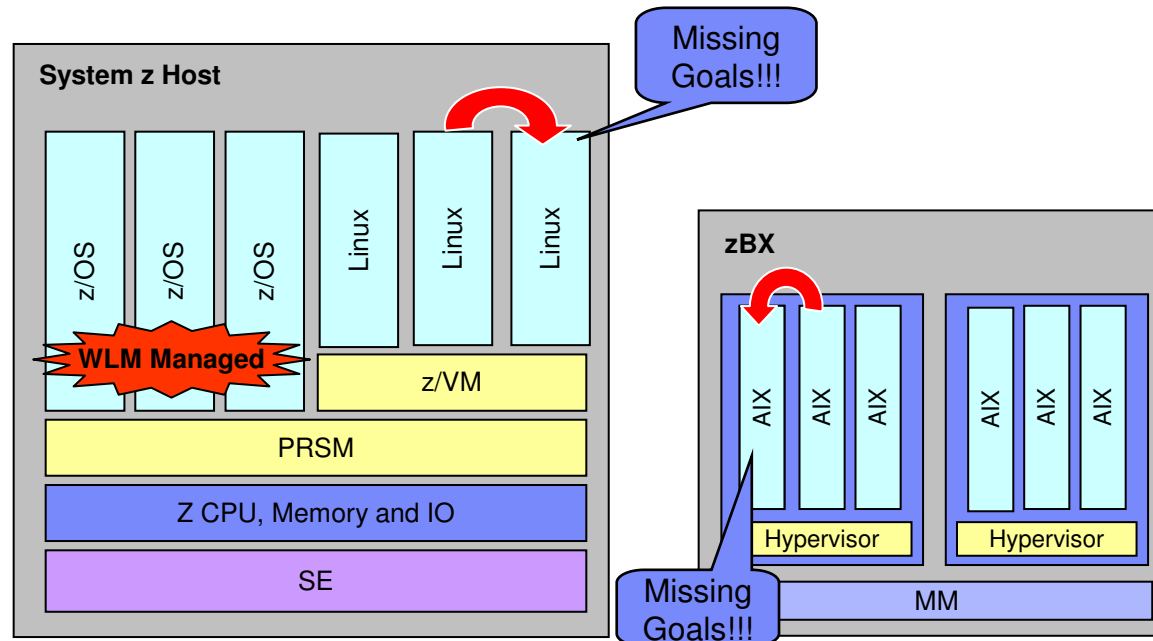
- ■ Manage resources across virtual servers to achieve workload goals
  - – Detect that a virtual server is part of Workload not achieving goals
  - – Determine that the virtual server performance can be improved with additional resources
  - – Project impact on all effected Workloads of moving resources to virtual server
  - – If good trade-off based on policy, redistribute resources
  - – Initially support CPU management

zManager – Reporting of Resource Adjustment Actions

- Resource Adjustment Report displays movement of processing capacity between service classes

Summary

- zEnterprise Unified Resource Manager provides workload awareness to optimize the system resources in accordance with understanding the policies assigned to a particular workload

- zEnterprise Platform Performance Manager extends z/OS goal oriented workload management concepts across the platform / ensemble

- Workload based goal oriented policy definition

- Monitoring and reporting in context of Workload Performance Policy

- Goal oriented resource management
  - Extending Intelligent Resource Director management across environments of the platform
  - Management functions will evolve over time