Romney White – System z Architecture and Technology
MVMUA – June 29, 2011

IBM zEnterprise System for z/VM

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Notes:

Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance ratios stated here.

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Agenda

- zEnterprise System Overview
- HMC-Based z/VM Management
- New HMC Roles
- zEnterprise Unified Resource Manager
- zEnterprise Synergy with z/VM
- Performance Management
- Conclusion

IBM zEnterprise System – Best in Class Systems and Software Technologies

A system of systems that unifies IT for predictable service delivery

Unified management for a smarter system:
zEnterprise Unified Resource Manager

- Unifies management of resources, extending IBM System z® qualities of service end-to-end across workloads
- Provides platform, hardware and workload management

Scale out to a trillion instructions per second:
IBM zEnterprise BladeCenter® Extension (zBX)

- Selected IBM POWER7® blades and IBM System x® Blades[1] for tens of thousands of AIX® and Linux applications
- High performance optimizers and appliances to accelerate time to insight and reduce cost
- Dedicated high performance private network

The world's fastest and most scalable system:
IBM zEnterprise™ 196 (z196)

- Ideal for large scale data and transaction serving and mission critical applications
- Most efficient platform for Large-scale Linux® consolidation
- Leveraging a large portfolio of z/OS® and Linux on System z applications
- Capable of massive scale up, over 50 Billion Instructions per Second (BIPS)

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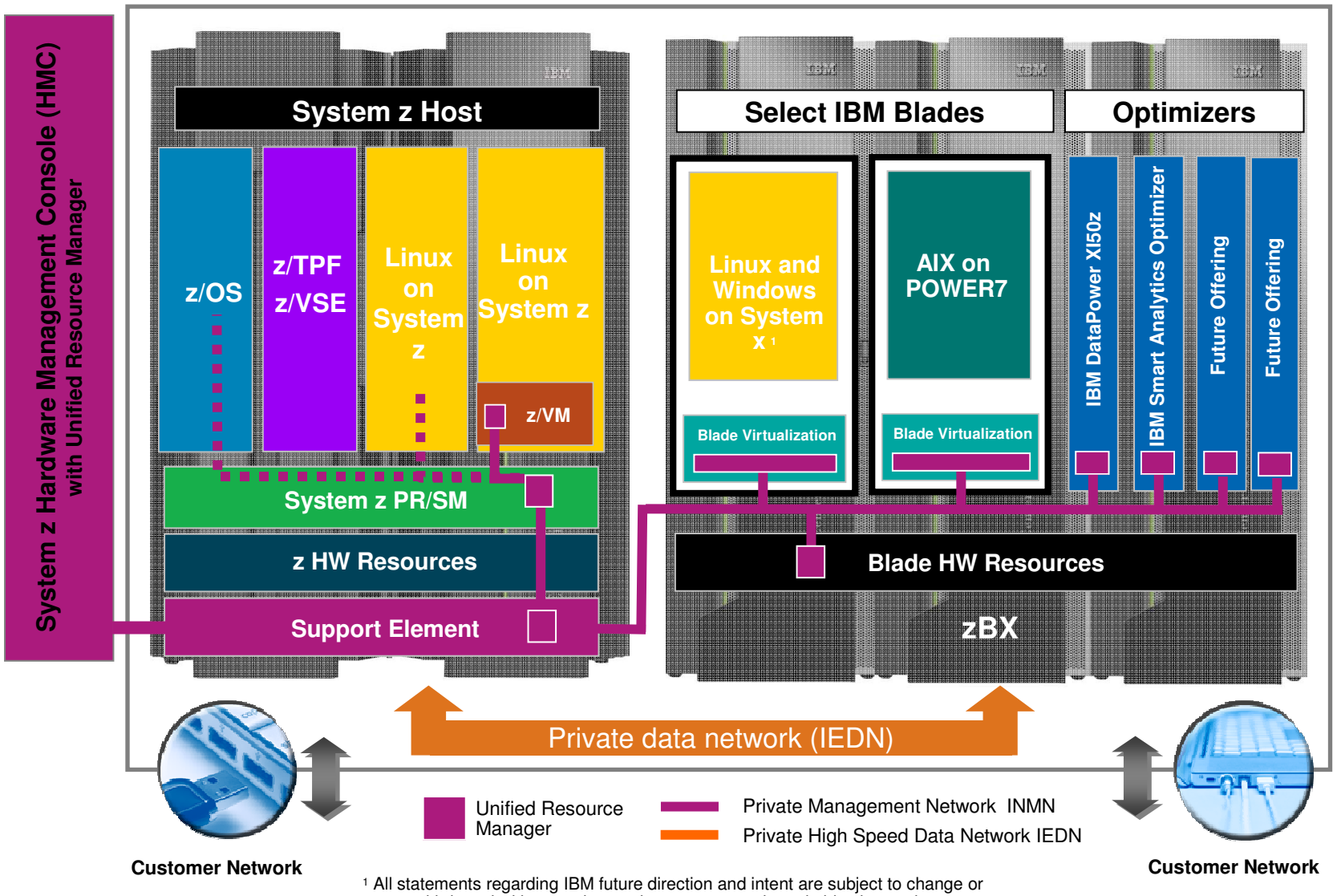
Putting zEnterprise System to the task

Use the smarter solution to improve your application design



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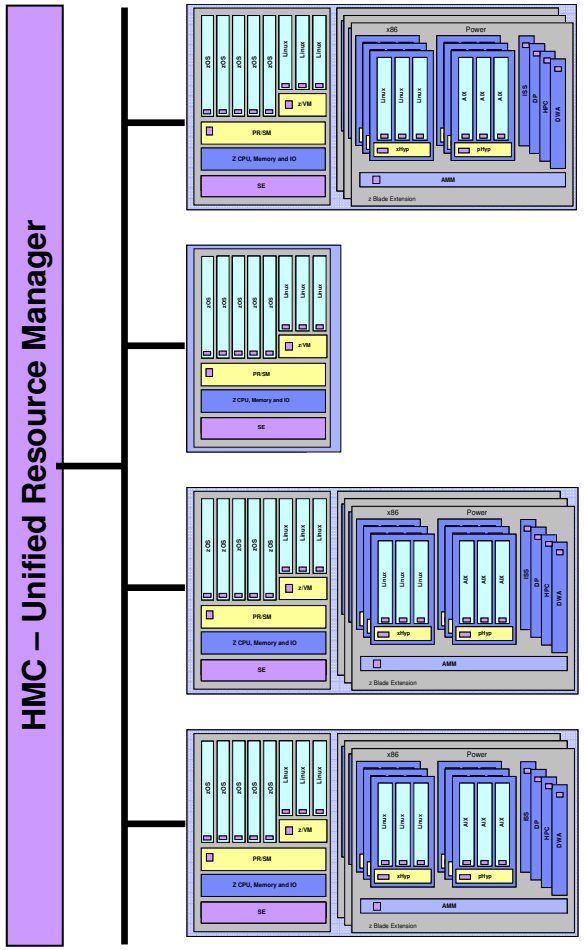
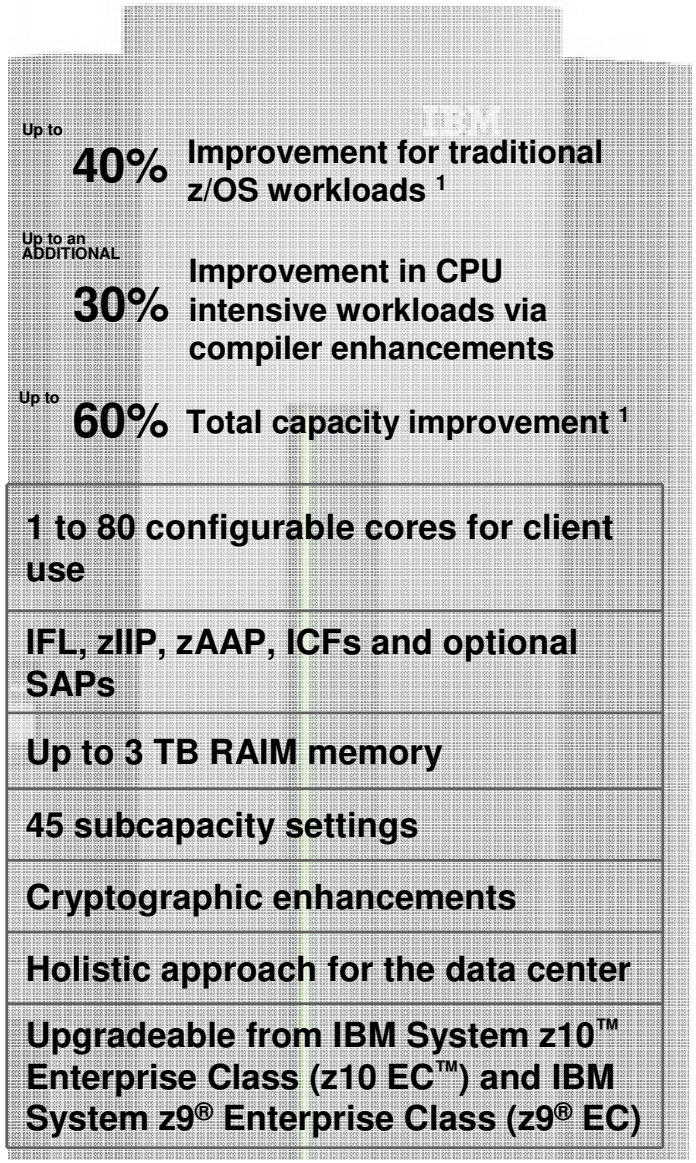
zEnterprise Ensemble

- A zEnterprise Node is a single zCEC with 0 to 4 zBX racks and up to two blade centers per rack
- A zEnterprise Ensemble is a collection of 1 to 8 zEnterprise Nodes managed as a single virtualized pool of server resources
- A zEnterprise node can be a member of a single ensemble
- An ensemble is the management scope for the Unified Resource Manager
- A primary / alternate pair of HMCs provides the management console for the ensemble
  - The alternate HMC takes over in case the primary fails



The Value Begins At the Heart of z196 …



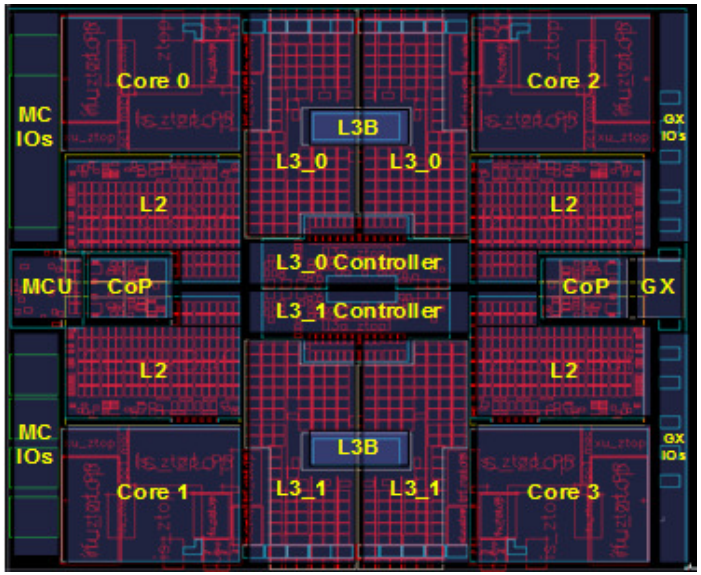
zEnterprise 196 (z196)
Machine Type: 2817
Models: M15, M32, M49, M66, M80

- **Improved connectivity**
  - One to four books
  - Hot pluggable I/O drawer
  - InfiniBand Coupling links
- **Focus on the environment**
  - Options to help eliminate hotspots and save on energy
  - Static power savings
  - Query maximum potential power
  - Leadership technology for cooling and power distribution
- **Operating System Flexibility**
  - z/OS, z/VM®, z/VSE™, z/TPF and Linux on System z
- **Security and reliability**
  - Elliptic curve cryptography
  - Concurrent patch update enhancements

[1] For average LSPR workloads running z/OS 1.11.

z196 – IBM Leadership Technology At the Core

- **New 5.2 GHz Quad Core Processor Chip boosts hardware price/performance**
  - 100 new instructions – improvements for CPU-intensive, Java™, and C++ applications
  - Over twice as much on-chip cache as System z10 to help optimize data serving environment
  - Out-of-order execution sequence gives significant performance boost for compute-intensive applications
  - Significant improvement for floating-point workloads
- **Performance improvement for systems with large numbers of cores – improves MP ratio**
- **Data compression and cryptographic processors right on the chip**



z196 – Helping to Control Energy Consumption in the Data Center

- **Better control of energy use and improved efficiency in your data center**
- **New water-cooled option allows energy savings without compromising performance**
  - Maximum capacity server has improved power efficiency of 60% compared to the System z10 and a 70% improvement with the water-cooled option
- **Save input power with optional High-Voltage DC by removing the need for an additional DC to AC inversion step in the data center**
- **Improve flexibility with overhead cabling option while helping to increase air flow in a raised floor environment**
- **z196 is same footprint as System z10 EC[1]**

[1] With the exception of water cooling and overhead cabling

… and the Value Extends To Heterogeneous Platforms …

IBM zEnterprise BladeCenter Extension (zBX) Machine Type: 2458 – Model 002

- **Integrated IBM Certified Components driven by System z order**
  - Standard parts – TOR switch, BladeCenter Chassis, Power Distribution Units, optional Acoustic Panels
- **System z support**
  - Problem reporting, hardware and firmware updates
- **Expanding operating system support for zEnterprise**
  - AIX, Linux on x86[1]
- **Simplified management**
  - Improved time to install and implement new applications
  - Central point of management for heterogeneous workloads
  - No change to applications

Optimizers
- IBM Smart Analytics Optimizer
- WebSphere® DataPower® XI50z appliance

Select IBM Blades
- BladeCenter PS701 Express
- IBM x86[1]

One to four – 42u racks – capacity for 112 blades
No System z software running in zBX – Passport Advantage software licensed to blades
No MIPS/MSU rating
Configured for high availability
Optional rear door heat exchanger

… managed by the zEnterprise Unified Resource Manager

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zBX … Infrastructure to Support More Resources

- **zBX houses the multiplatform solutions key to the zEnterprise System**
  - Optimizers that are dedicated to workloads
    - IBM Smart Analytics Optimizer and WebSphere DataPower XI50z appliance
    - Closed environments with hardware and software included in solution
    - Individualized tools for sizing and customizing – dependent on the optimizer
  - Select IBM POWER7 and System x[1] blades – running *any* application supported by the operating system installed on the blade – with no change
  - Mix Smart Analytics Optimizer with POWER7 and System x blades in same rack
  - Mix XI50z with POWER7 and System x blades in same BladeCenter chassis
  - zBX is a System z machine type for integrated fulfillment, maintenance, and support
- **Secure network connection between zBX and z196 for data and support**
  - Fast 10 Gb Ethernet connection to the data
  - Less latency – fewer 'hops' to get to the data and no need for encryption / firewall
  - Traffic on user networks not affected
- **Sharing of resources – up to eight z196 servers can attach to the zBX and have access to solutions**
- **Configuration, support, monitoring, management – all by Unified Resource Manager**

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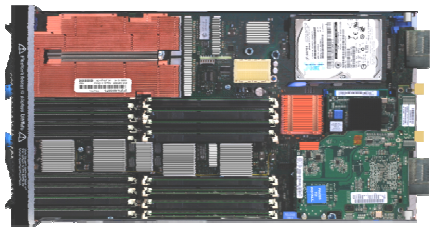
IBM POWER7 and System x[1] Blades

General purpose processors under one management umbrella

What is it?

The zBX infrastructure can host select IBM POWER7 and System x blades. Each blade comes with an installed hypervisor that offers the possibility of running an application that spans z/OS, Linux on System z, AIX on POWER®, or Linux and Windows on System x (SOD) [1] but have it under a single management umbrella.



How is it different?

- **Complete management:** Advanced management brings operational control and cost benefits, improved security, workload management based on goals and policies
- **Virtualized and Optimized:** Virtualization means fewer resources are required to meet peak demands with optimized interconnection
- **Integrated:** Integration with System z brings heterogeneous resources together that can be managed as one
- **Transparency:** Applications certified to run on AIX, Linux, and Windows will also be certified and run on blades without changes to deployed guest images
- **More applications:** Brings larger application portfolio to System z

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IBM Smart Analytics Optimizer

Capitalizing on breakthrough technologies to accelerate business analytics

What is it?

The IBM Smart Analytics Optimizer is a workload optimized, appliance-like, add-on, that enables the integration of business insights into operational processes to drive winning strategies. It accelerates select queries, with unprecedented response times.

How is it different?

- **Performance:** Unprecedented response times to enable 'train of thought' analyses frequently blocked by poor query performance
- **Integration:** Connects to DB2® through deep integration providing transparency to all applications
- **Self-managed workloads:** Queries are executed in the most efficient way
- **Transparency:** Applications connected to DB2, are entirely unaware of IBM Smart Analytics Optimizer
- **Simplified administration:** Appliance-like hands-free operations, eliminating many database tuning tasks

Faster insights for enabling new opportunities

WebSphere DataPower XI50z Appliance

Purpose-built hardware for simplified deployment and hardened security

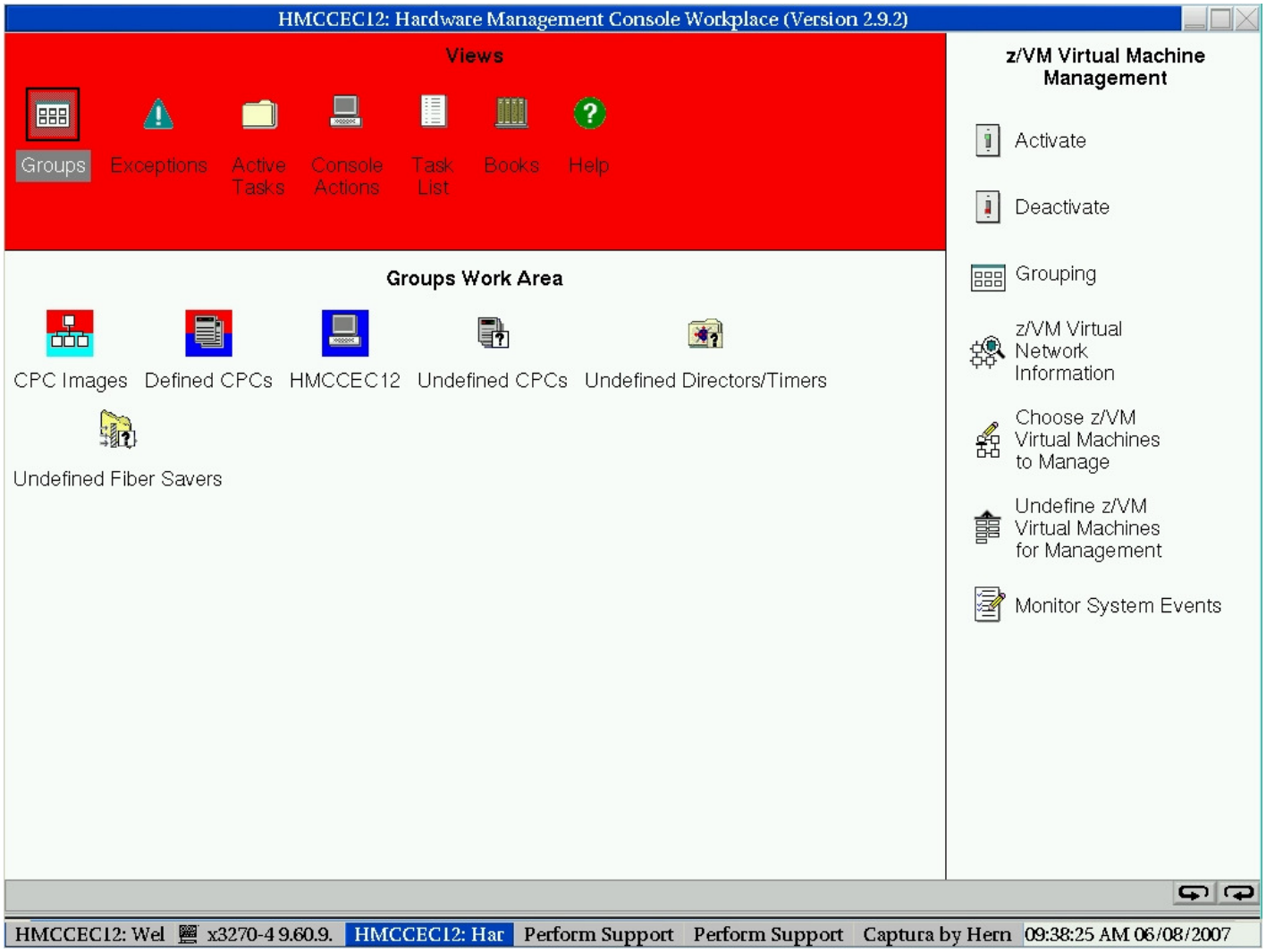
What is it?

The IBM WebSphere XI50z DataPower appliance integrated in the zEnterprise System can help simplify, govern, and enhance the security of XML and IT services by providing connectivity, gateway functions, data transformation, protocol bridging, and intelligent load distribution.

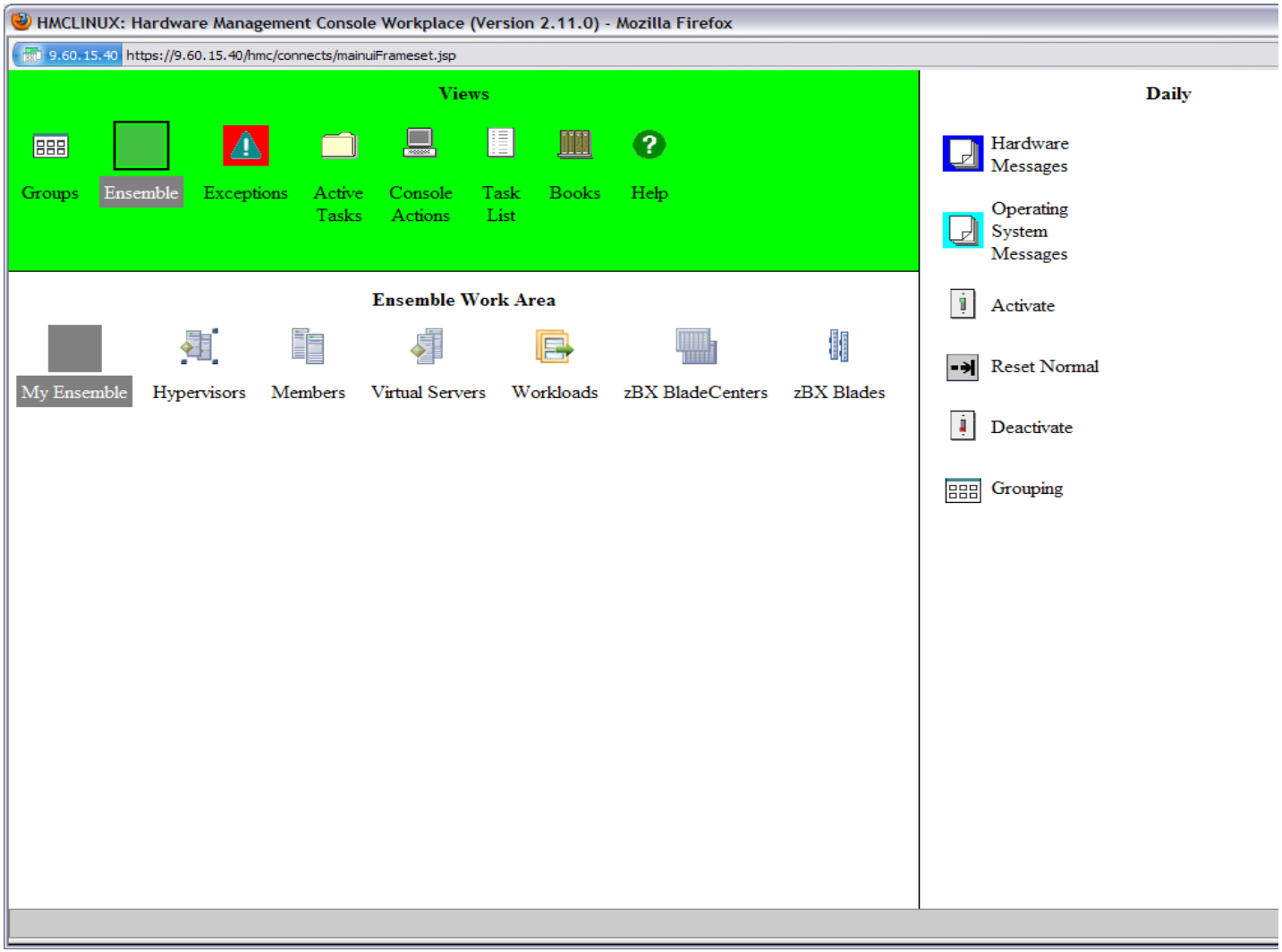
How is it different?

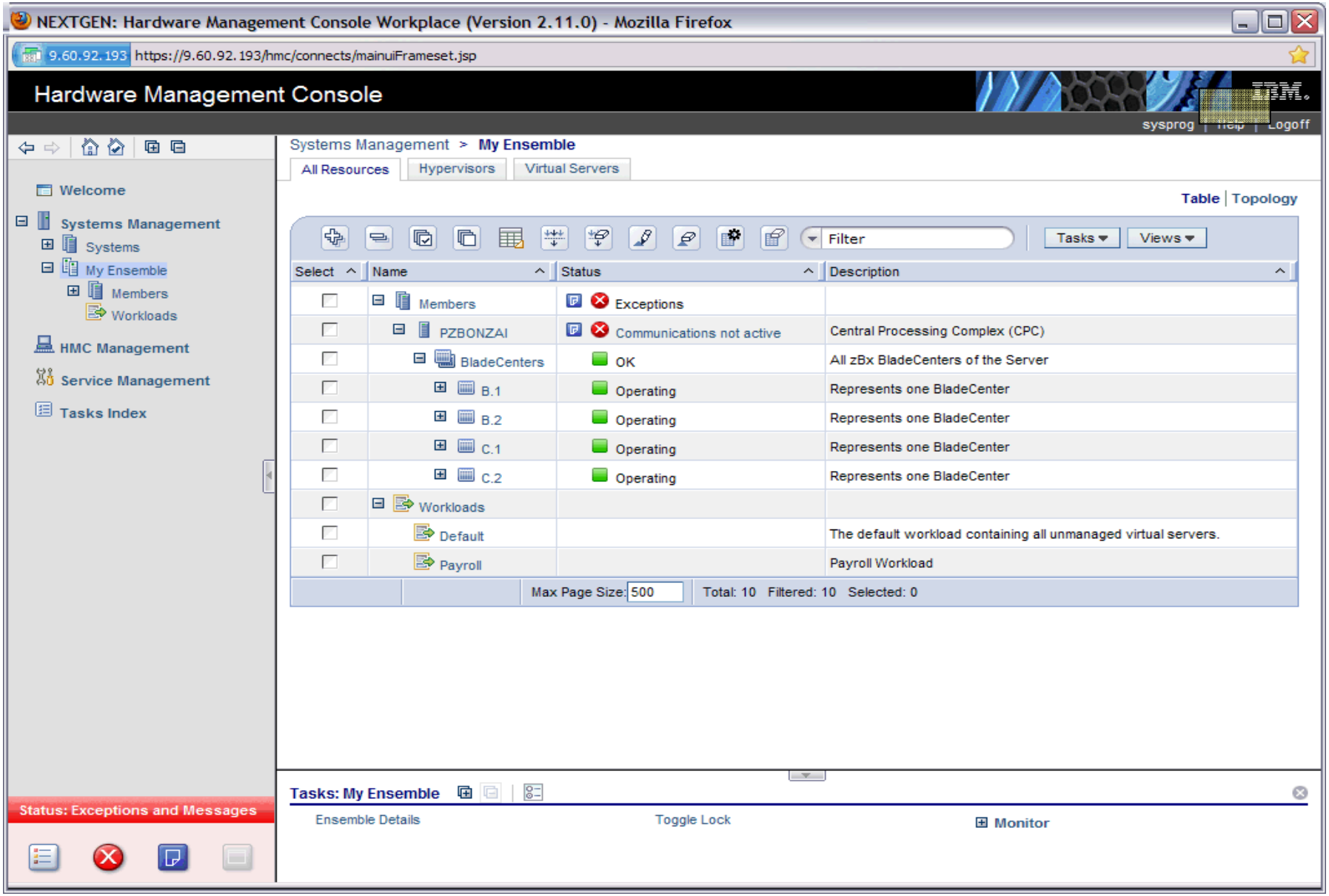
- **Security:** VLAN support provides enforced isolation of network traffic with secure private networks and integration with RACF® security
- **Improved support:** Monitoring of hardware with “call home” for current/expected problems and support by System z Service Support Representative
- **System z packaging:** Increased quality with pre-testing of blades and zBX; upgrade history available to ease growth; guided placement of blades to optimize
- **Operational controls:** Monitoring rolled into System z environment from single console; time synchronization with System z; consistent change management with Unified Resource Manager

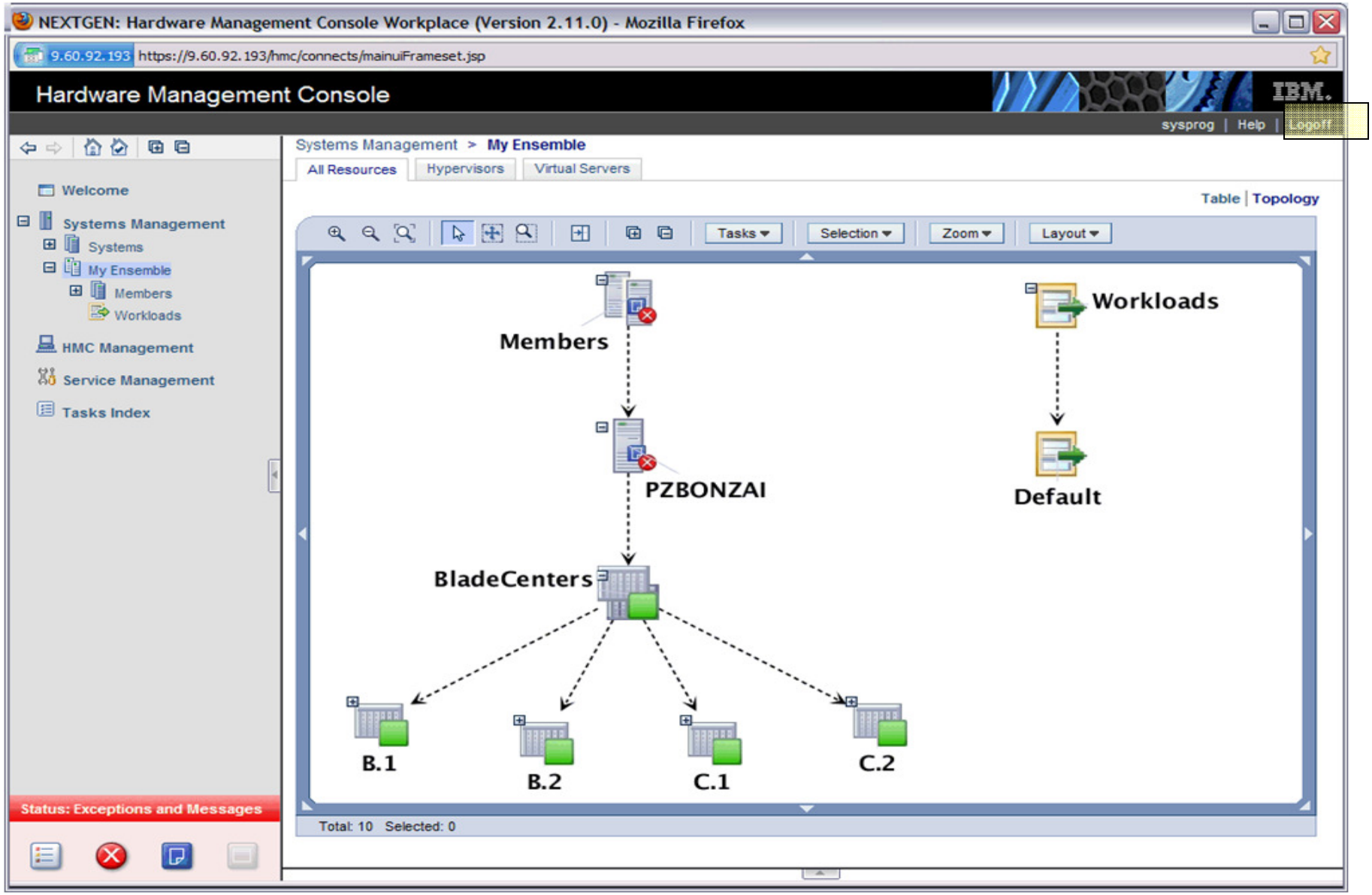
System z10 HMC-Based z/VM Management



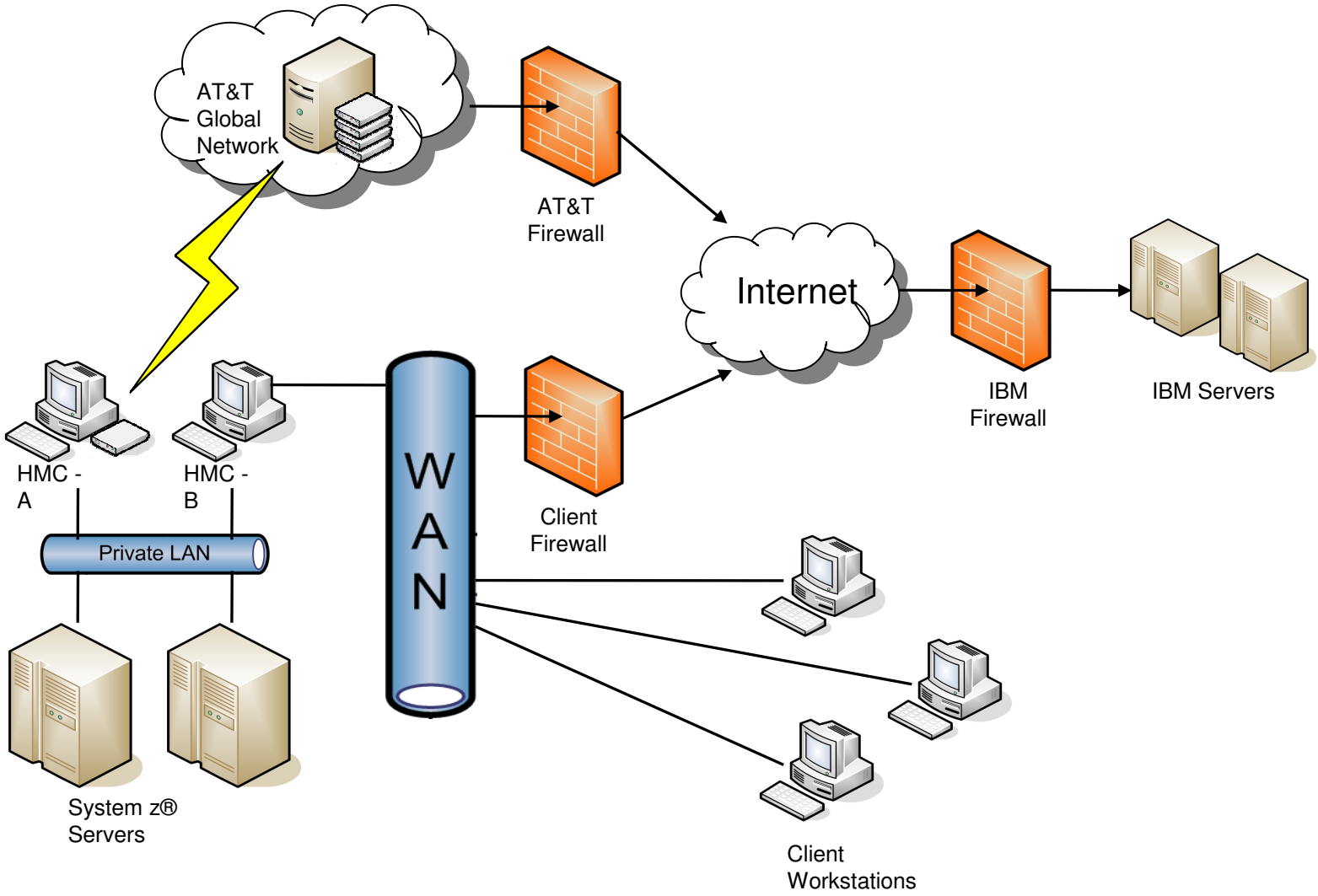
zEnterprise HMC-Based z/VM Management







HMC Connectivity



HMC Security Infrastructure

- Hardware Management Console (HMC) extended to support new management roles
  - Secure SSL based remote access (optional)
  - Full complement of certificate management capabilities
  - Complete user management suite
  - Full-function user definition
  - Highly flexible password rule definition
  - Centralized authentication using LDAP
  - Complete access controls for tasks and resources allowed for each user (i.e., User Roles)
  - Automatic replication of configuration data
  - Full-function embedded firewall

Ensemble Management Users and Roles

- New task and resource roles enable isolation across management disciplines
- New predefined users EnsOperator and EnsAdmin

Role	Description
Ensemble Administrator	**Responsible for creating and managing the zGryphon ensemble** **Create Ensemble, Add Member…**
Virtual Network Administrator	**Responsible for Managing Virtual Networks, Hosts, and MAC Prefixes** **Manage Virtual Networks, Add Hosts to Virtual Networks, Create VLAN IDs…**
Virtual Server Administrator	**Responsible for managing virtual servers** **New /Modify Virtual Server, Add Virtual Disk, Migrate…**
Virtual Server Operator	**Responsible for performing and scheduling virtual server activation/deactivation, mounting virtual media** **Activate, Deactivate, Mount Virtual Media, Console session…**
Storage Resource Administrator	**Responsible for managing storage resources – Storage Access Lists, WWPNs, z/VM Storage Groups** **Export WWPN, Import SAL, Add Storage Resources…**
Workload Administrator	**Responsible for managing workloads** **New /Modify workload, Add / Remove Virtual Servers..**
Performance Management Administrator	**Responsible for managing performance policies** **New /Modify performance policy, Import policy**
Performance Management Operator	**Responsible for performing and scheduling policy activations and creating threshold notifications** **Activate, Export Policy, Monitor System Events**
Energy Management Administrator	**Responsible for managing power settings including power capping and power savings** **Set Power Cap, Set Power Savings Mode, Set zBX Power Policy**

zEnterprise Unified Resource Manager

Transforming the way resources are managed and deployed

What is it?

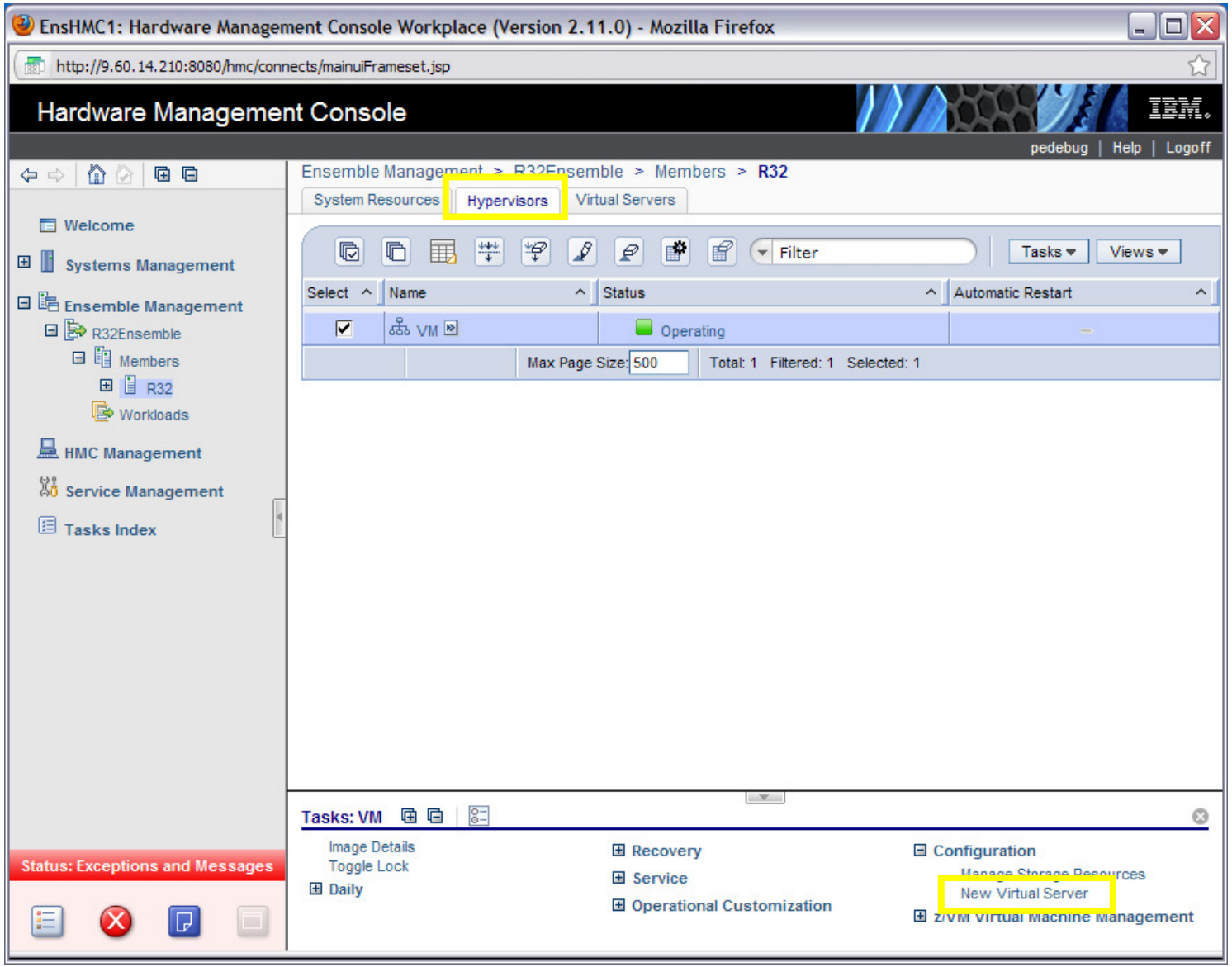
*Unified Resource Manager provides **workload awareness** to optimize the system resources in accordance with understanding the policies assigned to that particular workload. Functions are grouped into two suites of tiered functionality that enable different levels of capability - Manage suite and Automate suite.*

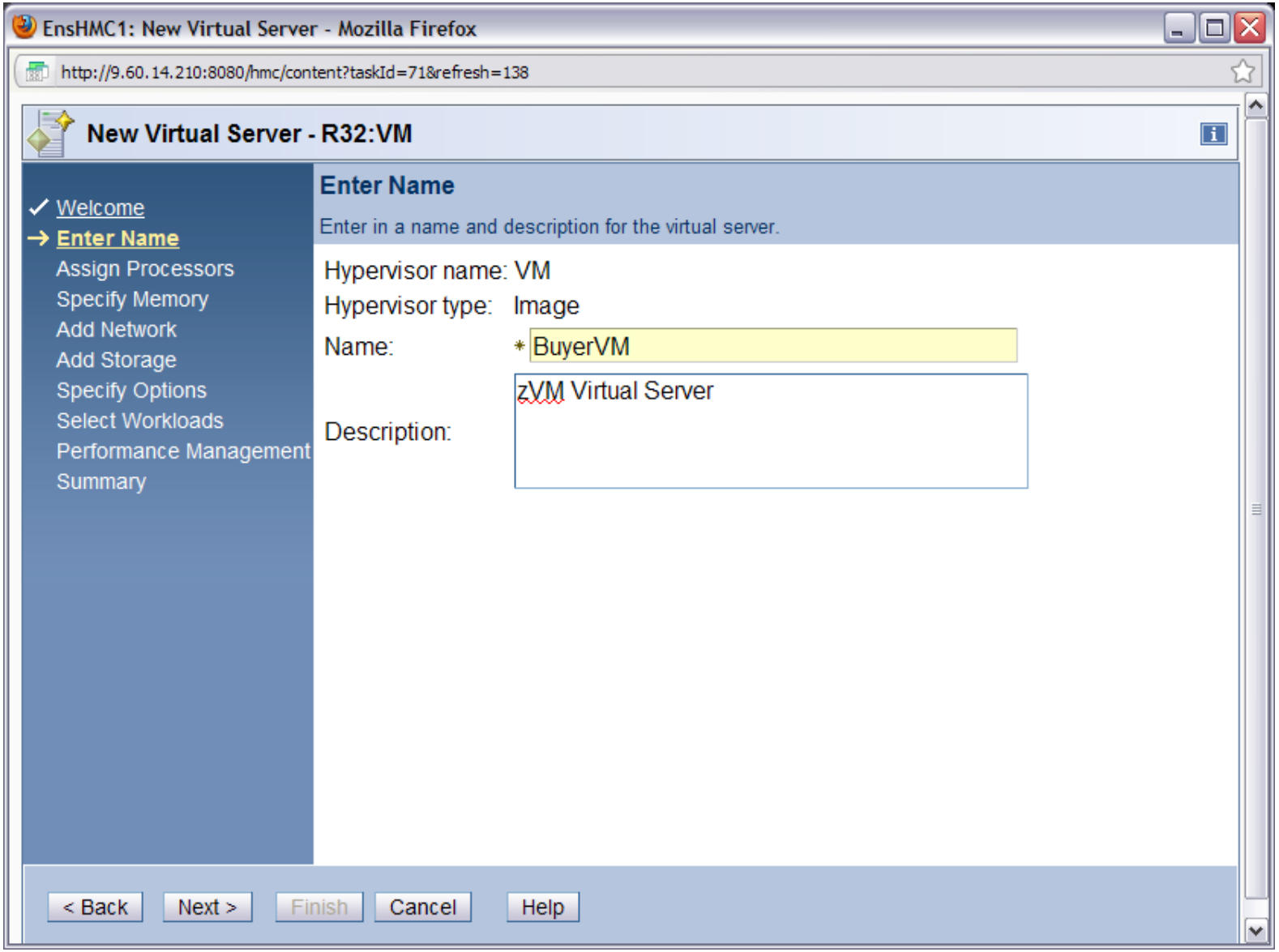
How is it different?

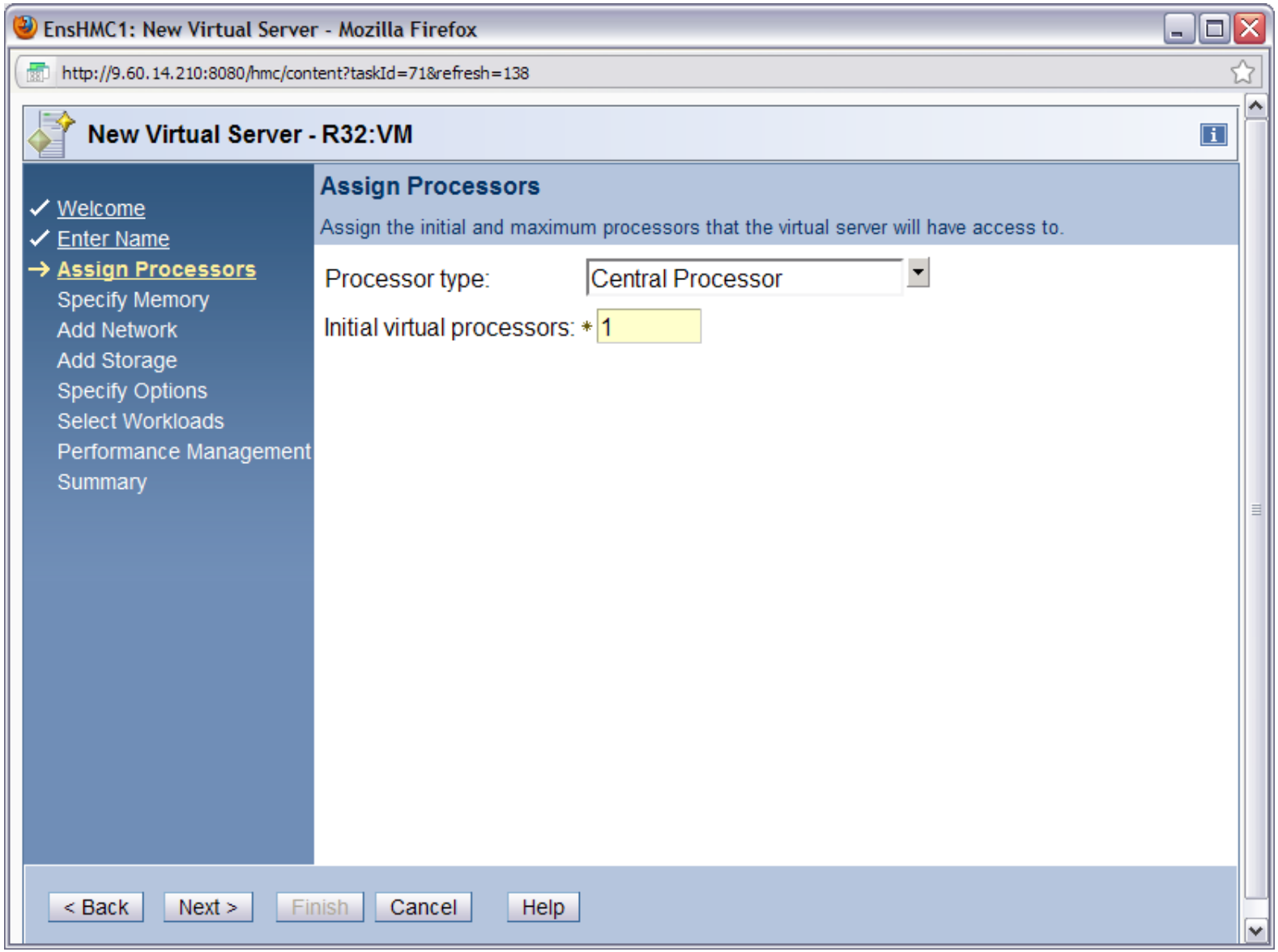
- **Heterogeneous management:** Total systems management across heterogeneous resources
- **Integration:** Single point of control, common skills for resources, reduced complexity of day to day operations
- **Monitoring.** New dashboard for CPU resources and energy management
- **Simplified installation:** 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:** **H**ardware problem detection, reporting and call home supported for virtual machines and blades

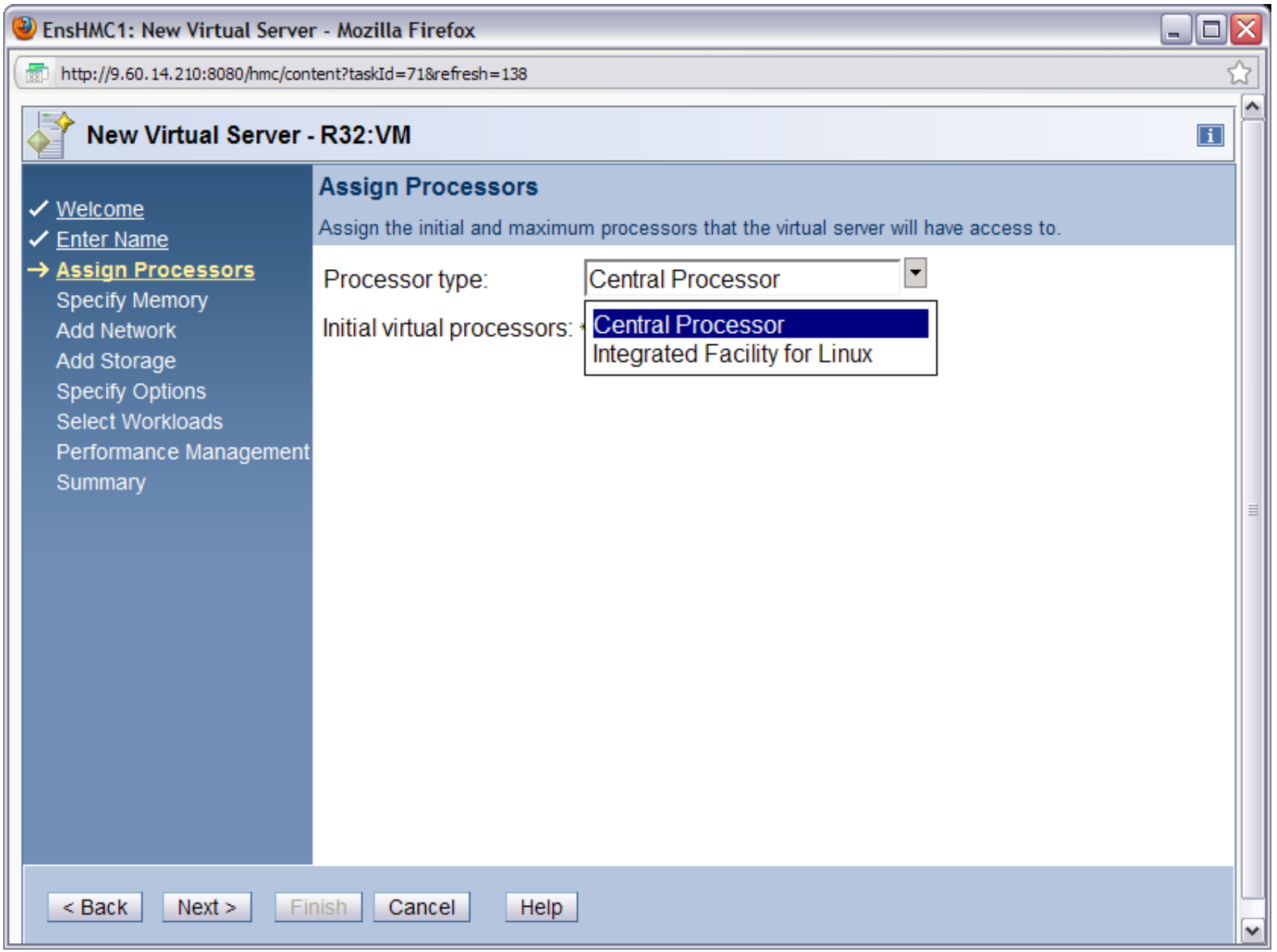
Use Cases

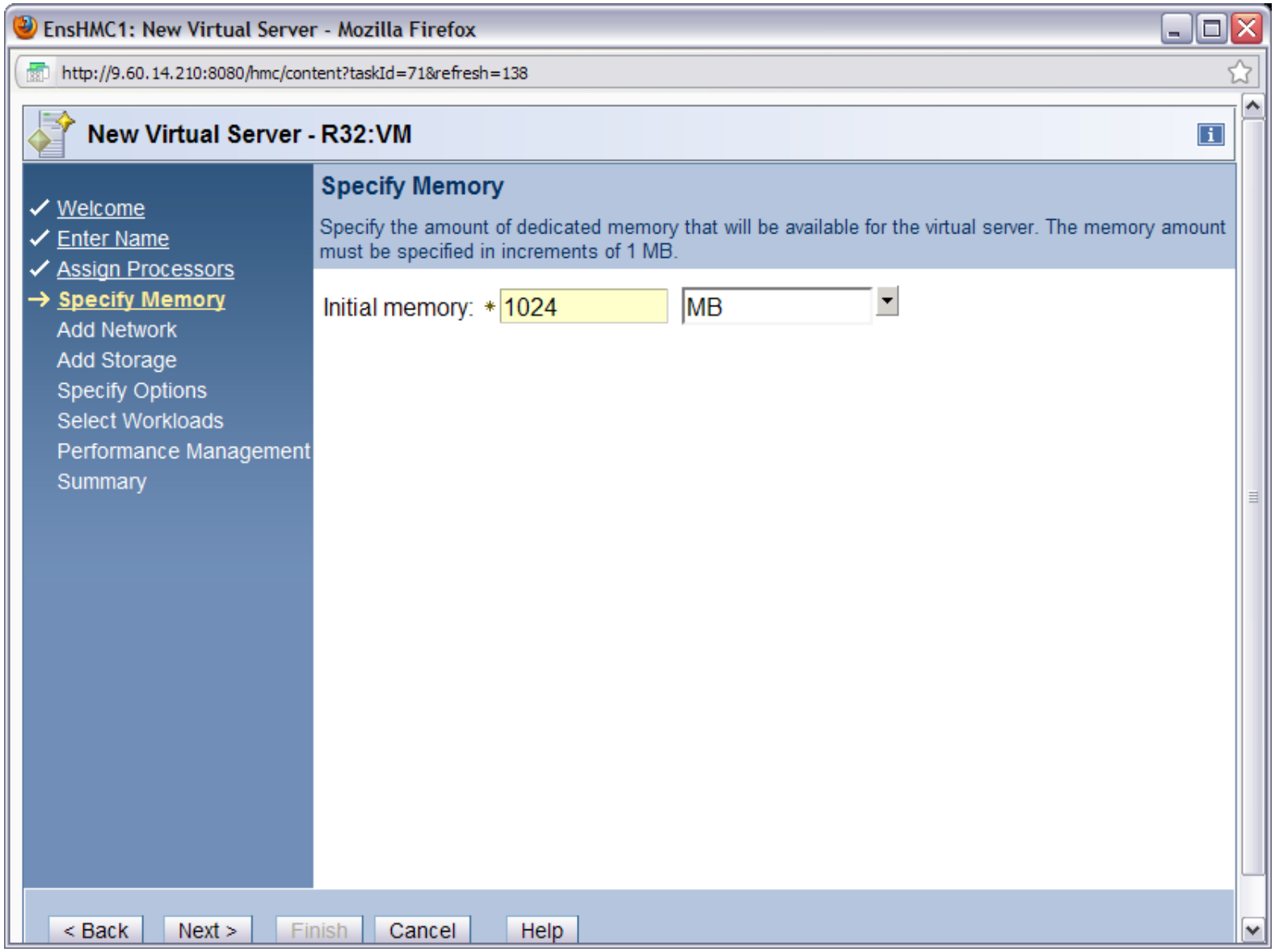
- New virtual server
- Virtual server details
- Create virtual network
- Associate virtual server with virtual network

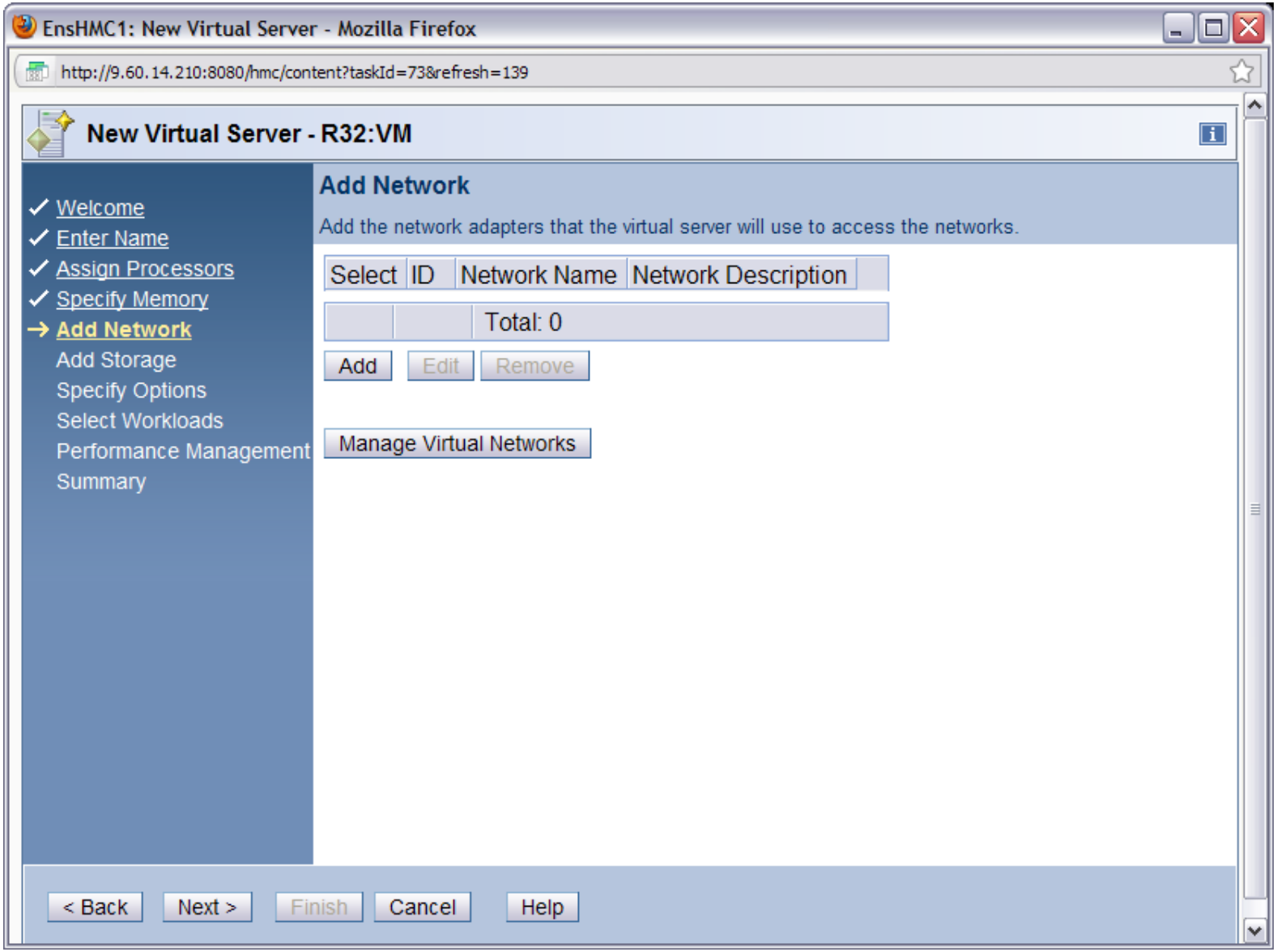


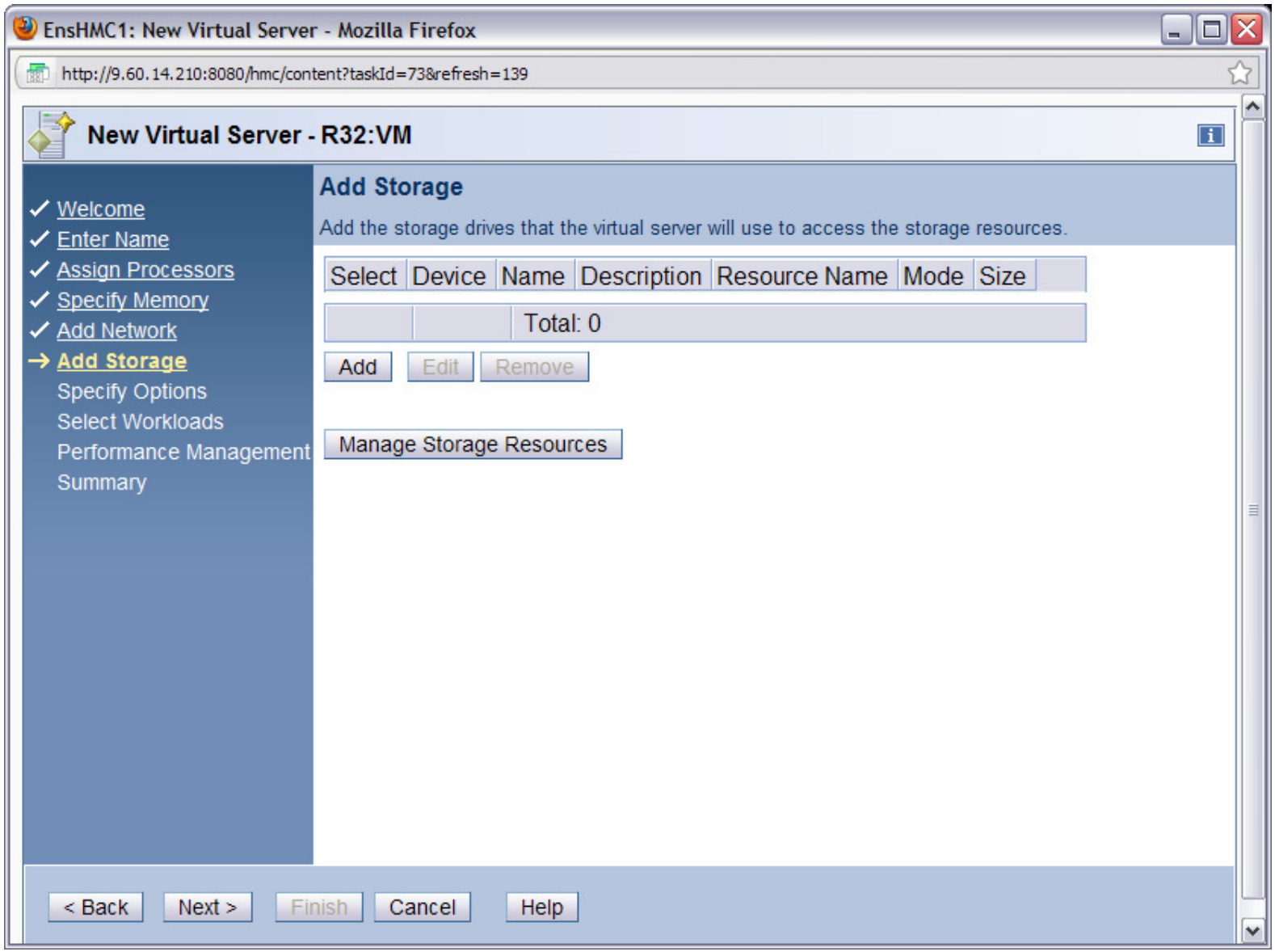


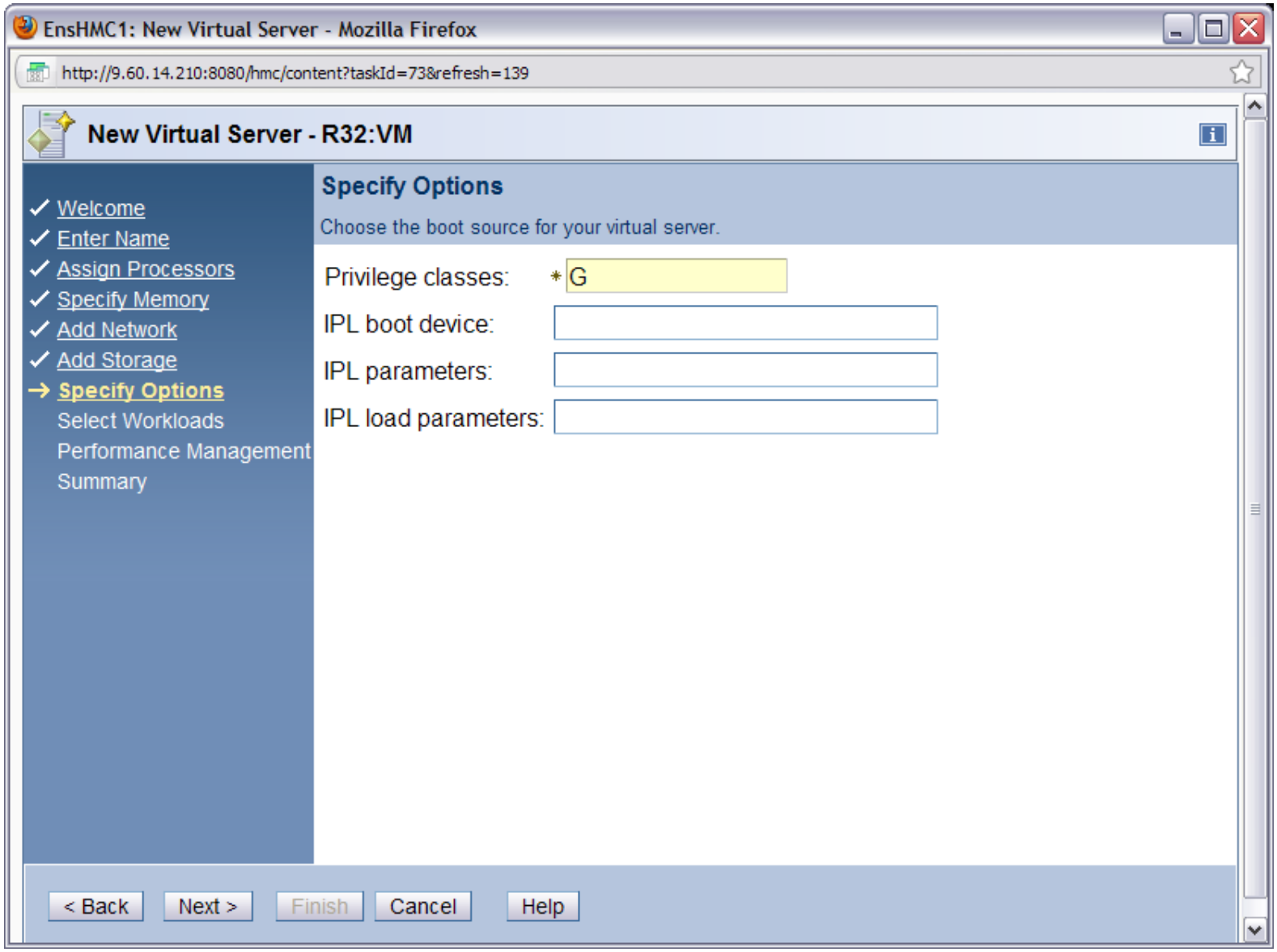


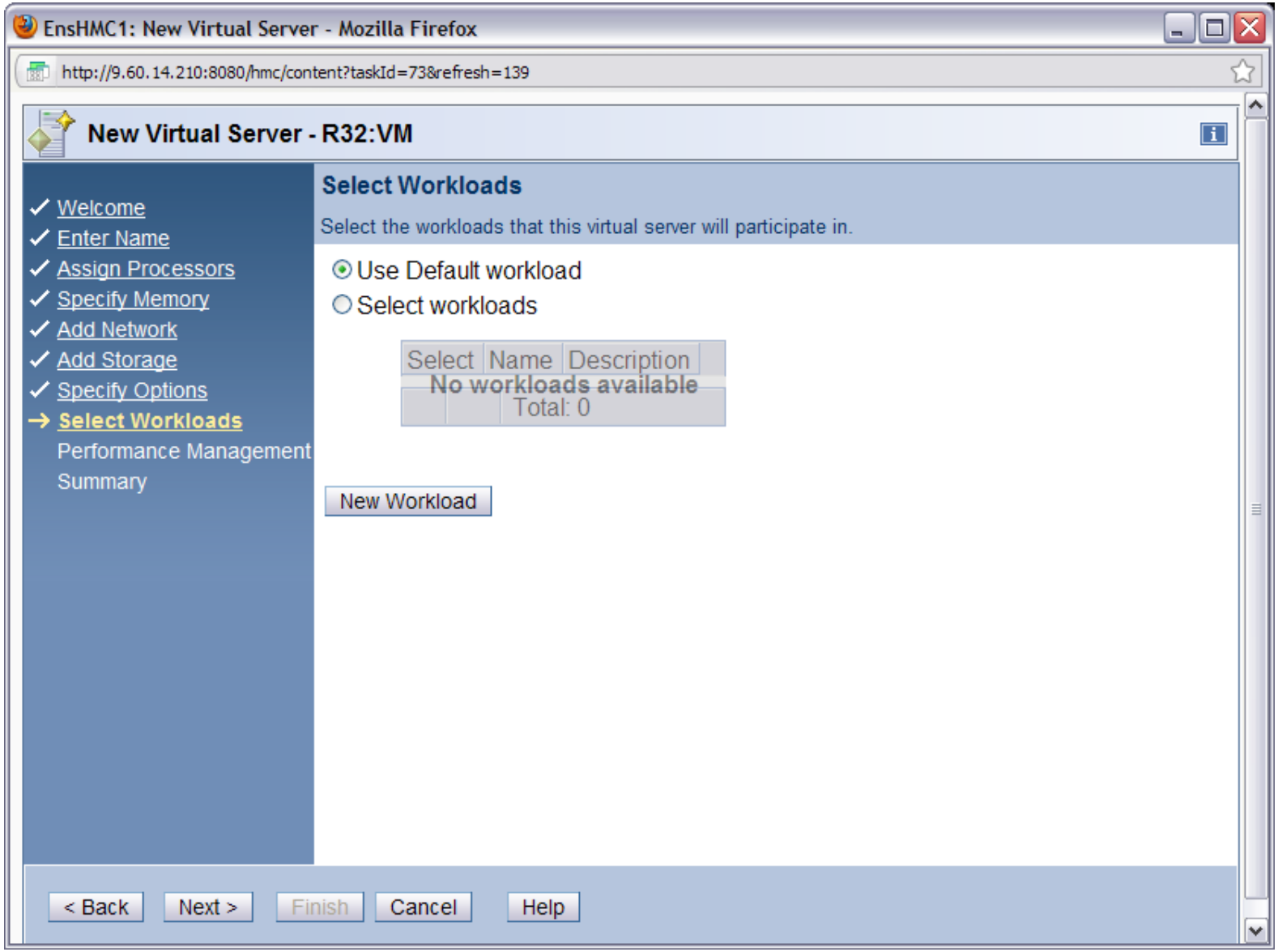


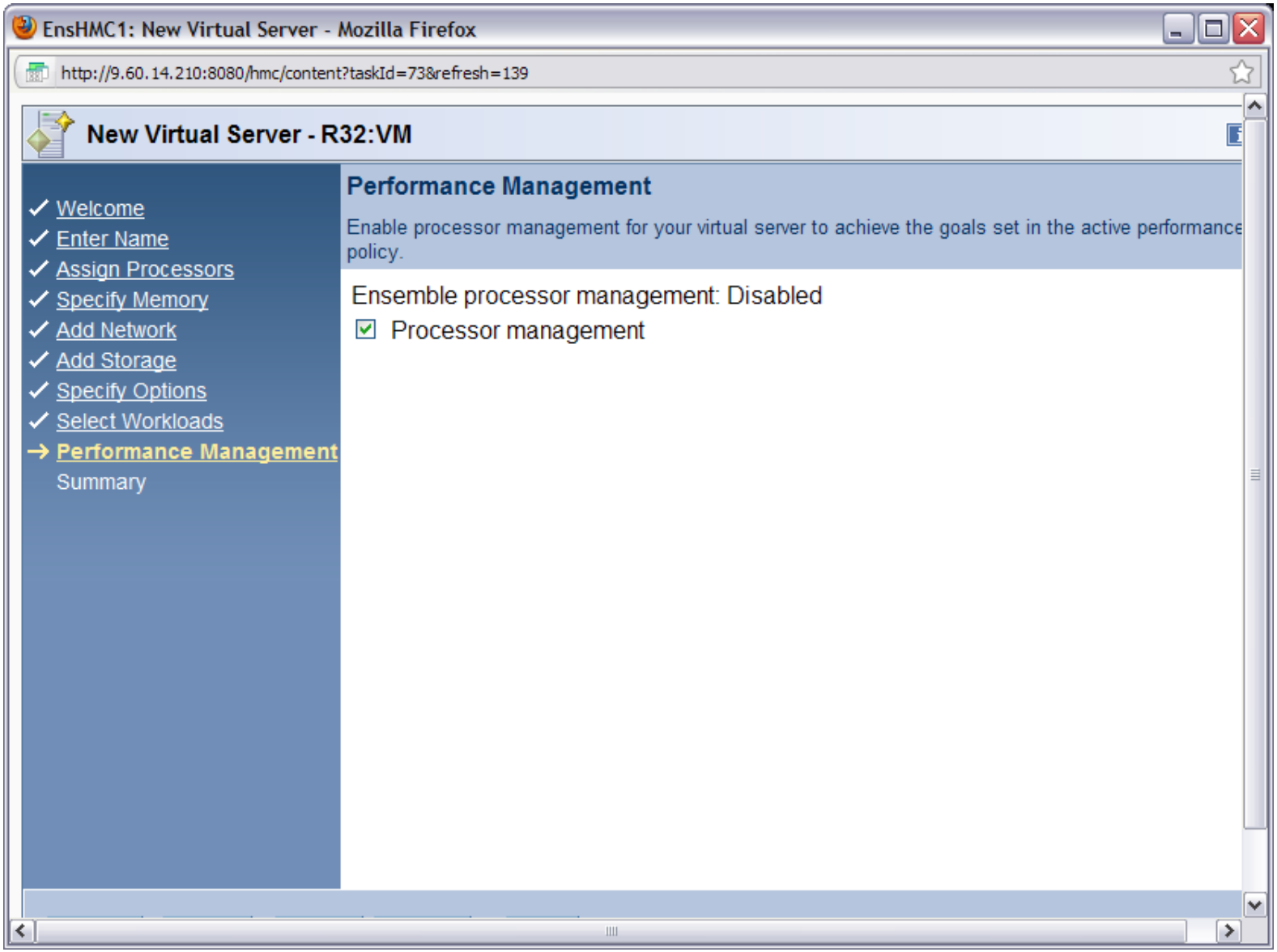


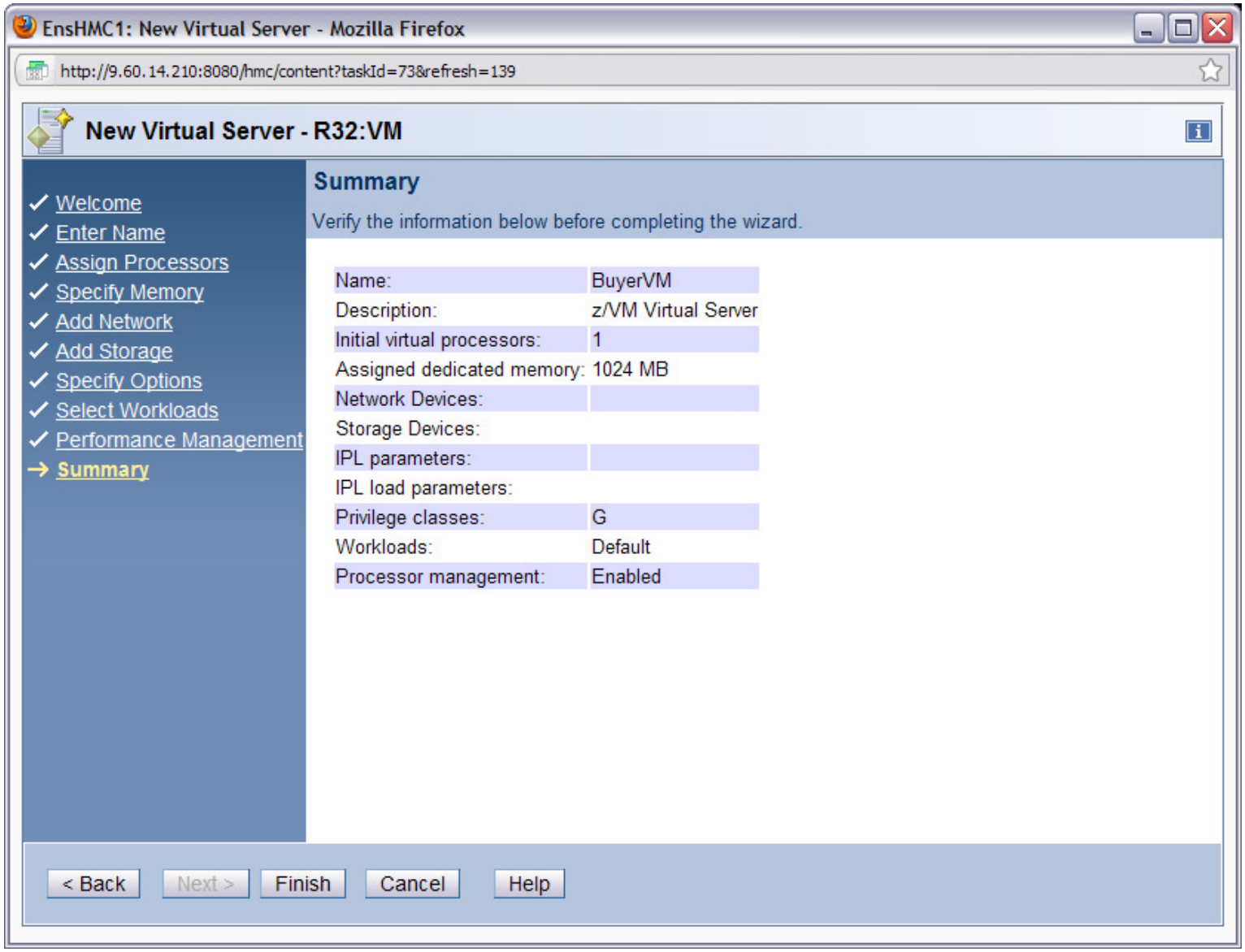


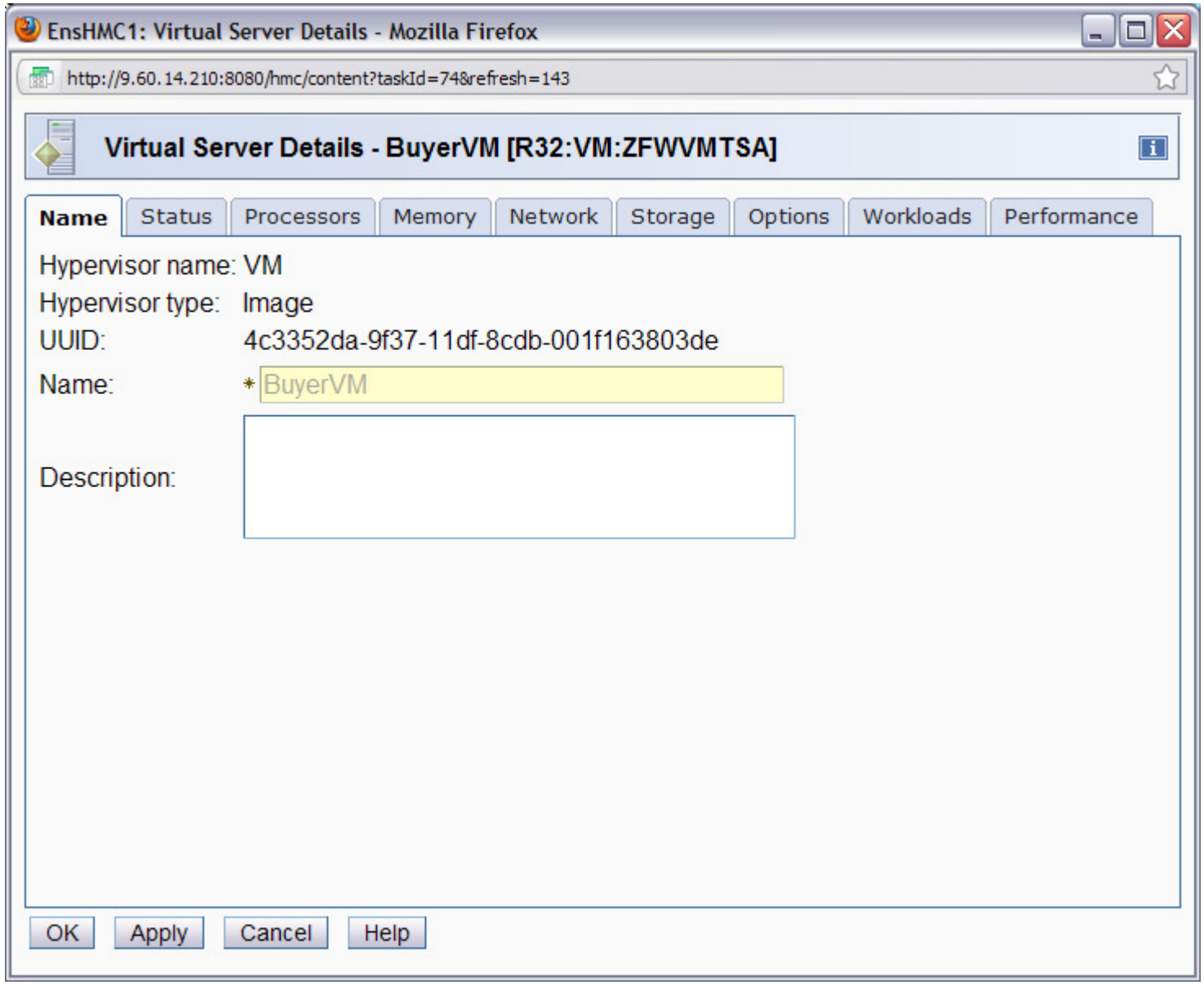


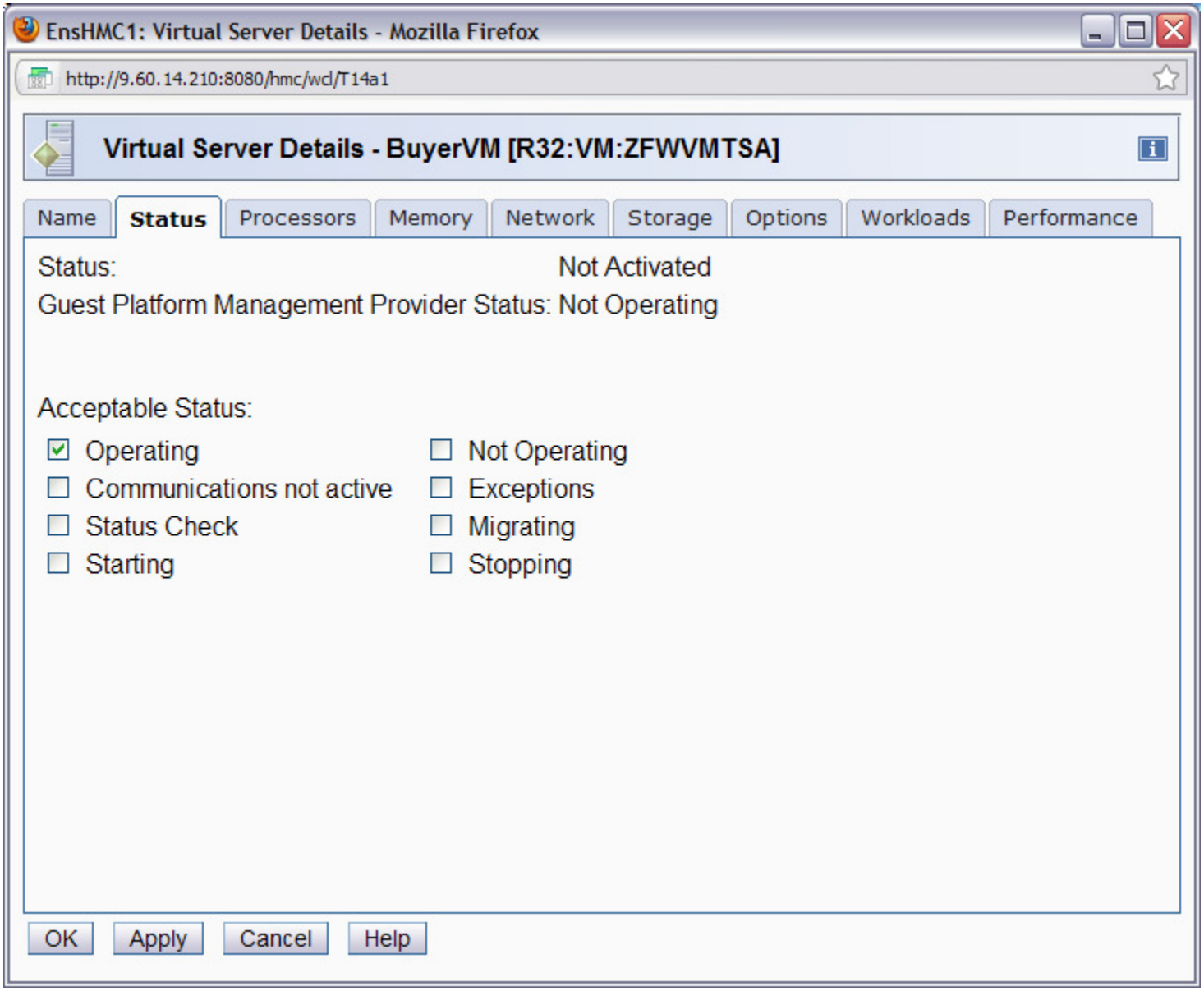


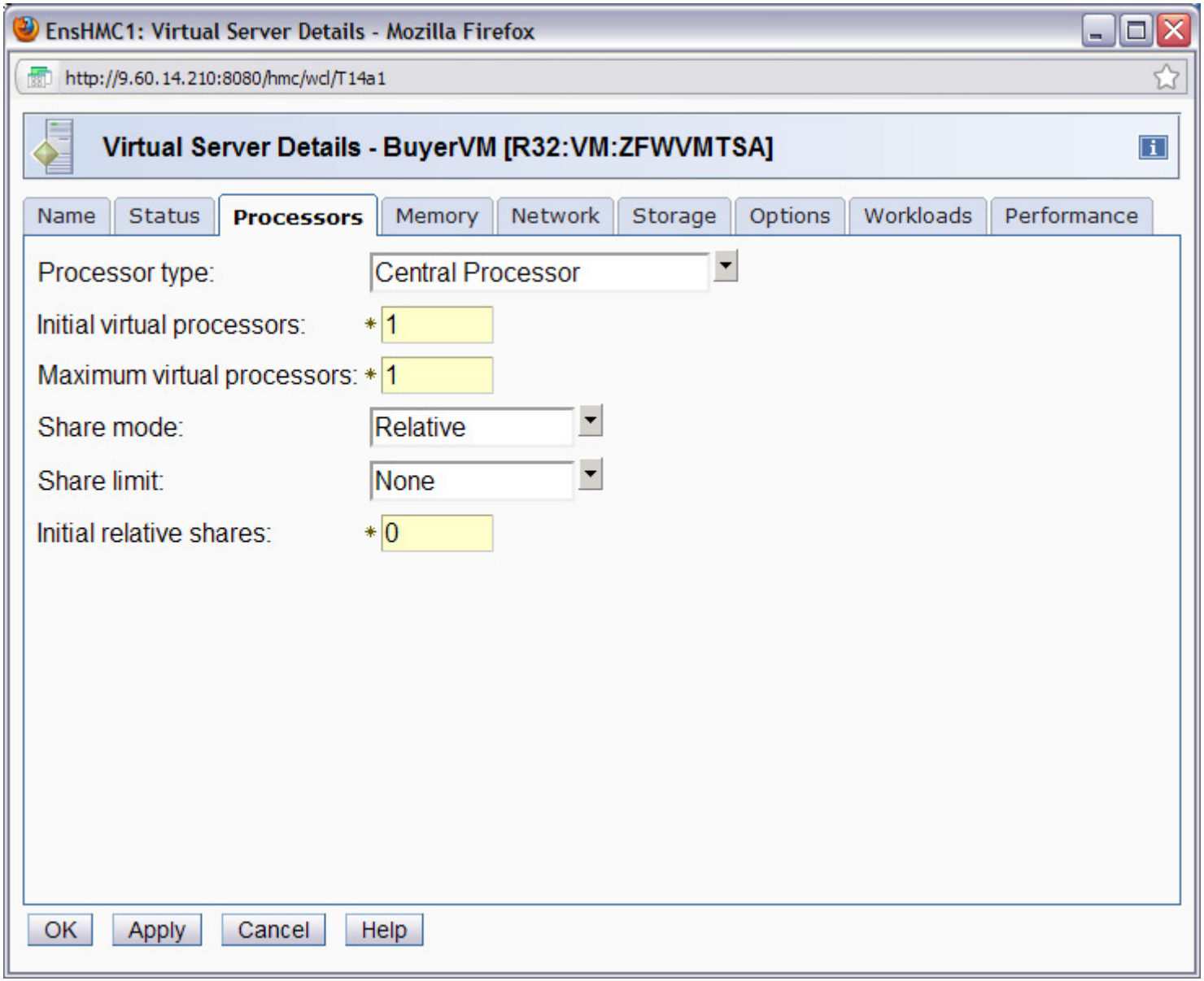


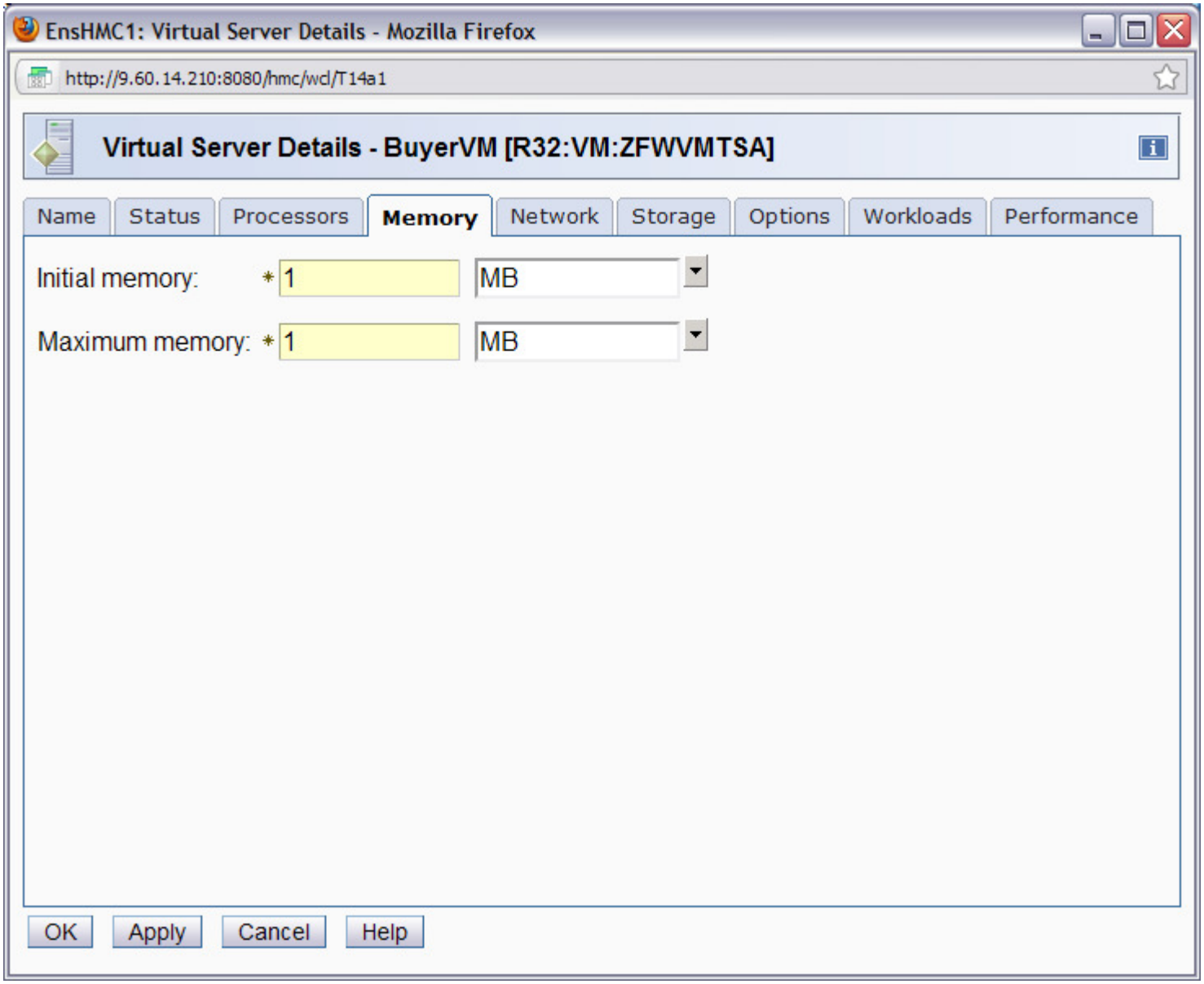


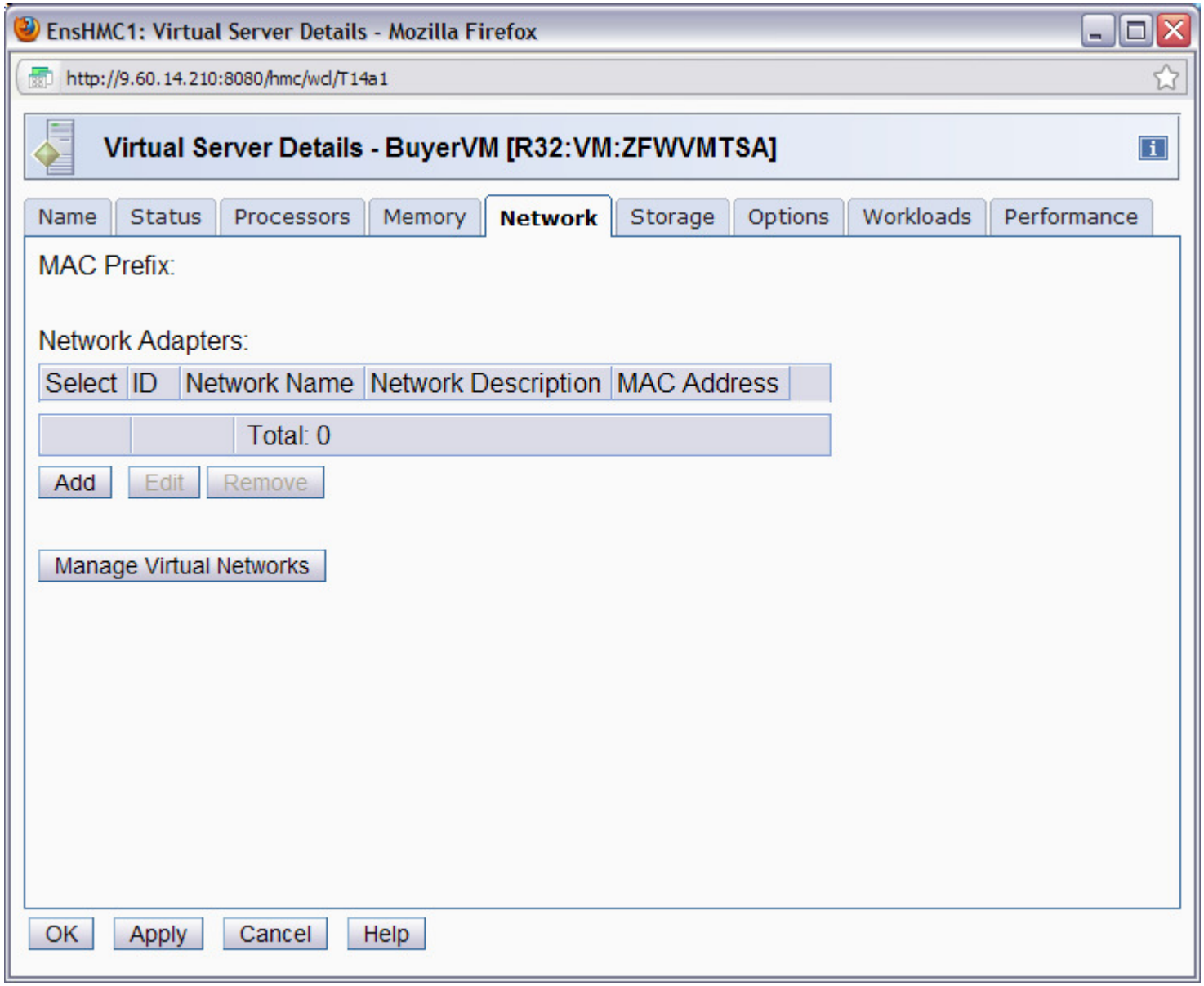


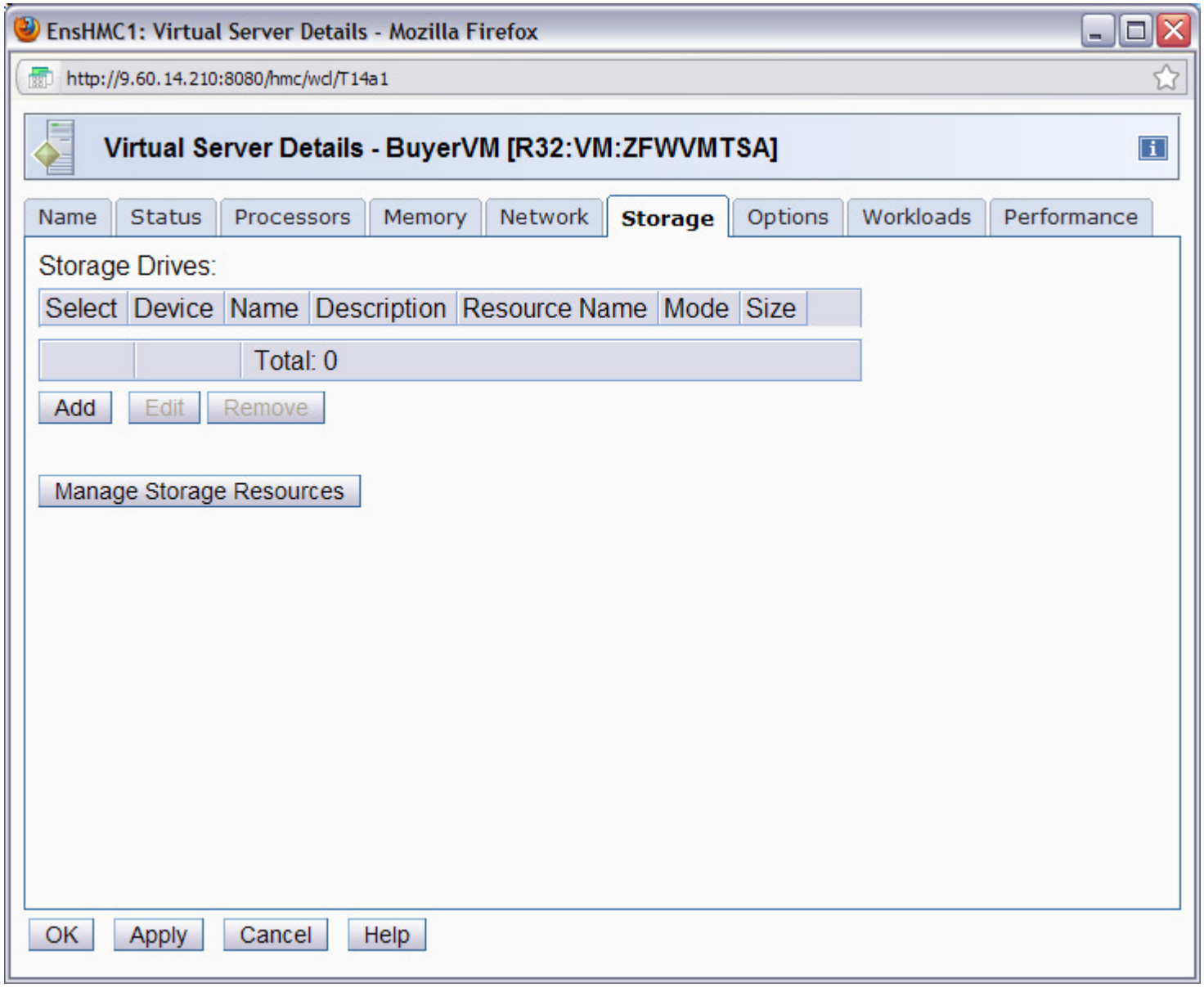


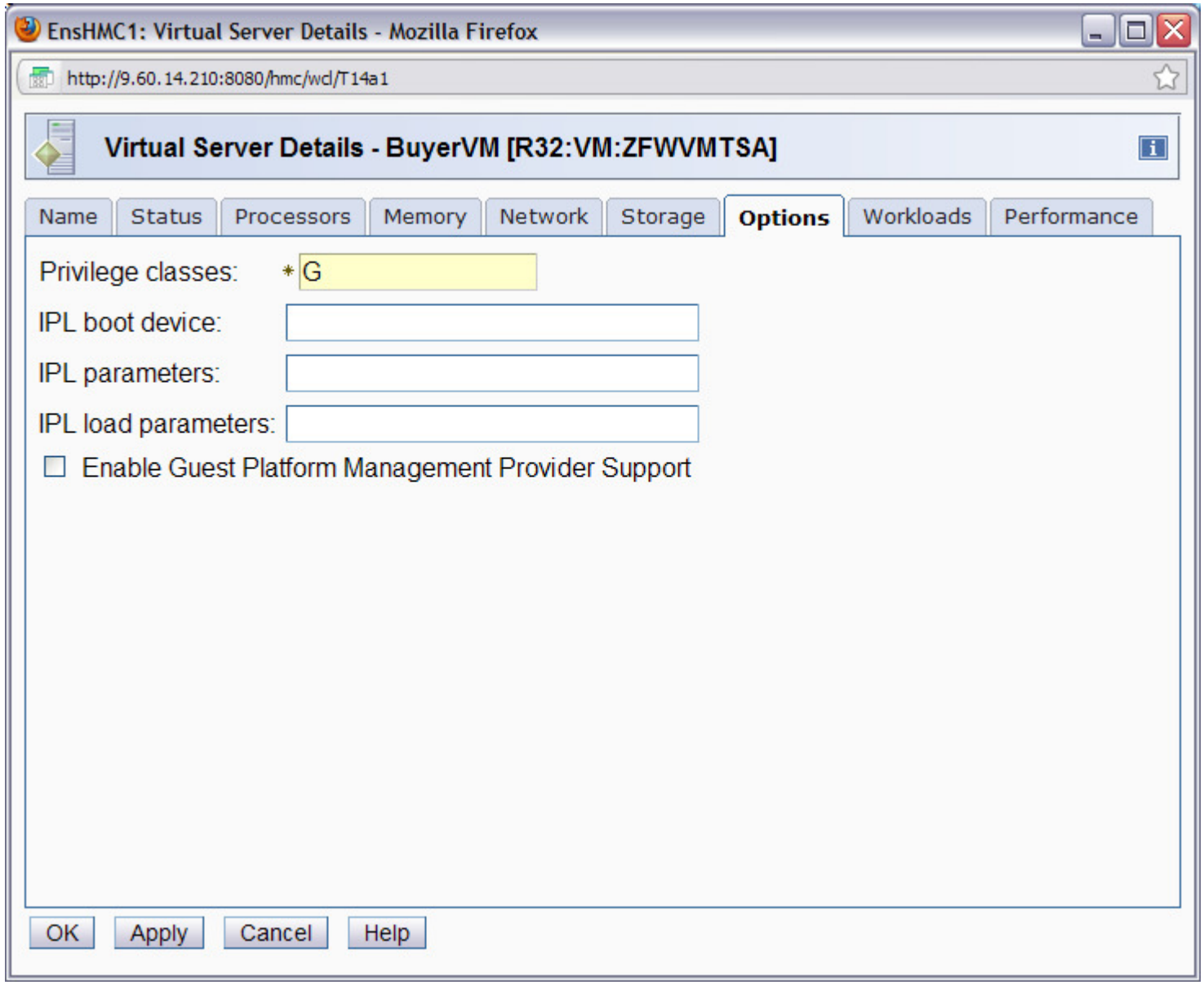


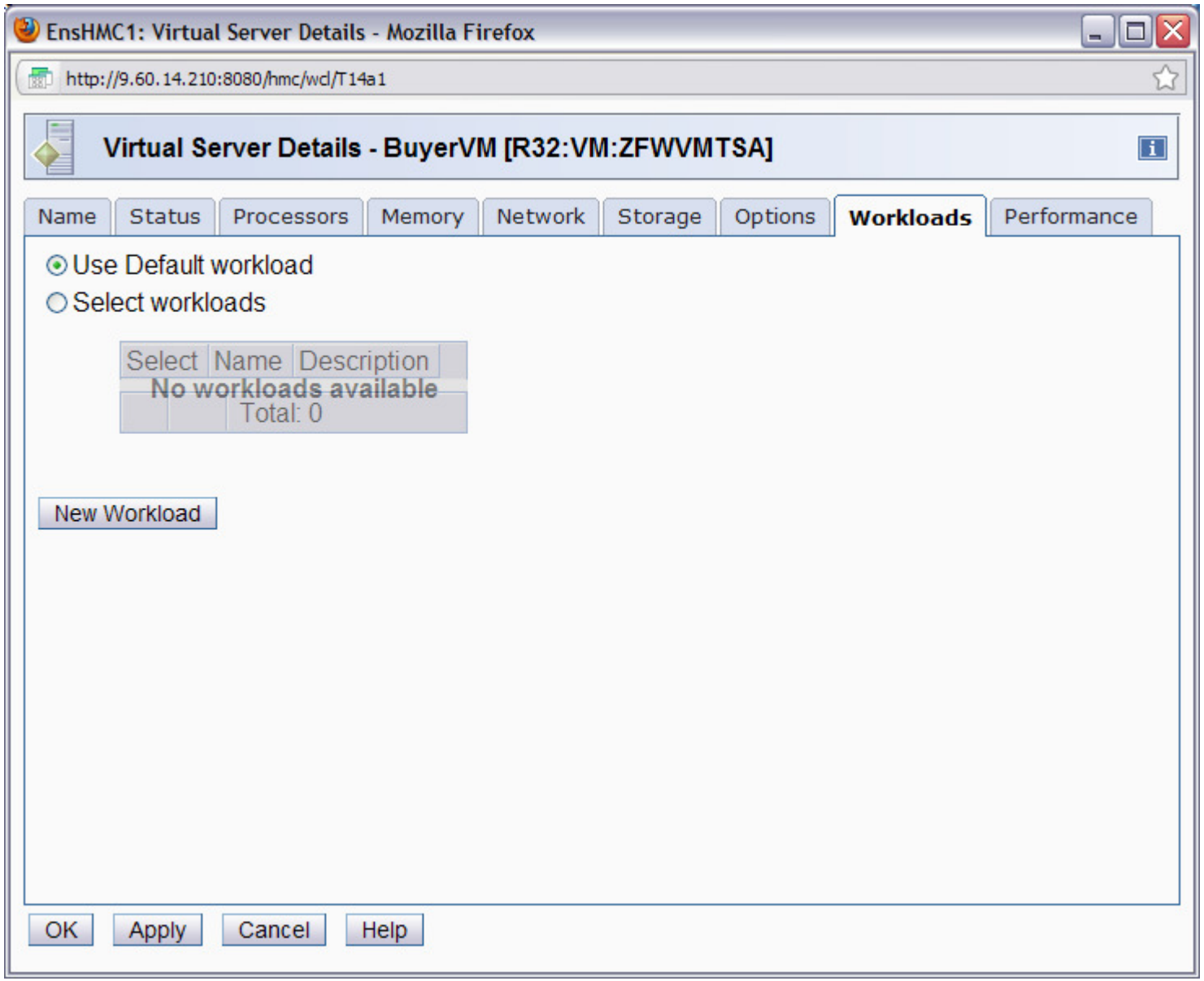


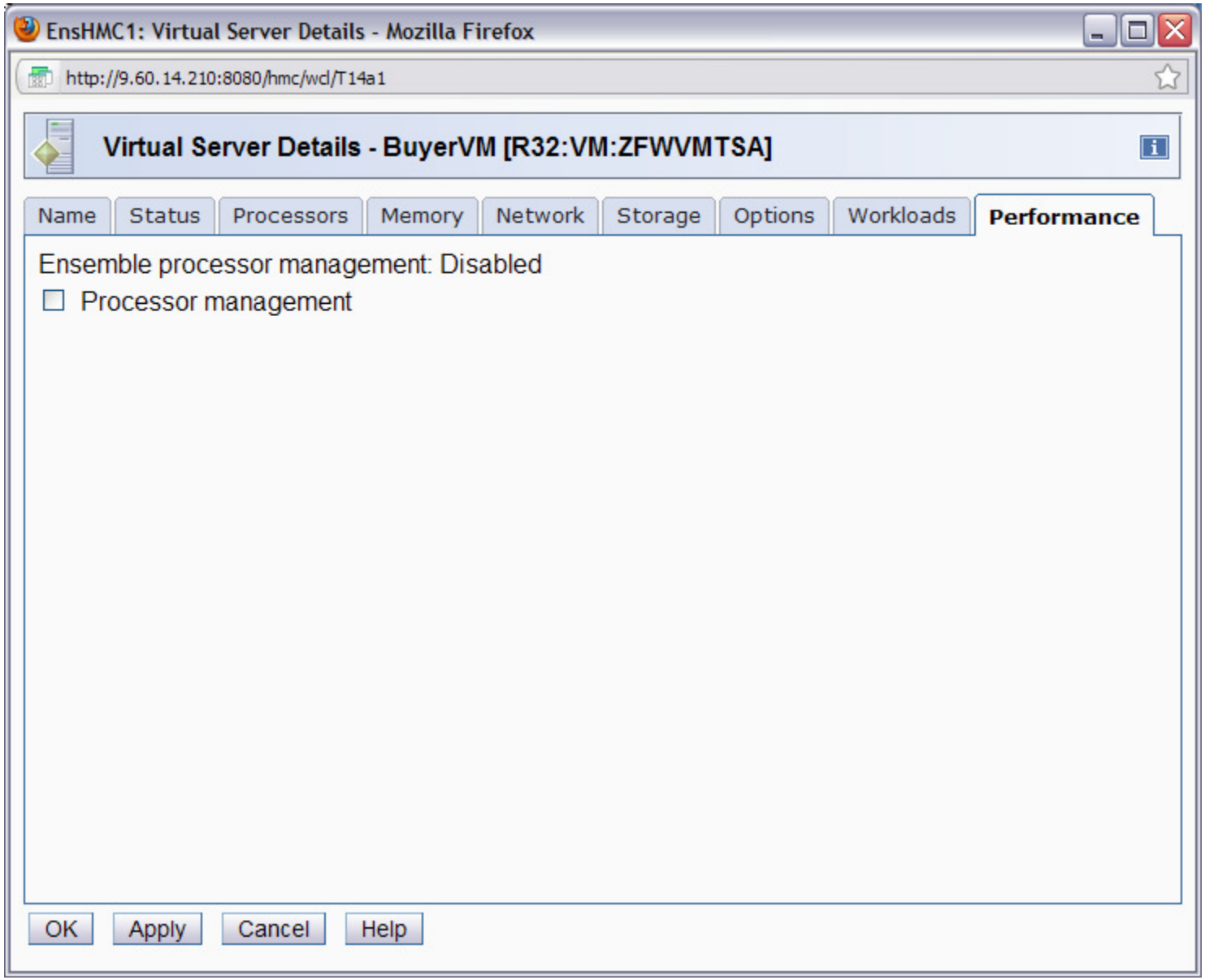




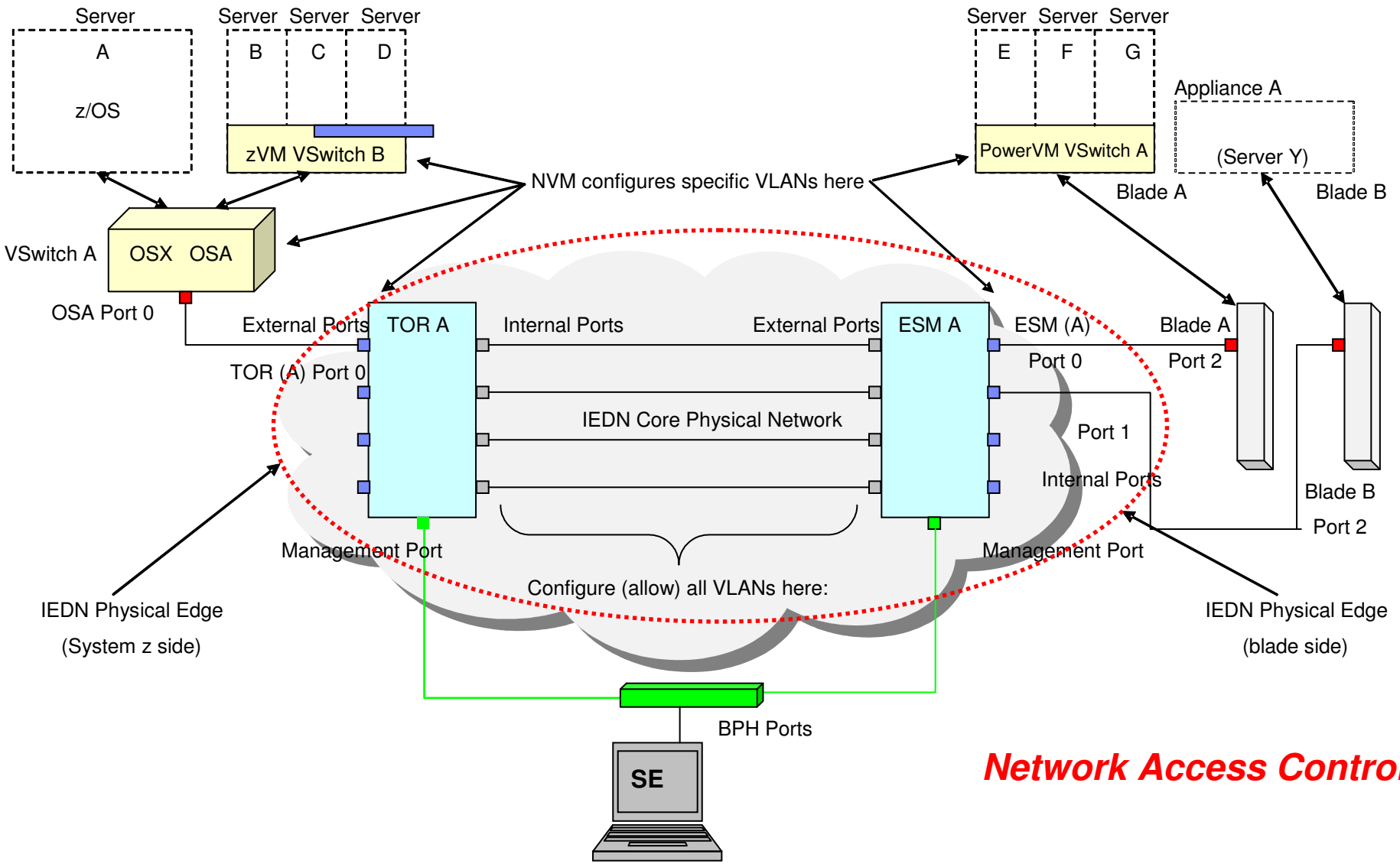






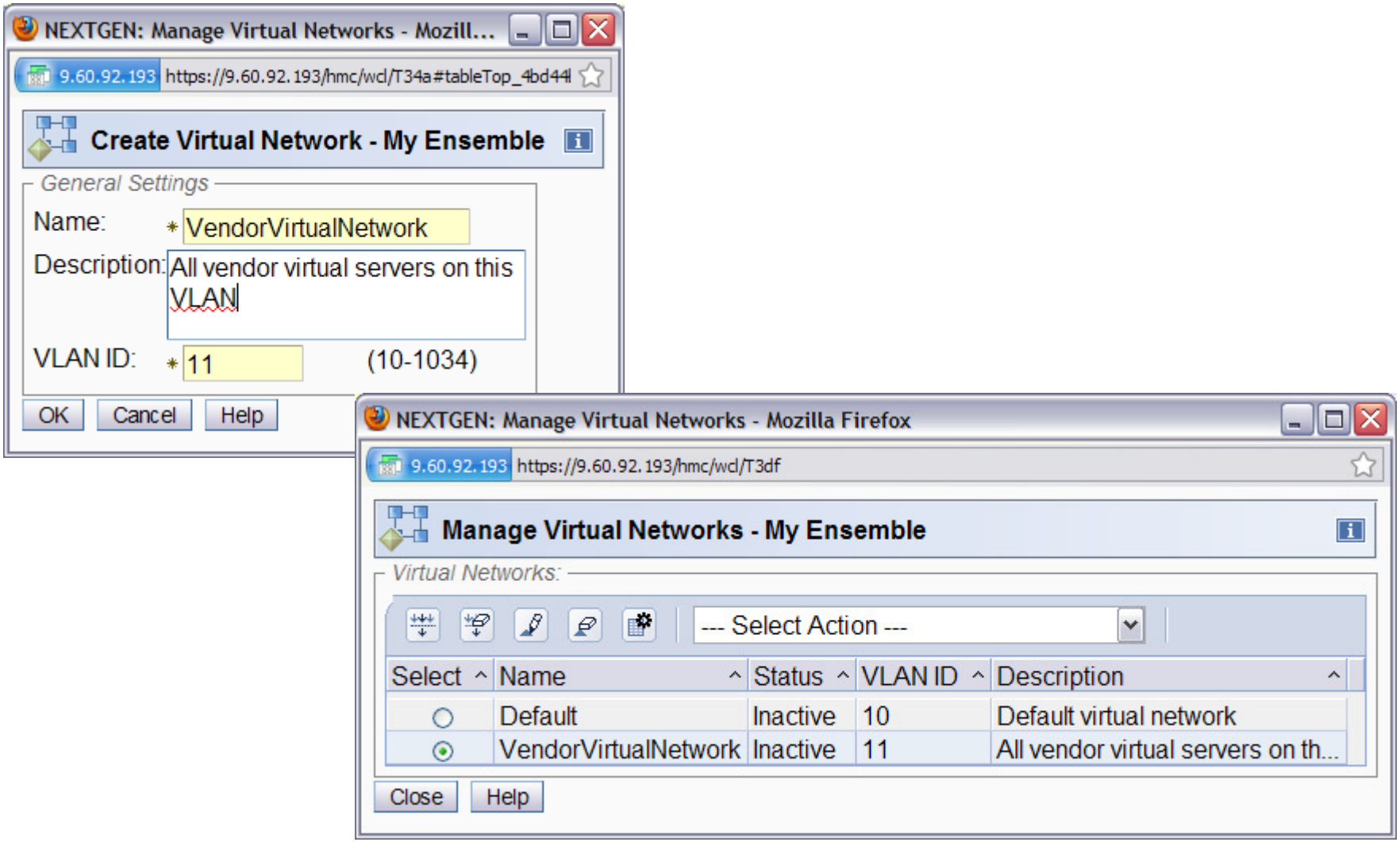


Virtual Networks and Access Controls

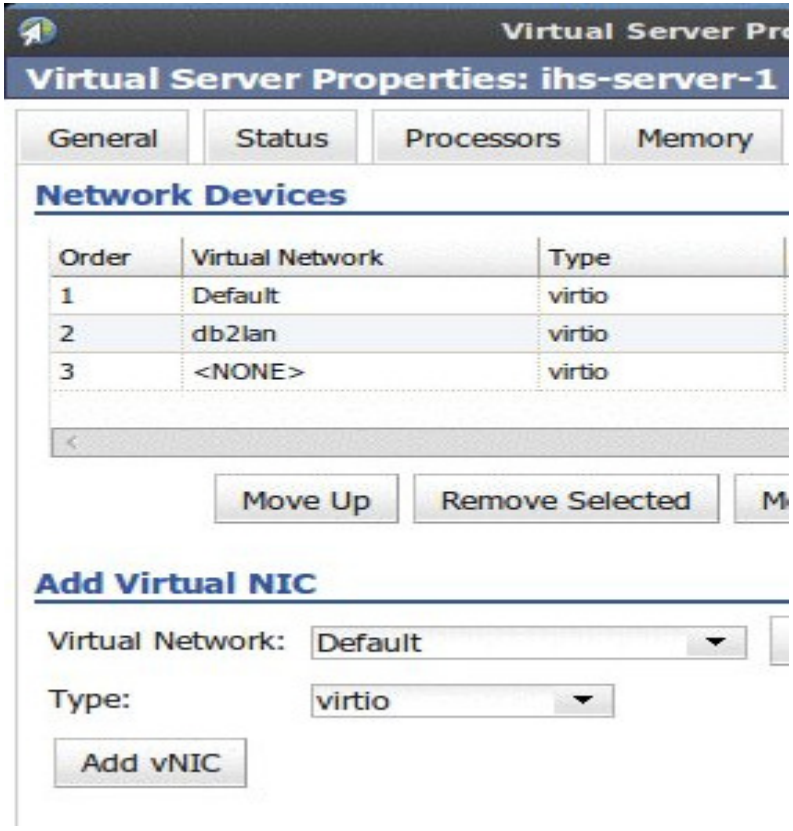


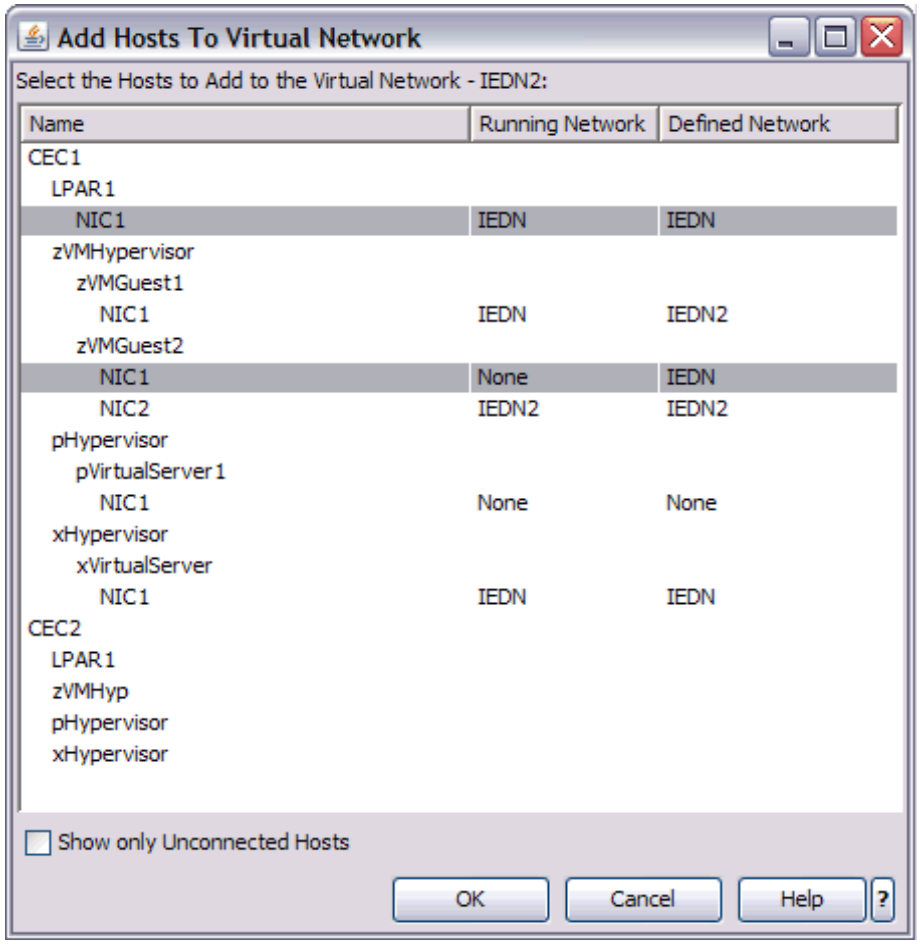
Network Access Control

Create Virtual Network



Associate Virtual Server With Virtual Network





Synergy with z/VM

- Server and application consolidation on System z using Linux and z/VM is the industry leader in large-scale, cost-efficient virtual server hosting
- zEnterprise introduces virtual server provisioning and management for Linux guests running on z/VM
  - Use the Unified Resource Manager to create z/VM virtual machines
  - Simplify the skill level needed to manage a Linux on z/VM environment
- Faster cores and a bigger system cache on the z196 let you do even more with less when running Linux on z/VM
- Integrated blades on zBX offer a new dimension for workload optimization

z/VM and Blades

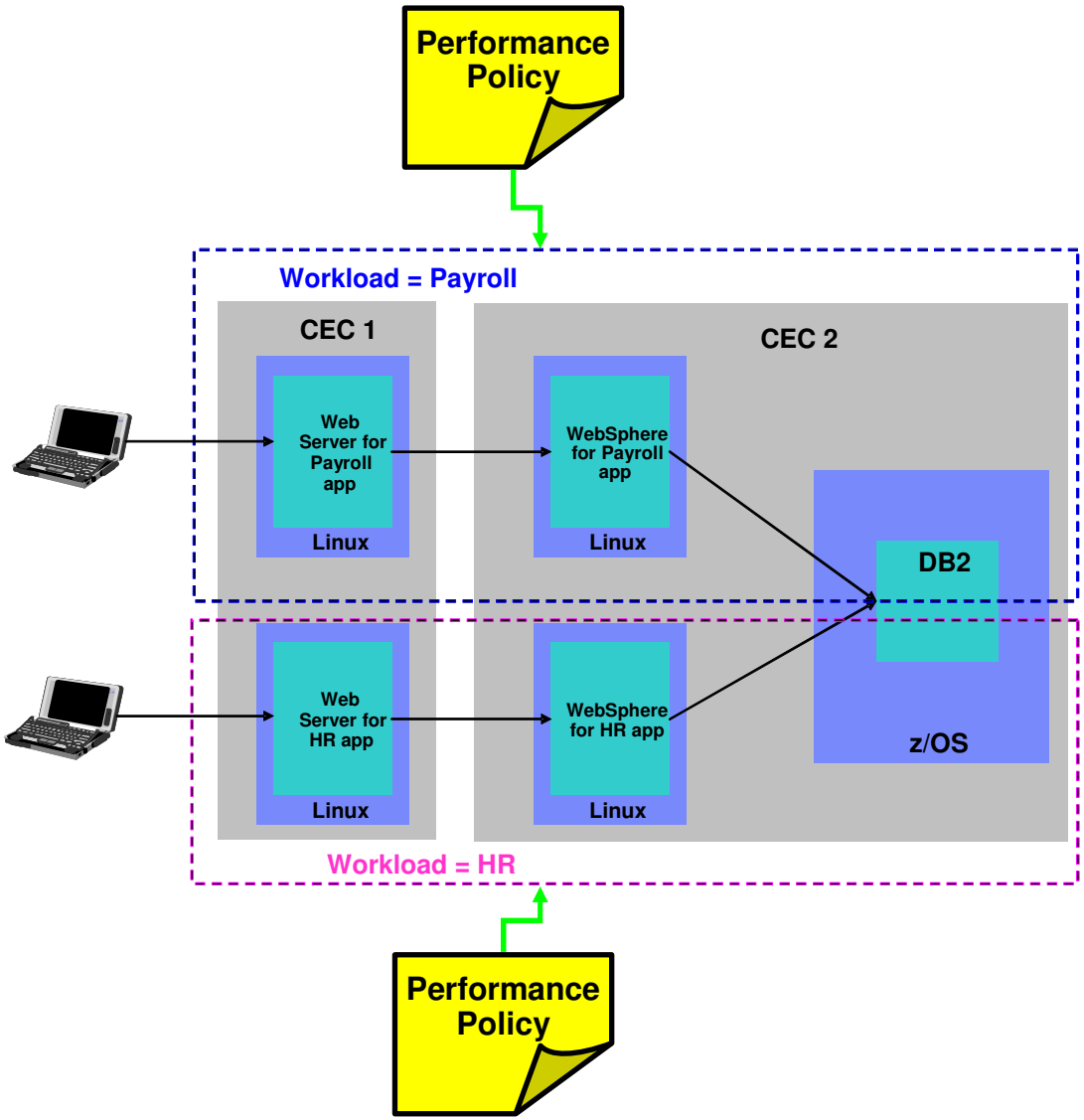
- Support applications that are not appropriate for Linux on System z
  - Not available for Linux on System z
  - Missing function in System z environment
    - e.g., Specialized hardware support
  - Resource requirements not suited for System z
    - e.g., Real-time applications
    - e.g., IBM Smart Analytics Optimizer
- Environments
  - AIX on PowerVM
  - Linux on x86 (SOD)
- Migration
  - Create virtual server on zEnterprise
  - Configure appropriate network and SAN connectivity
  - Point virtual server to existing disk resources
  - Activate virtual server

z/VM and Blades …

- Management
  - Single point of control
  - Workload context
    - Monitoring, reporting, performance management, workload management
- Data sharing
  - No different than with distributed servers (same SAN)
- Connectivity (Intra-Ensemble Data Network - IEDN)
  - 10Gb flat layer 2 network
  - Access controlled completely by zManager
  - Eliminate firewalls
  - Eliminate encryption
  - Increase throughput and reduce latency

Workload

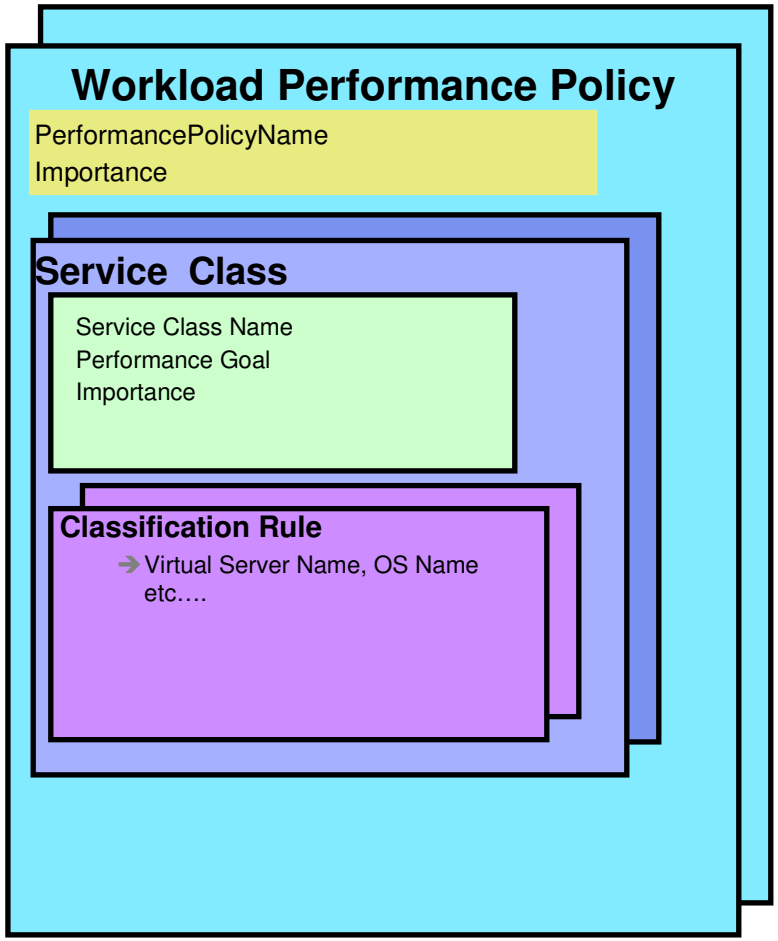
- A Workload is a grouping mechanism and “management view” of virtual servers supporting a business application
- Provides the context within which associated platform resources are presented, monitored, reported, and managed
- Performance policy is associated with Workload



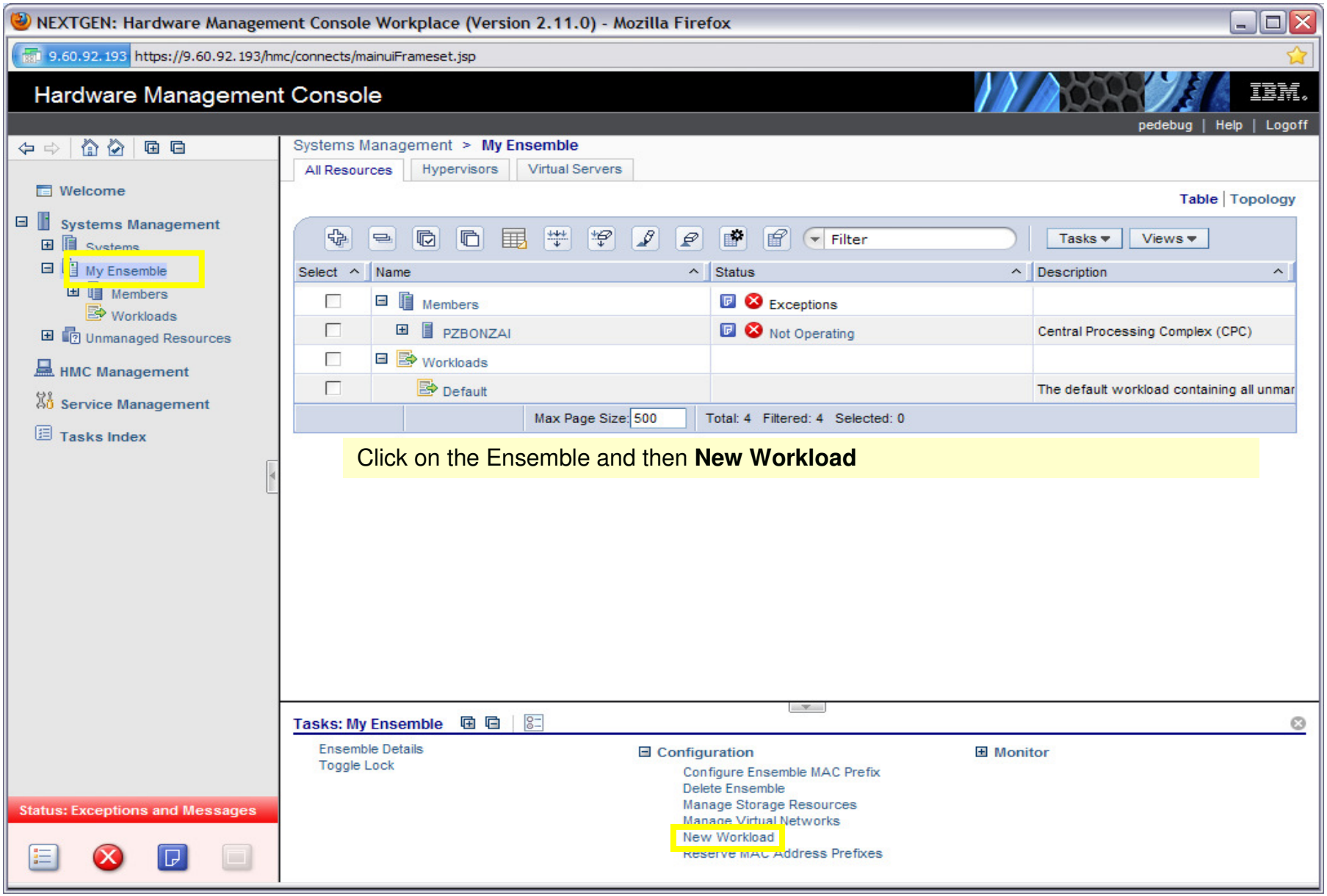
Workload Performance Policy

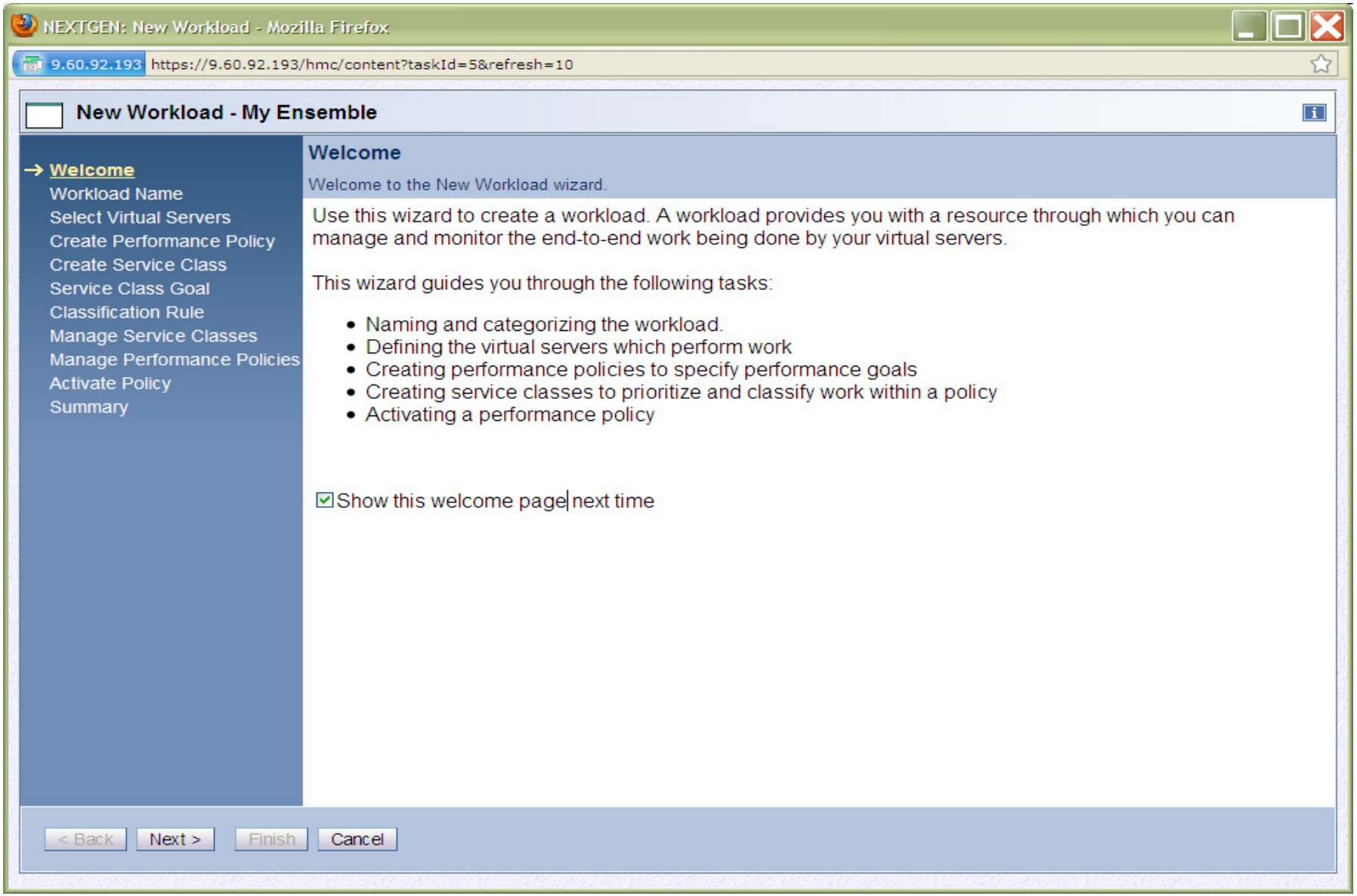
- Defines performance goals for virtual servers in a workload
  - Conceptually similar to simplified z/OS WLM Policy
- Provides basis for monitoring and managing platform resources used by virtual servers in a Workload
- Workload relationship to performance policy
  - Multiple performance policies associated with a workload
  - A single policy is active at a given time
  - Can dynamically change the active policy
    - Through the UI
    - On a time-based schedule
    - Example: Day shift / night shift policy

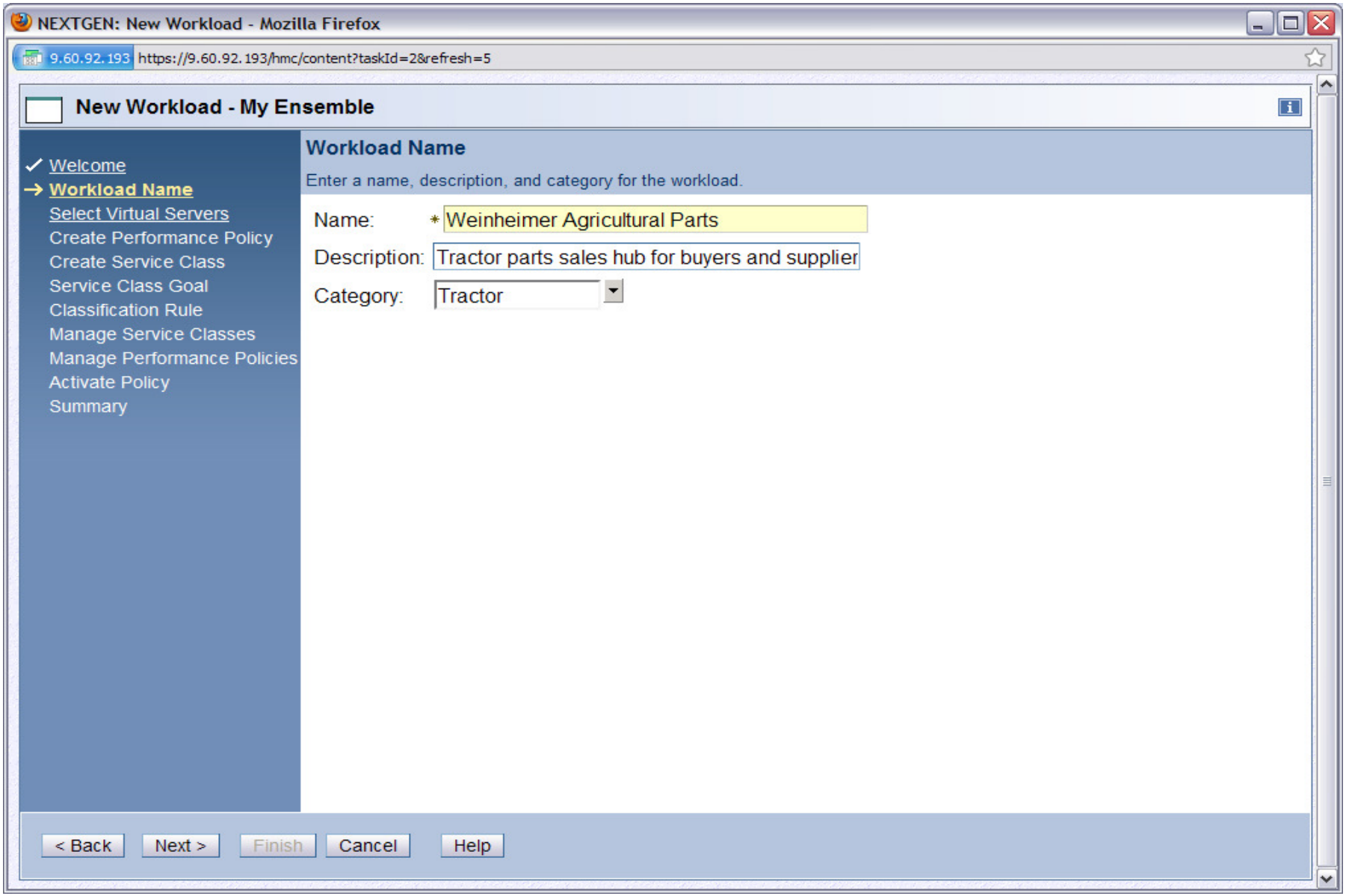
Workload Performance Policy…

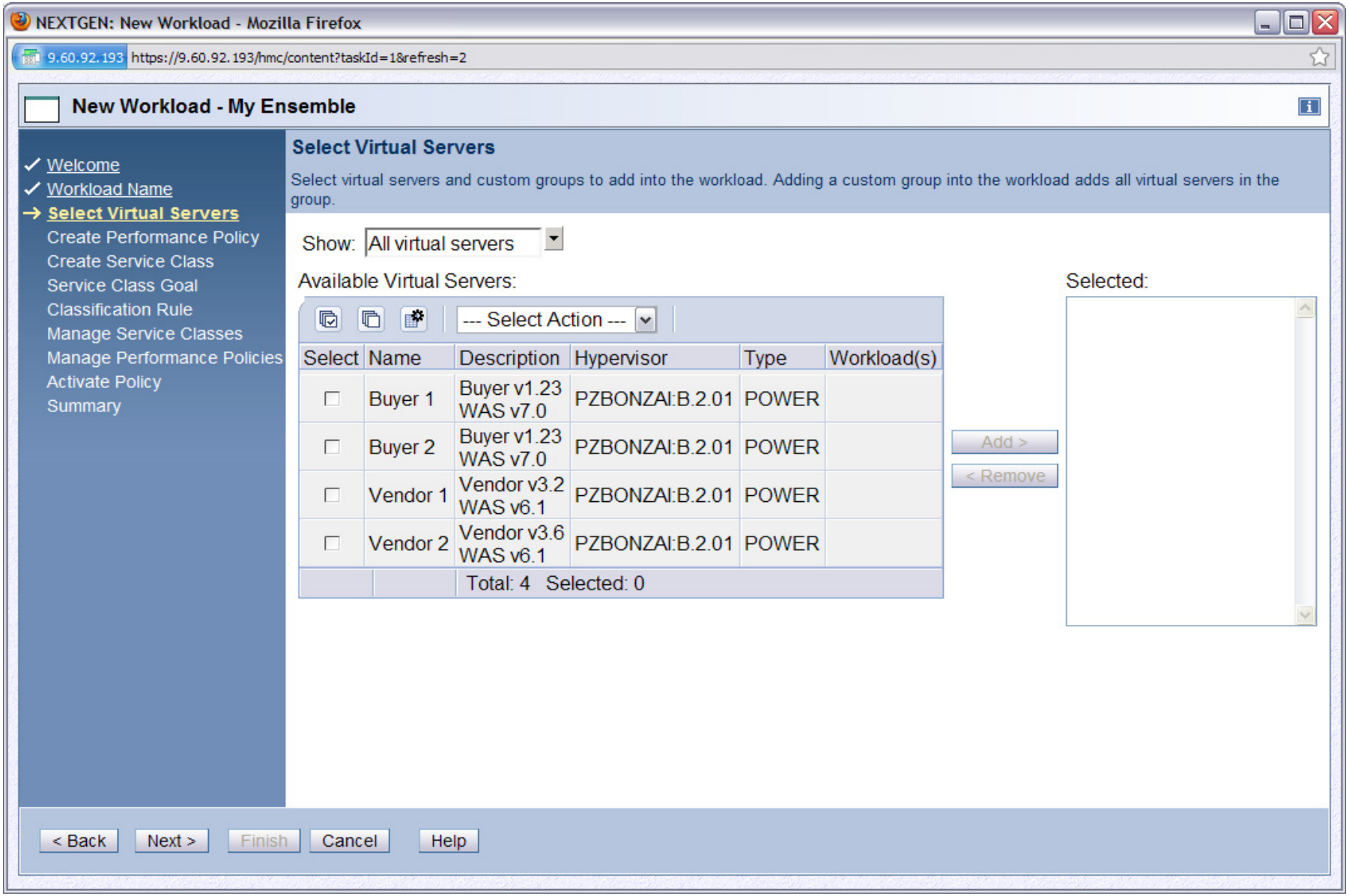


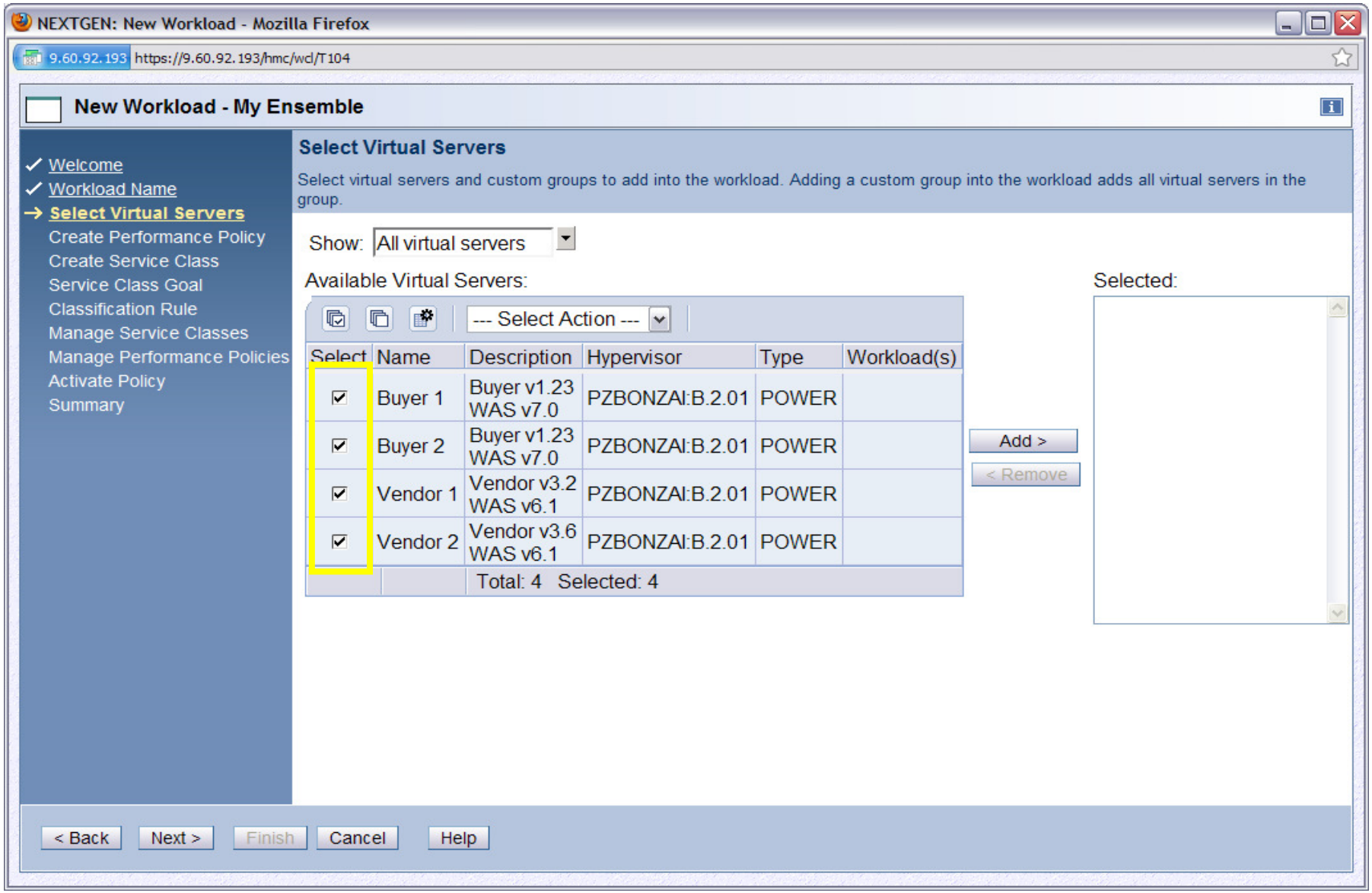
- Policy structure:
  - Policy contains a set of service classes
  - Classification rules map each virtual server within the workload to a service class
  - A service class assigns a performance goal and importance
- HMC is console for policy creation and editing
  - Wizard for policy creation
  - Repository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

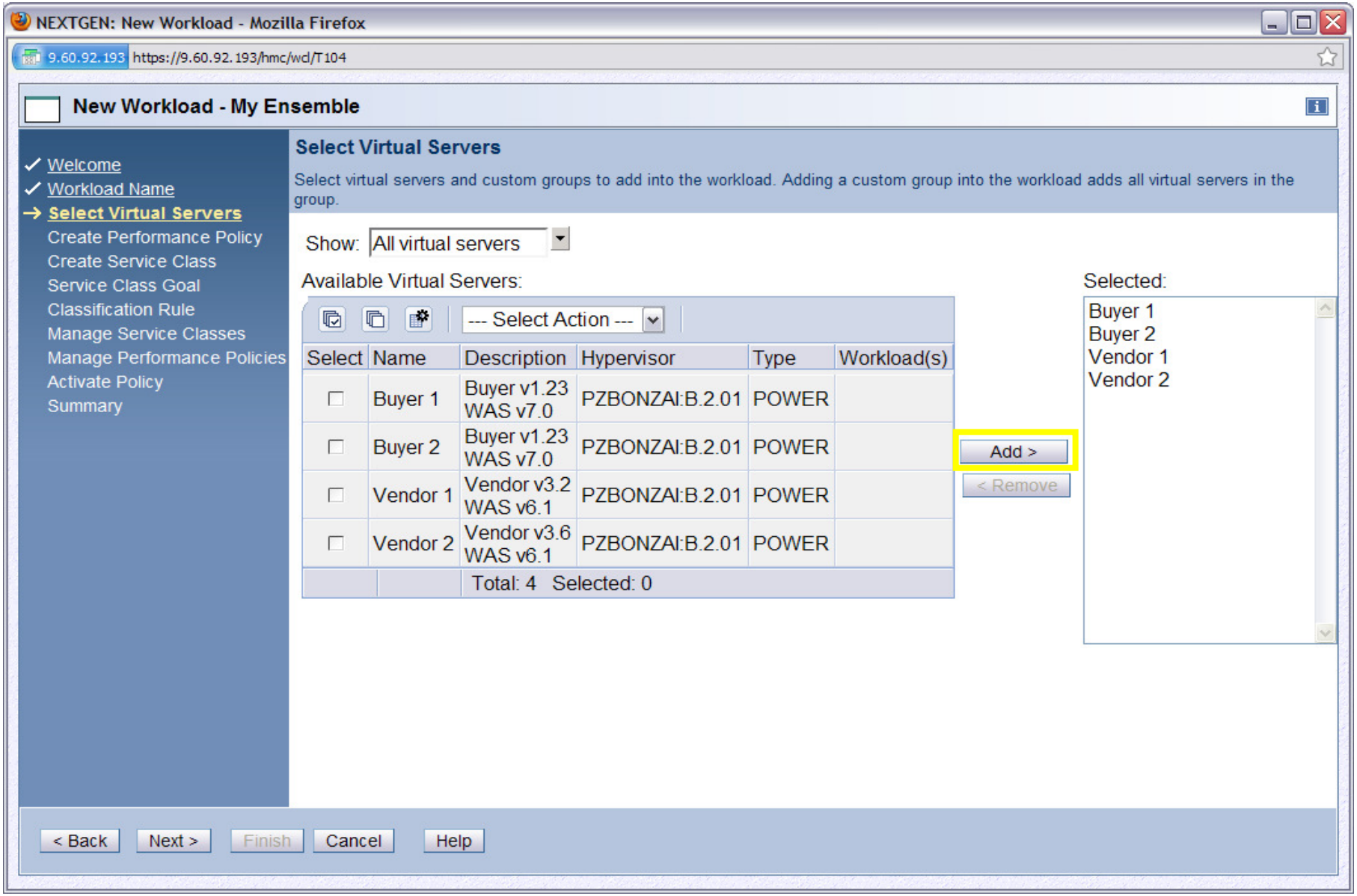


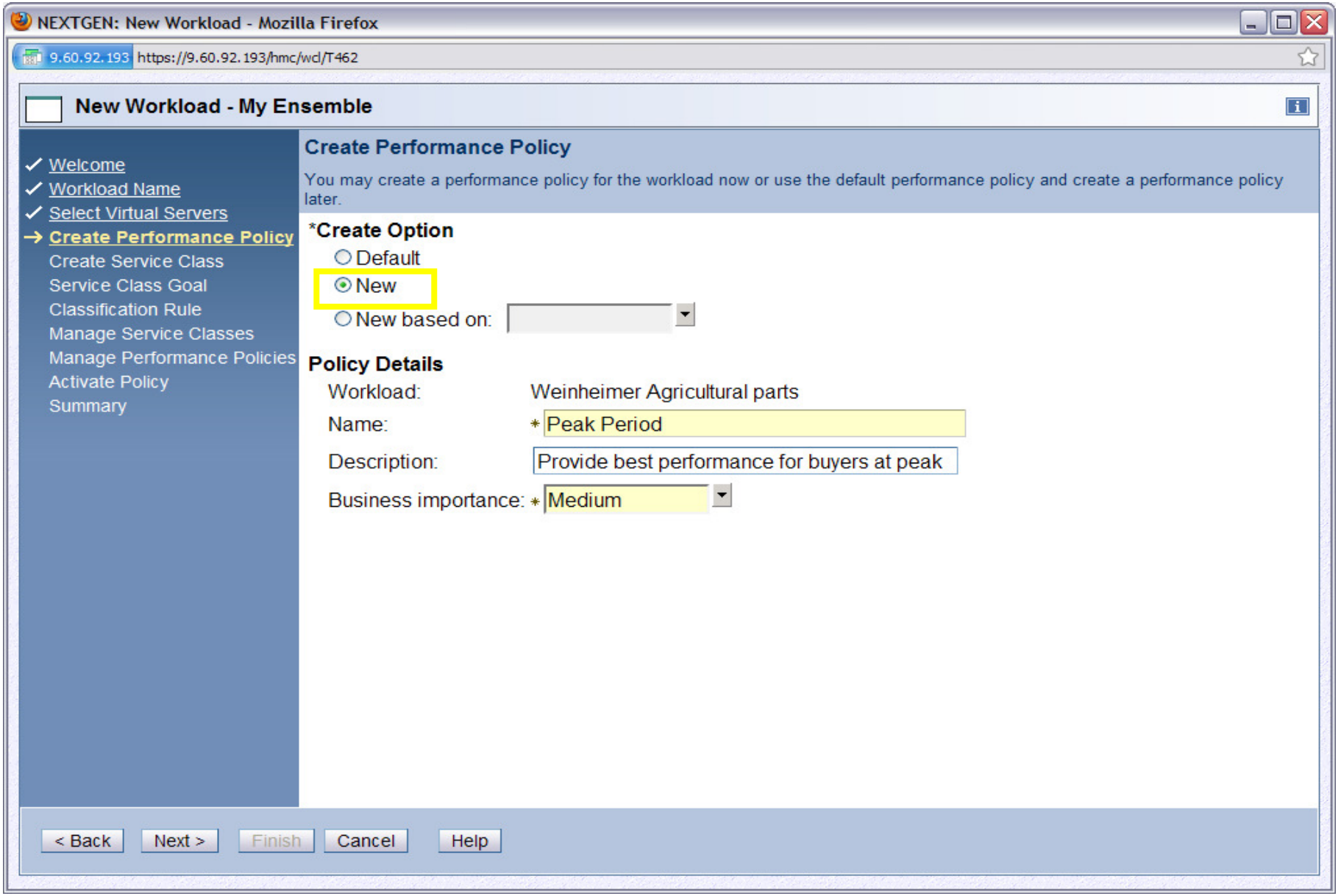


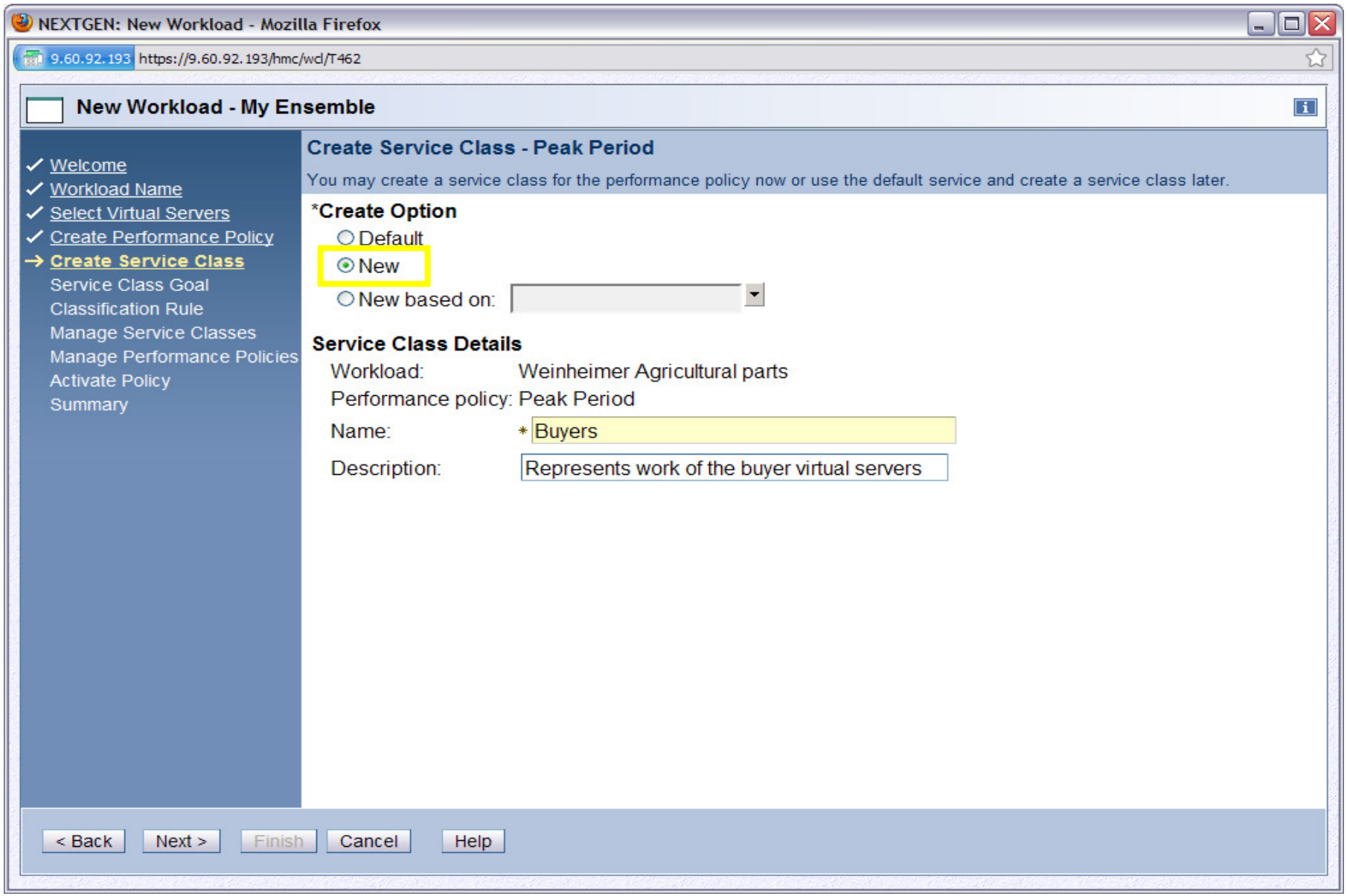


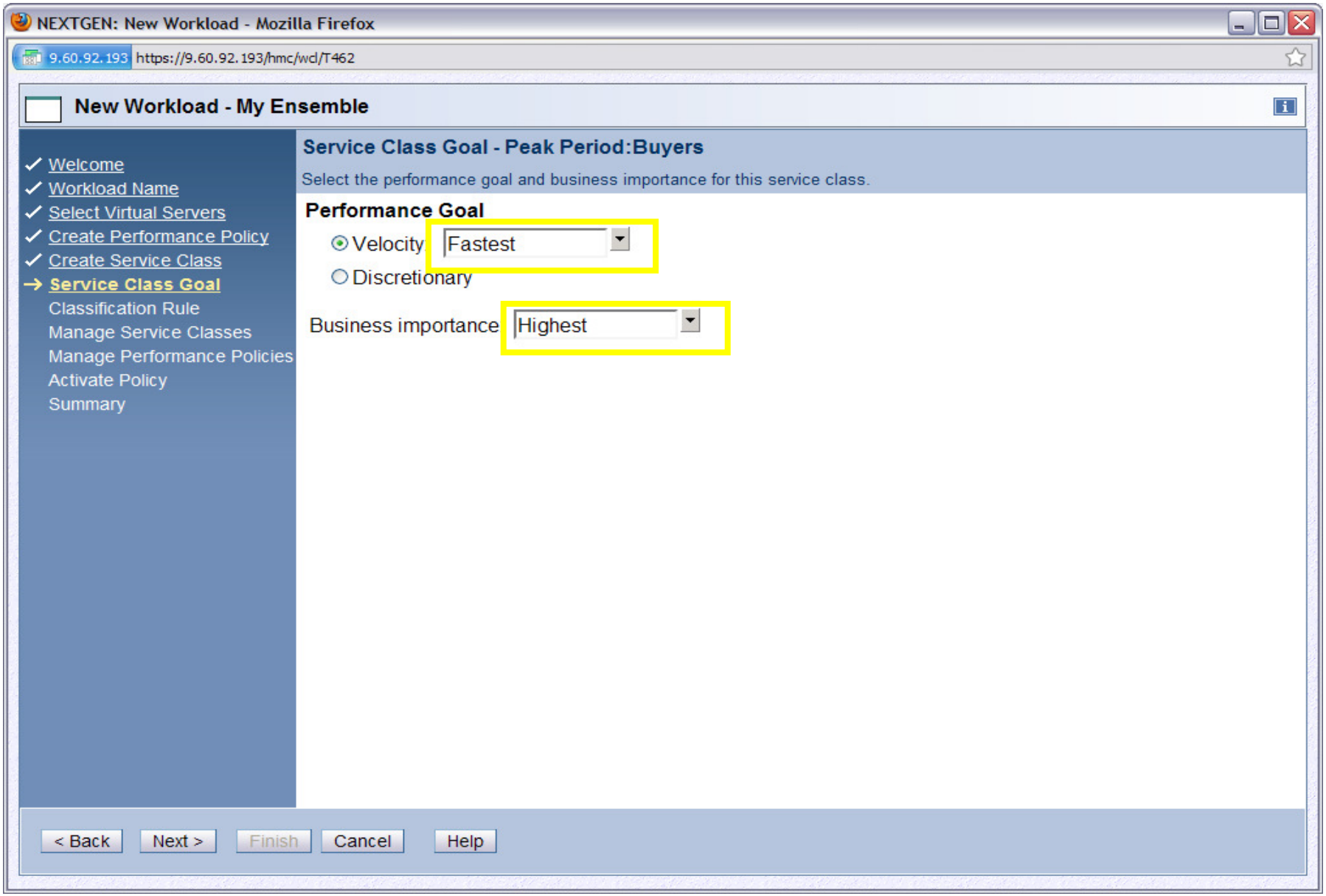


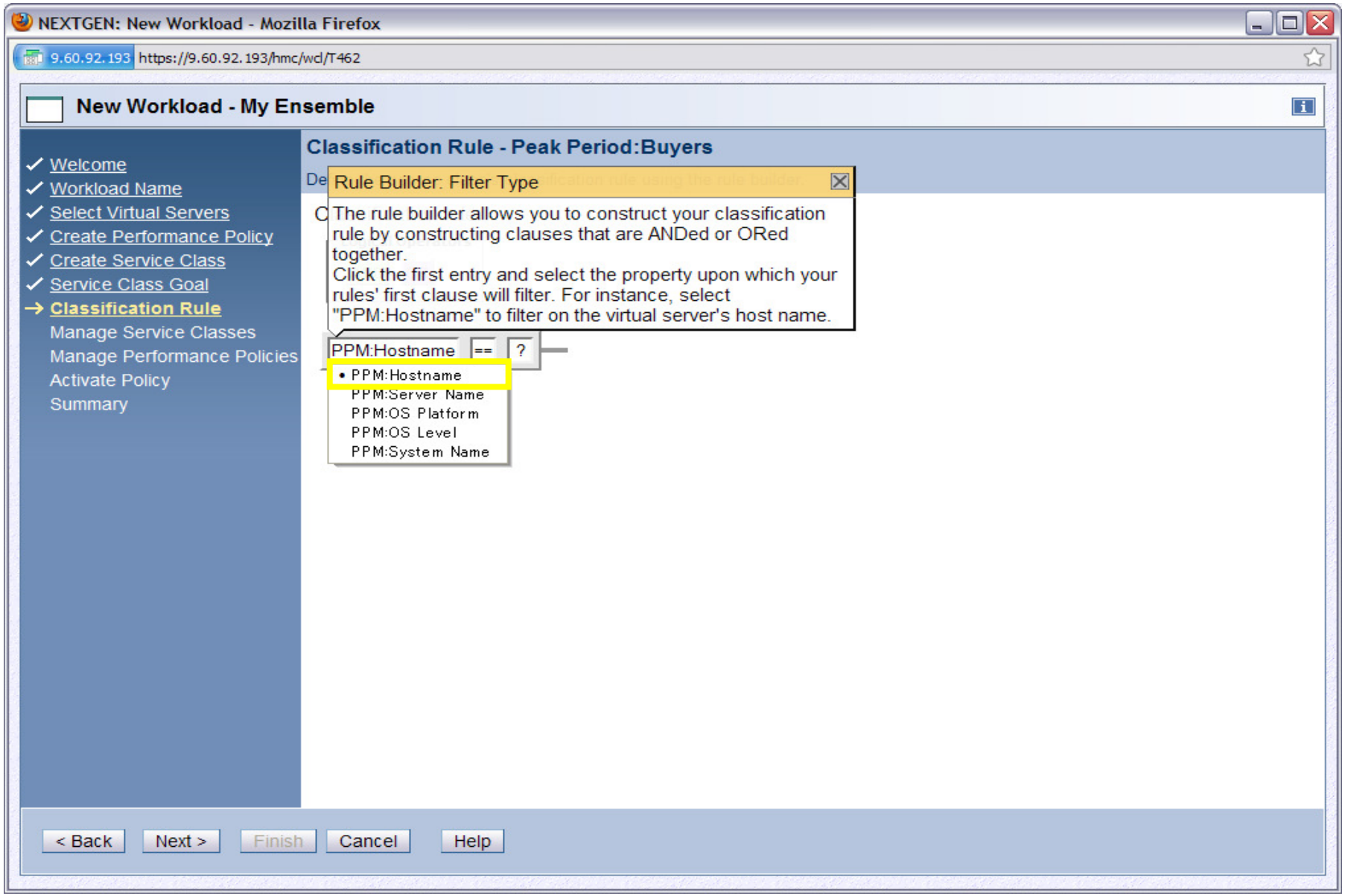


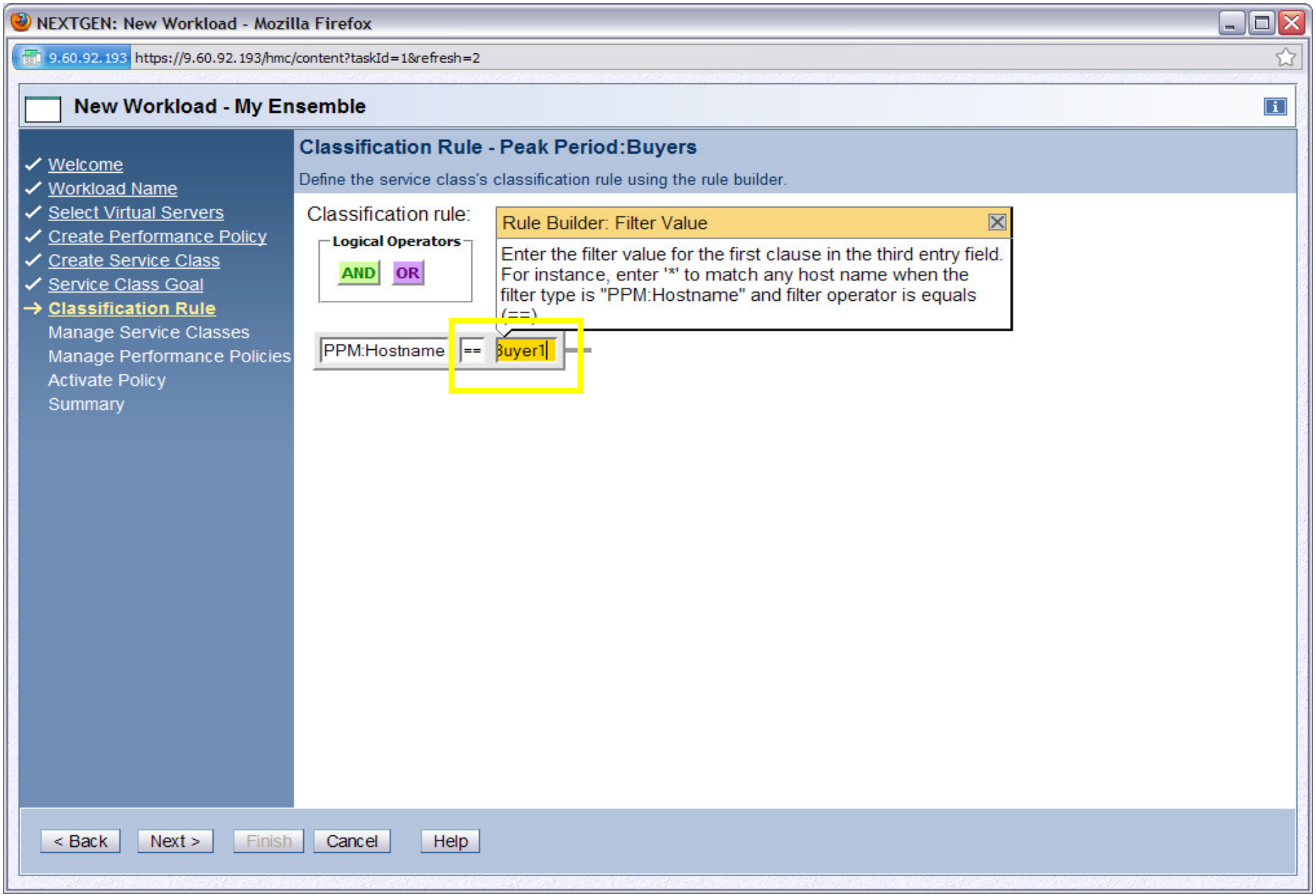


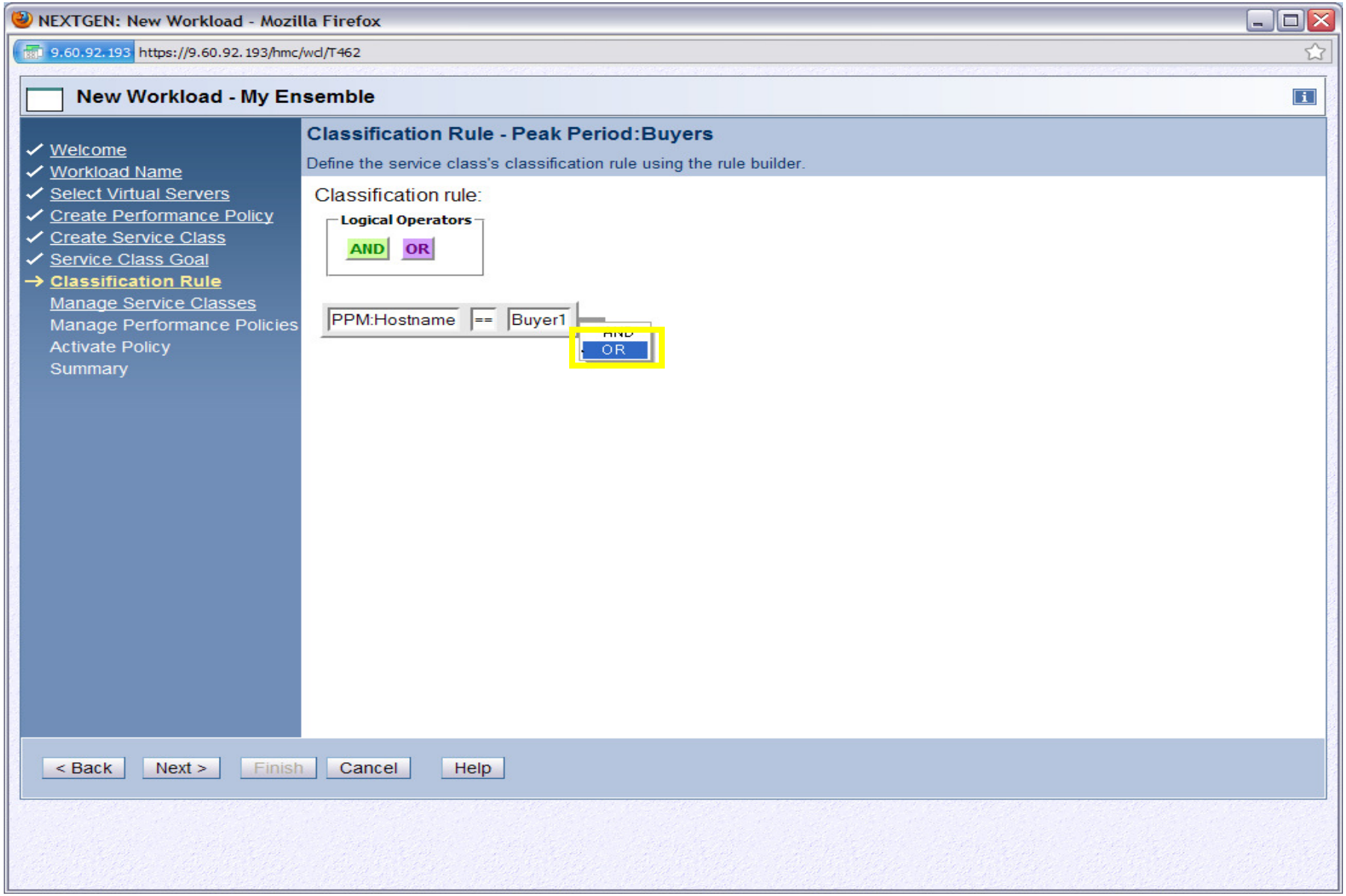


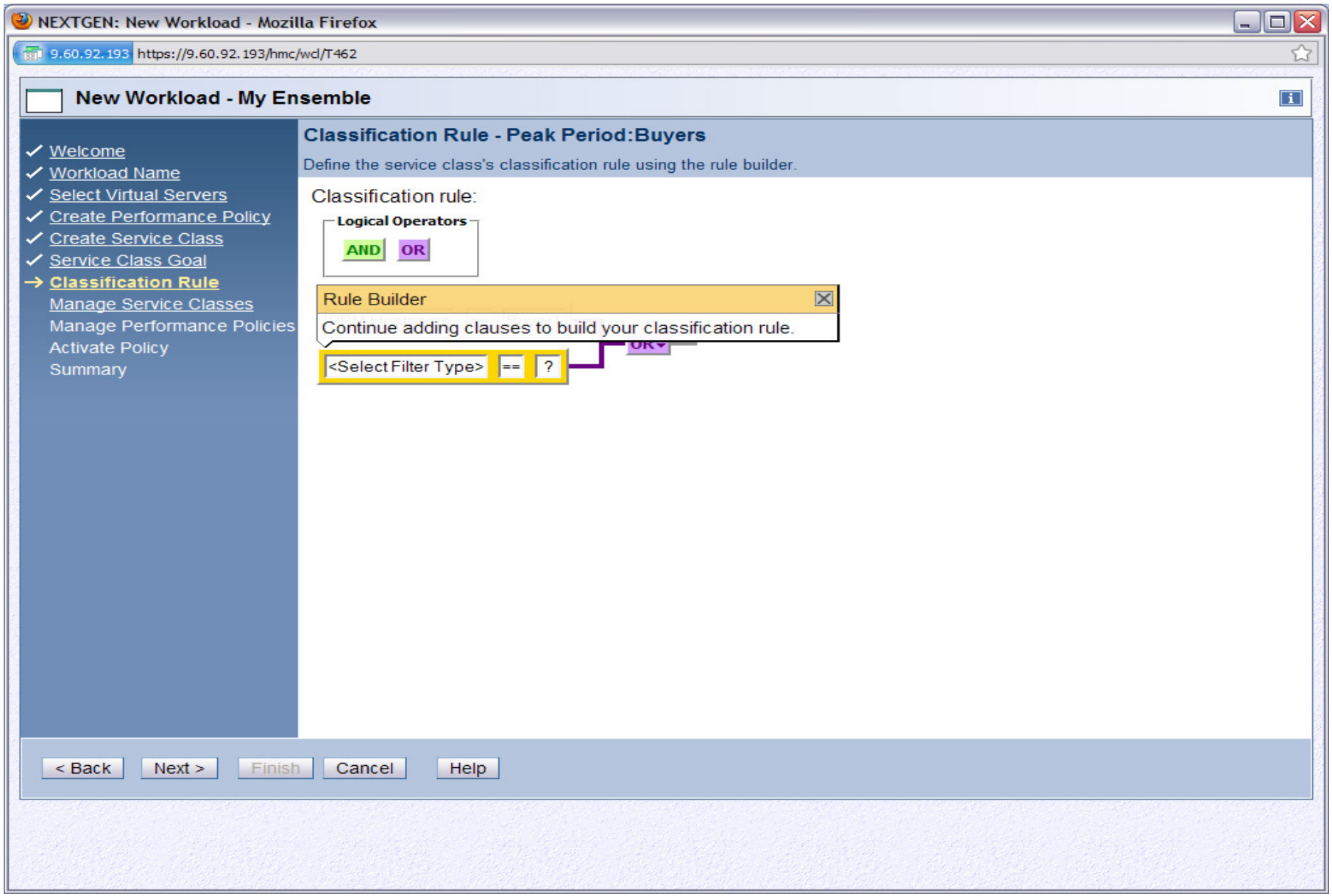


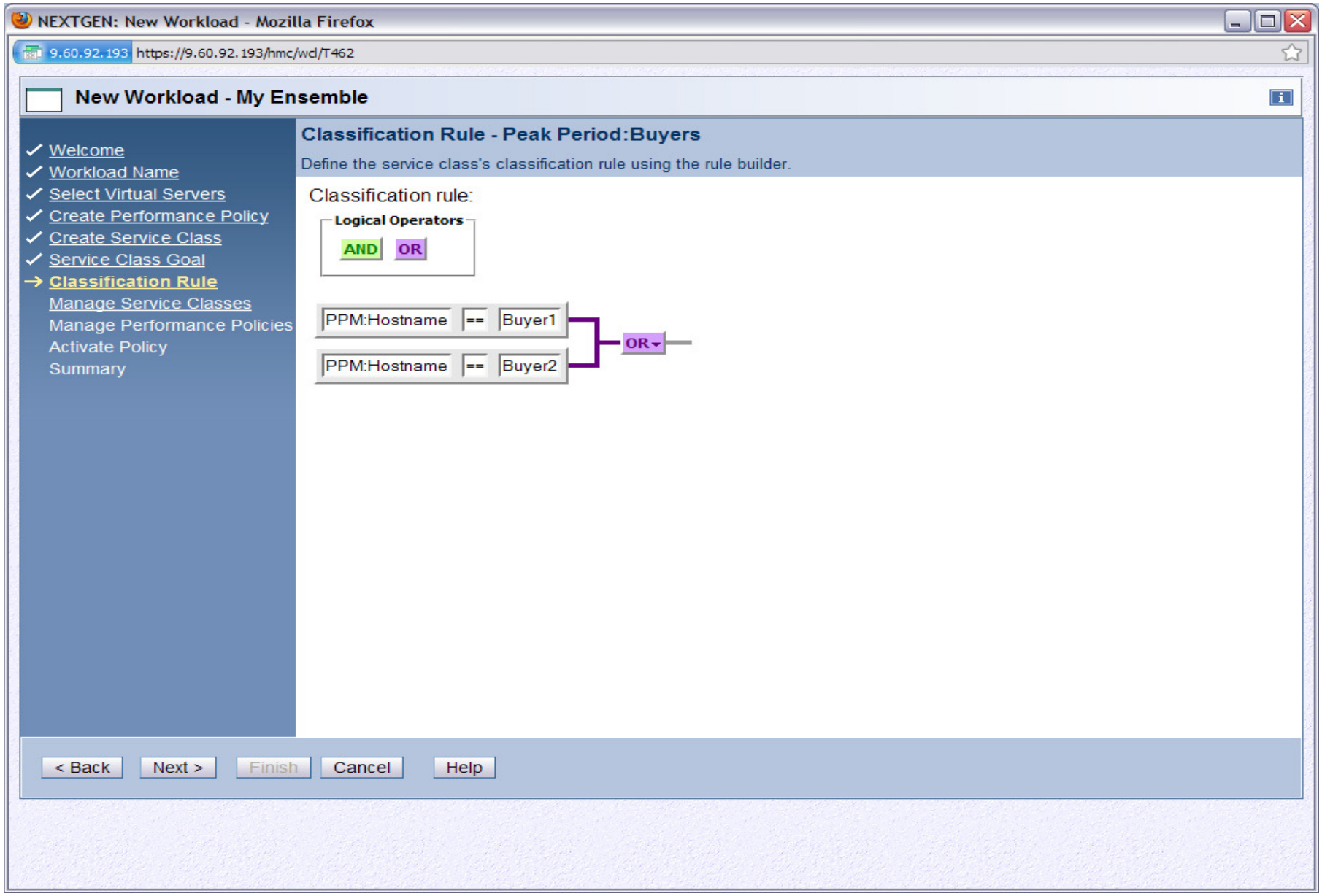


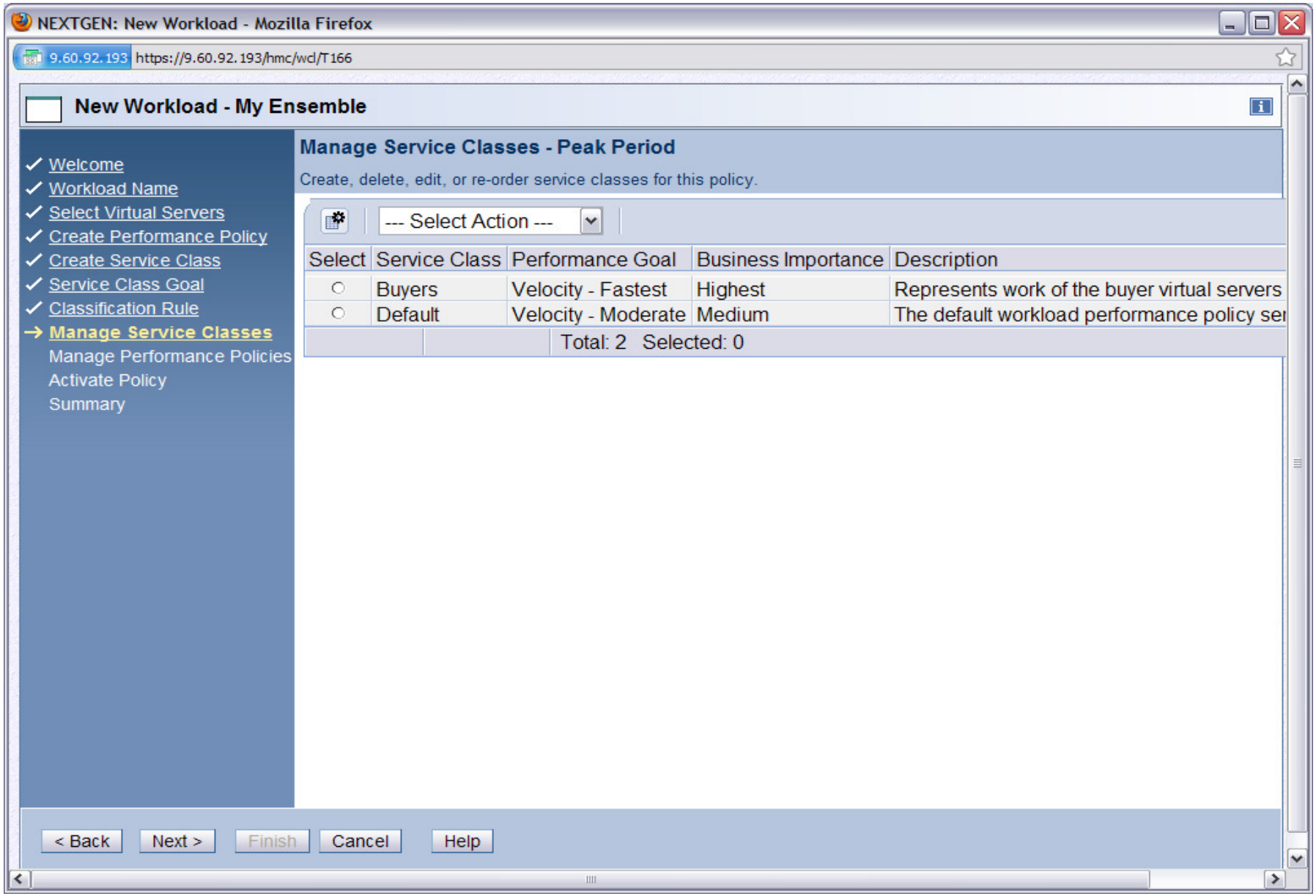


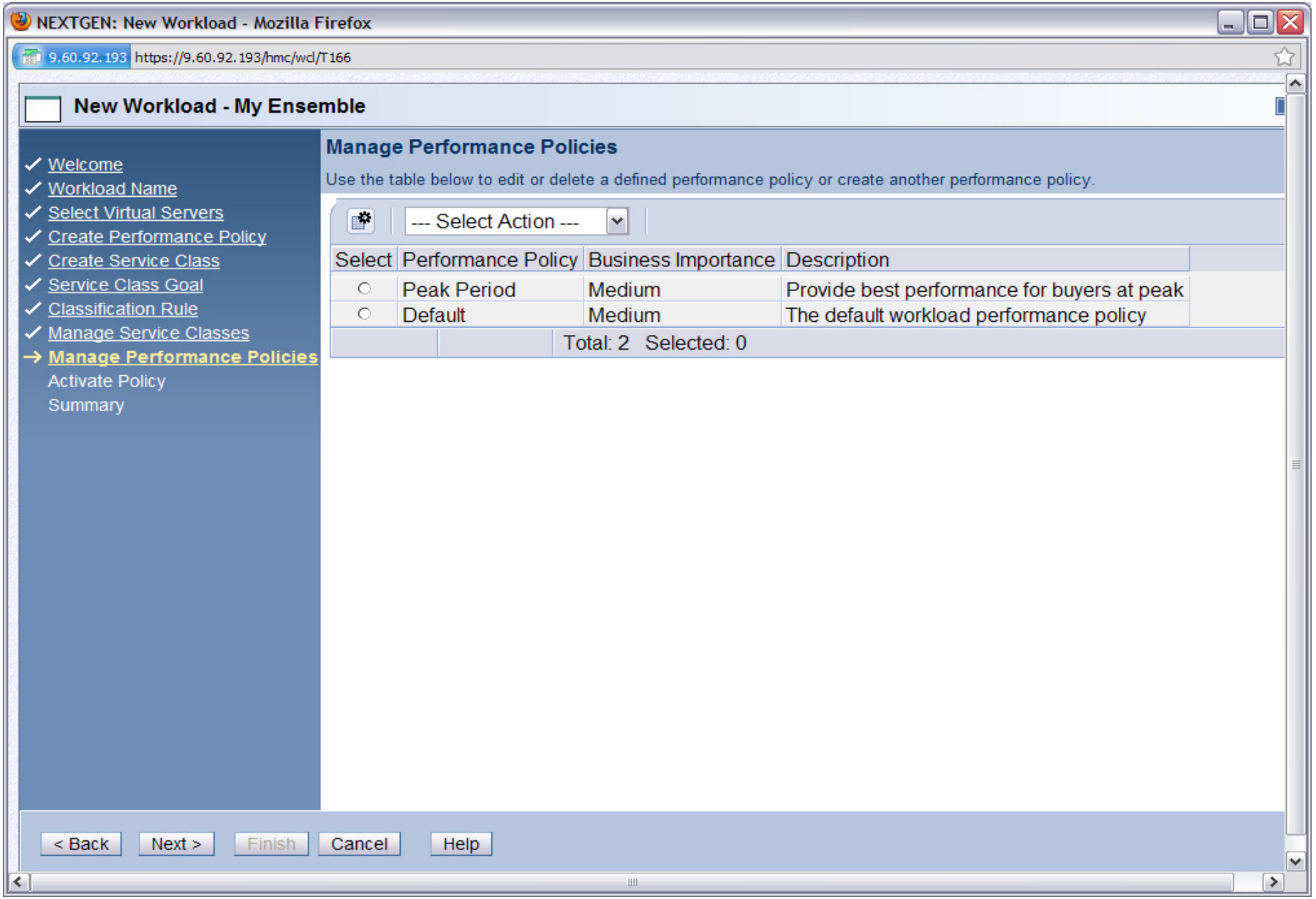


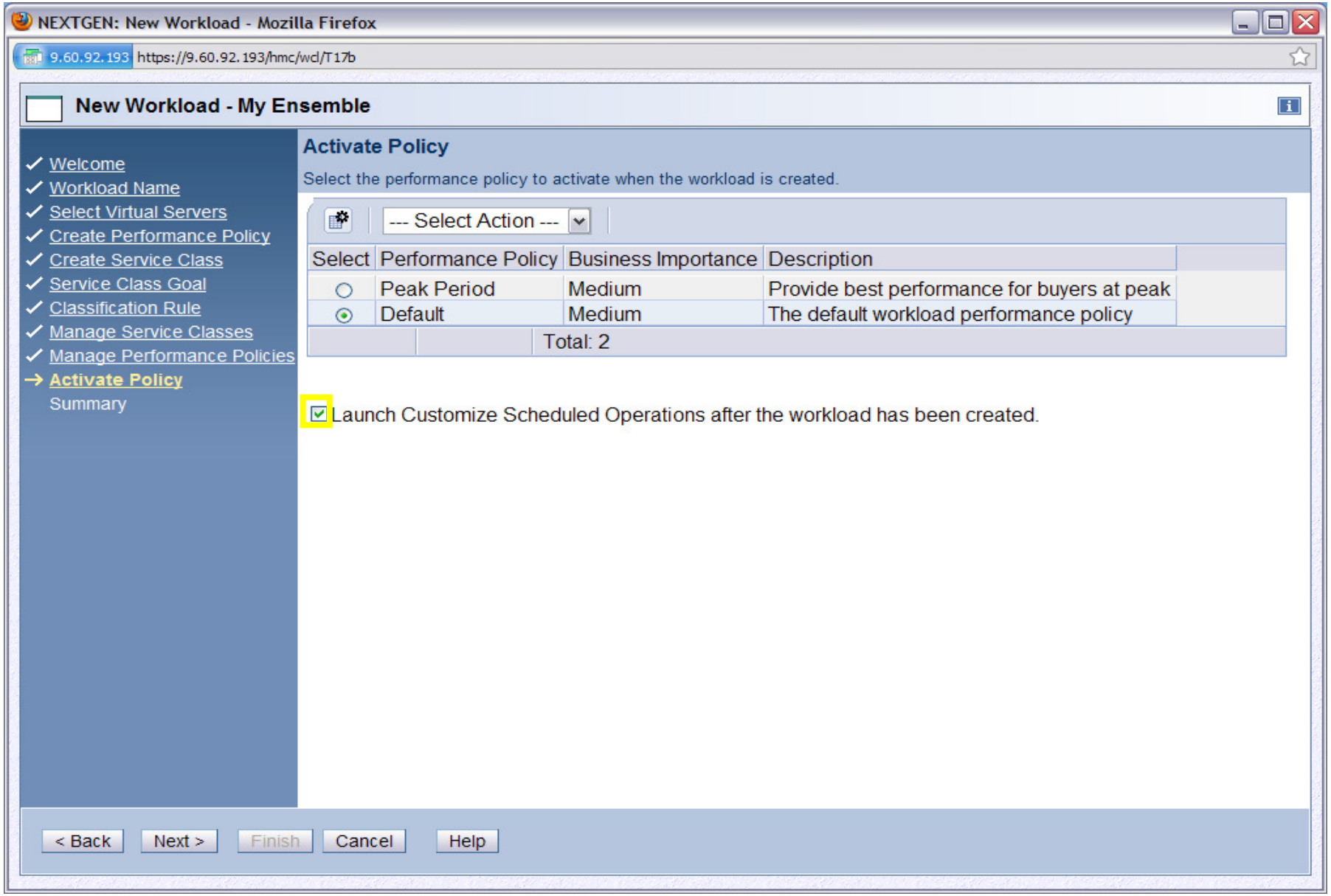


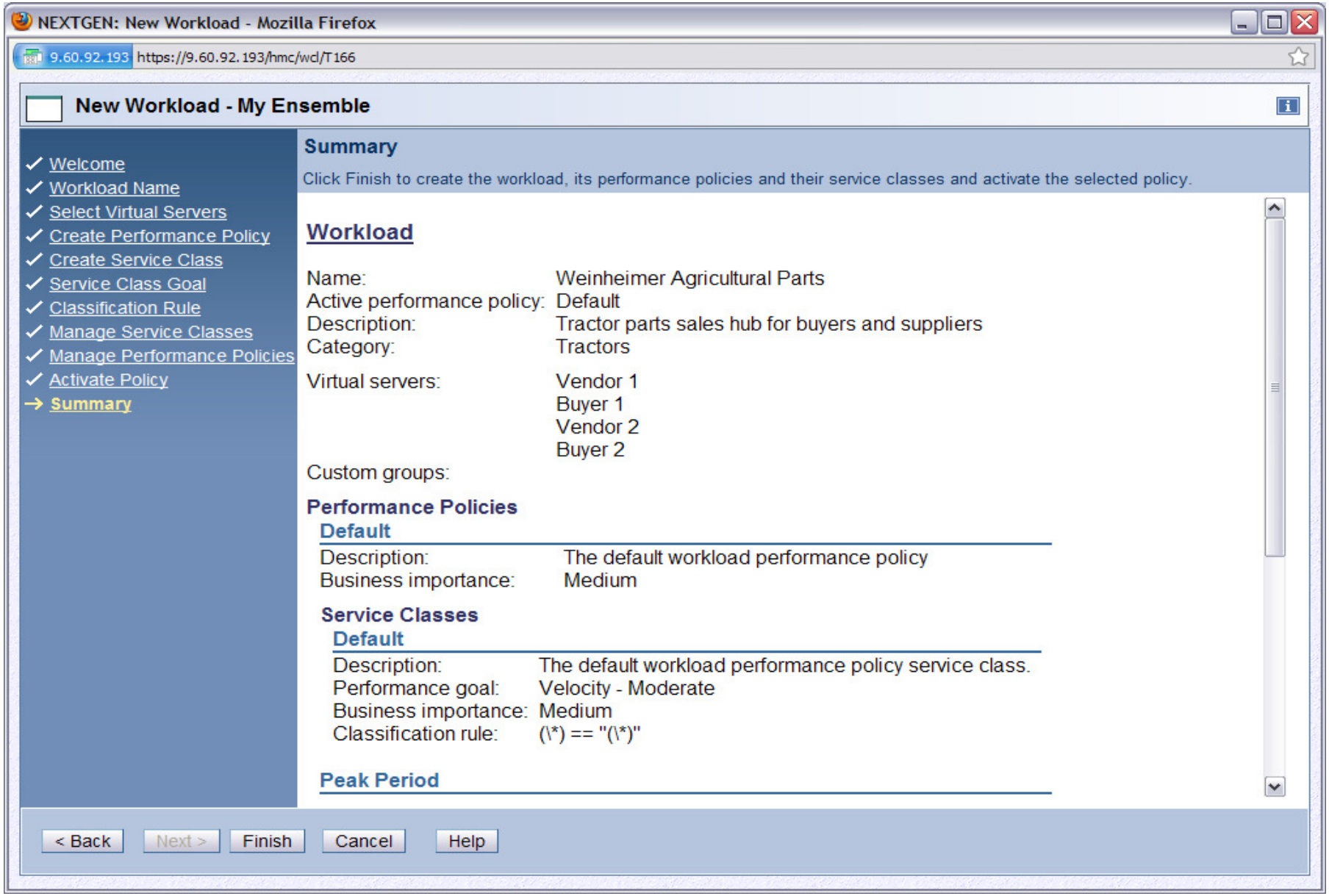


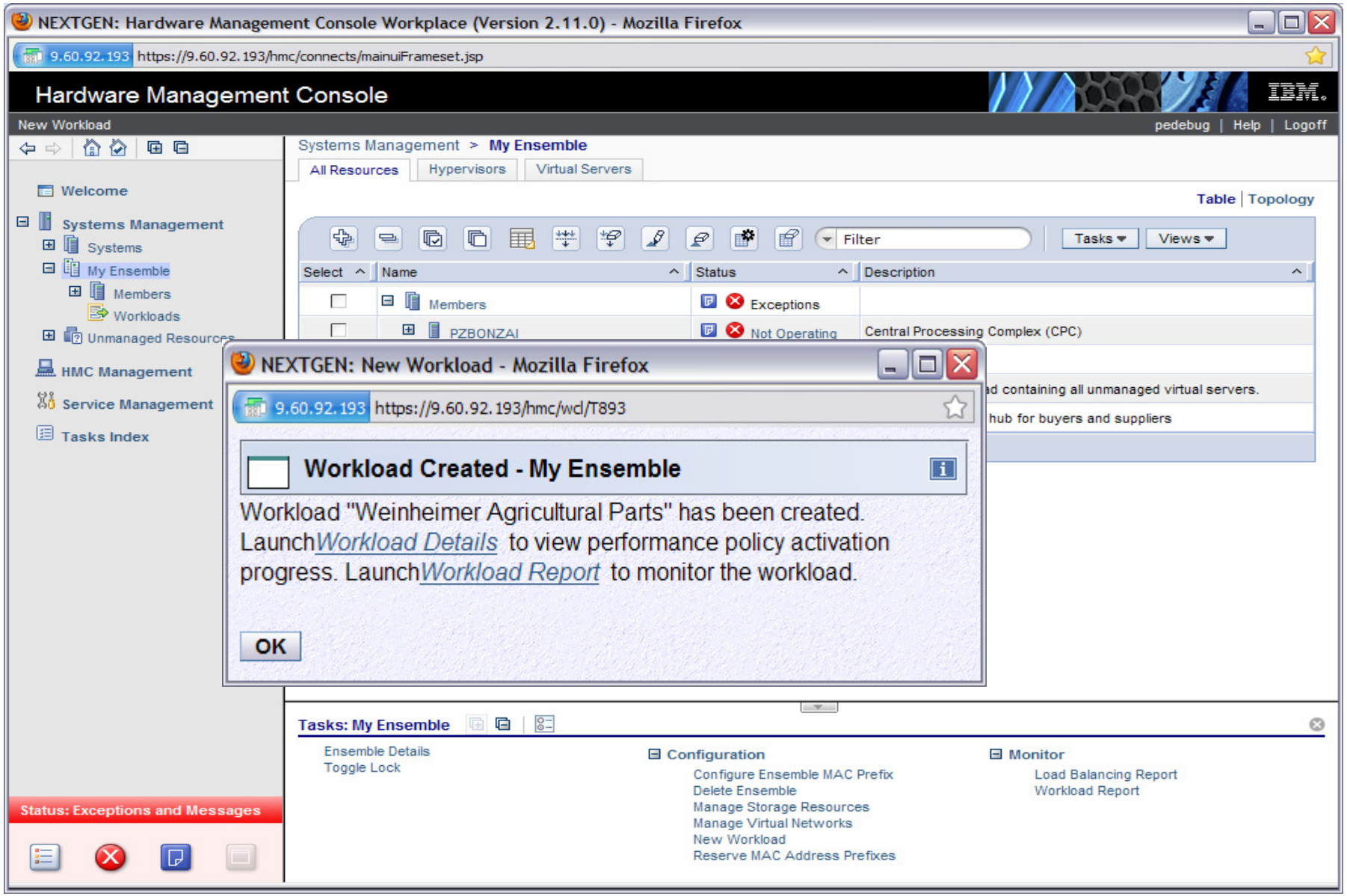




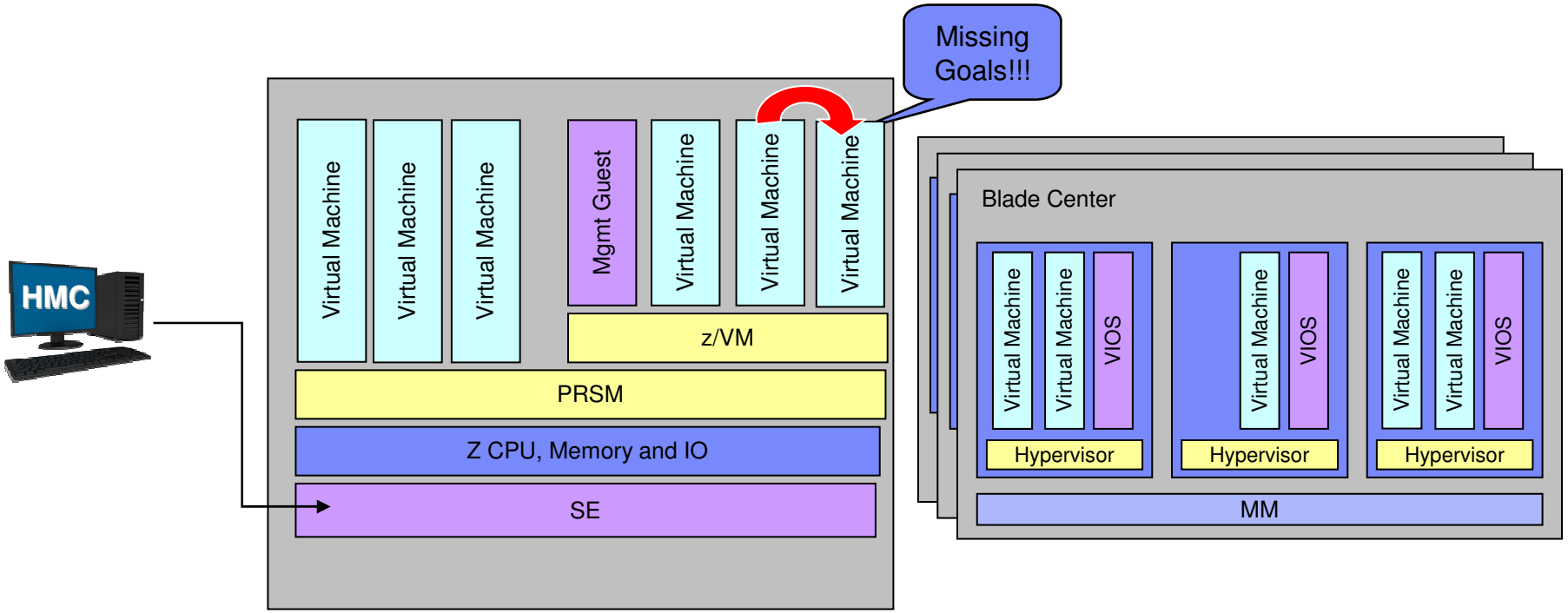




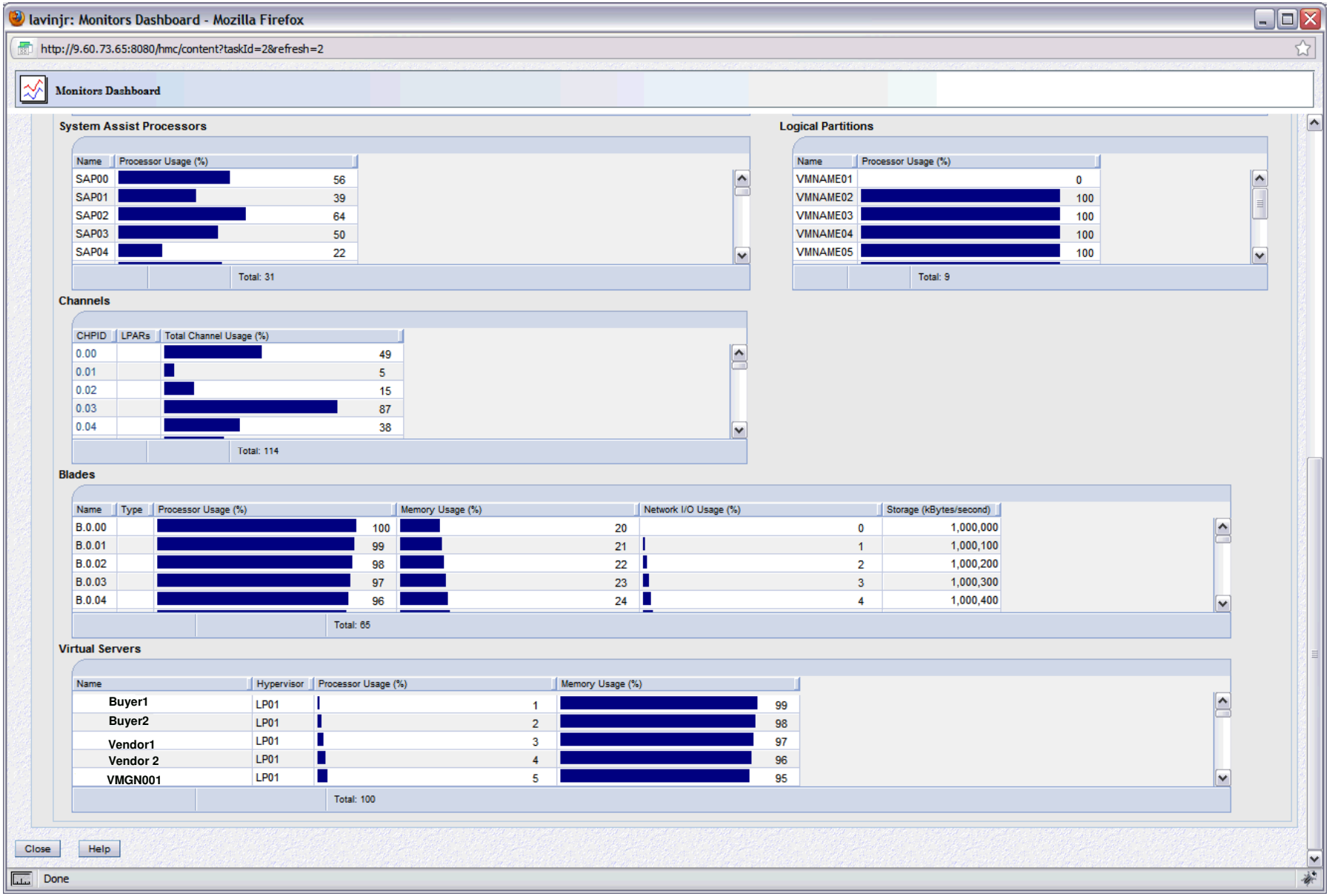


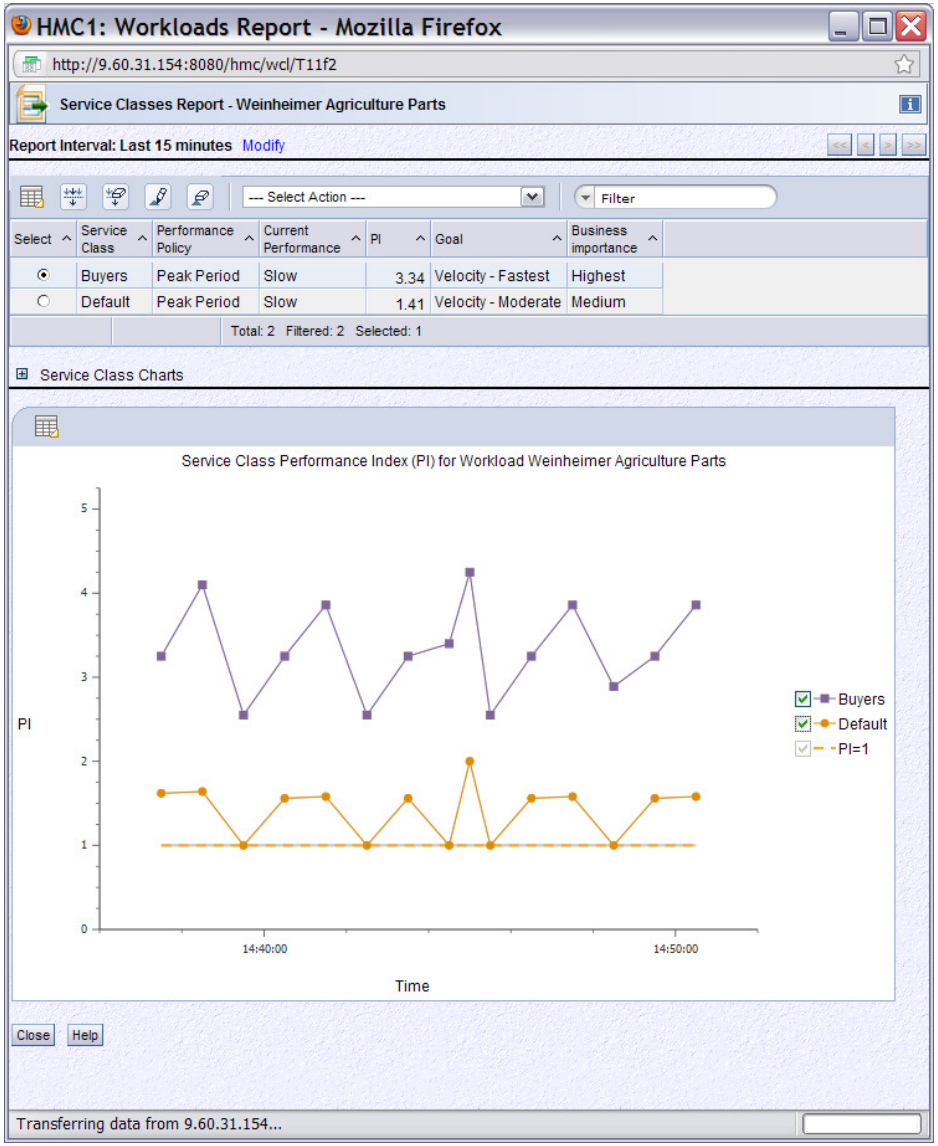


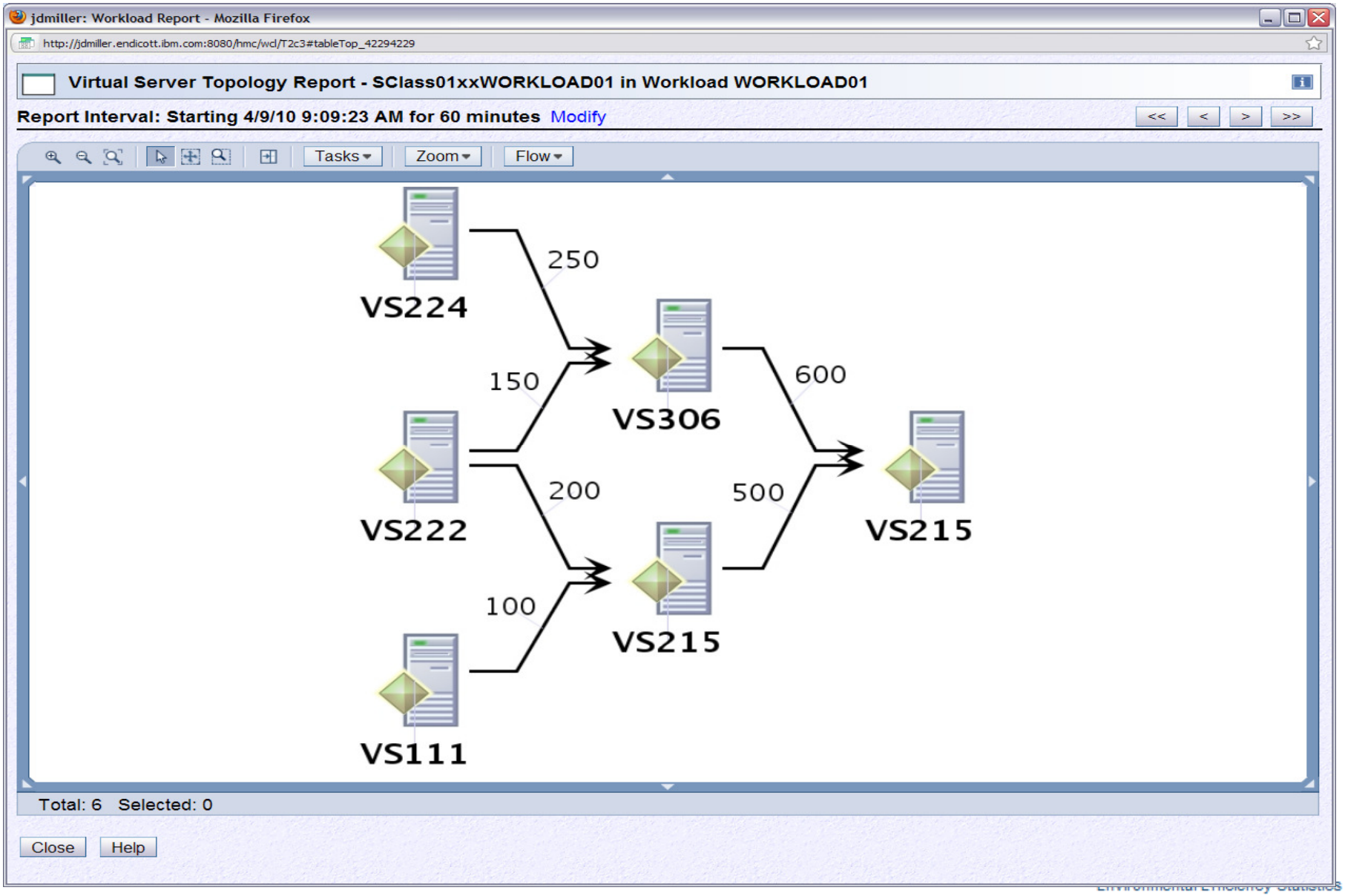
Managing Resources across z/VM Virtual Machines



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






jdmiller: Workload Report - Mozilla Firefox
http://jdmiller.endicott.ibm.com:8080/hmc/wcl/T2c3#tableTop_42294229
Virtual Server Topology Report - SClass01xxWORKLOAD01 in Workload WORKLOAD01
Report Interval: Starting 4/9/10 9:09:23 AM for 60 minutes Modify
<< < > >>
Tasks
Zoom
Flow
VS224
VS222
VS111
VS306
VS215
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Total: 6 Selected: 0
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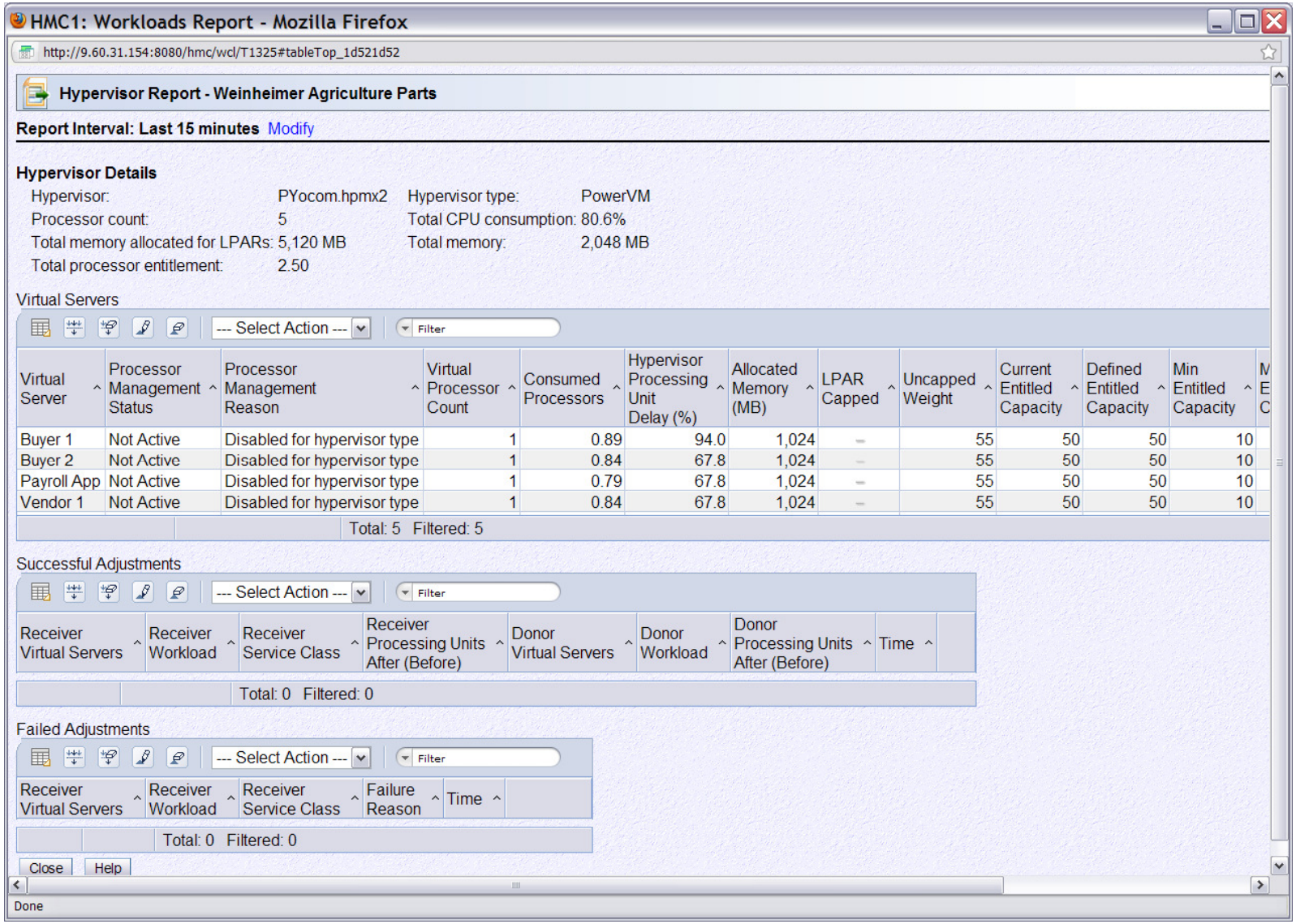
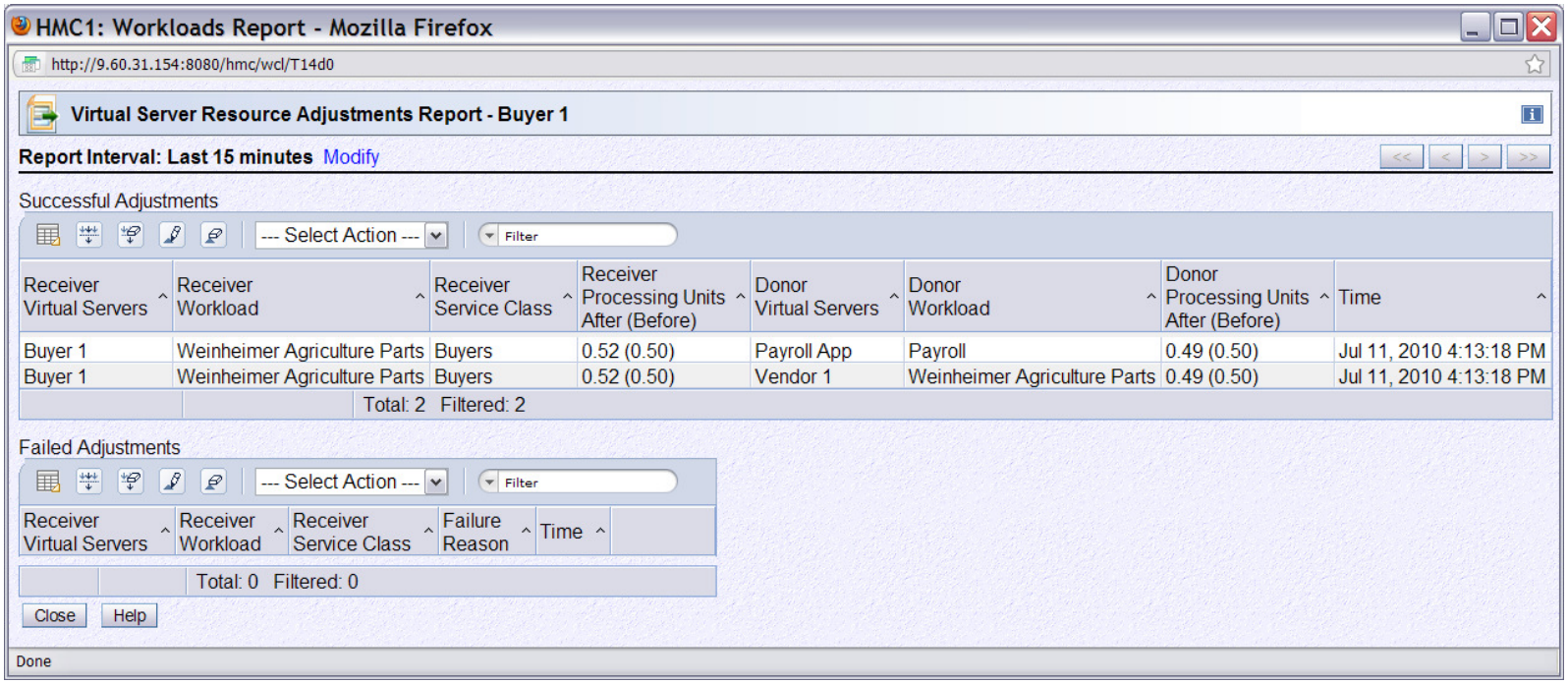
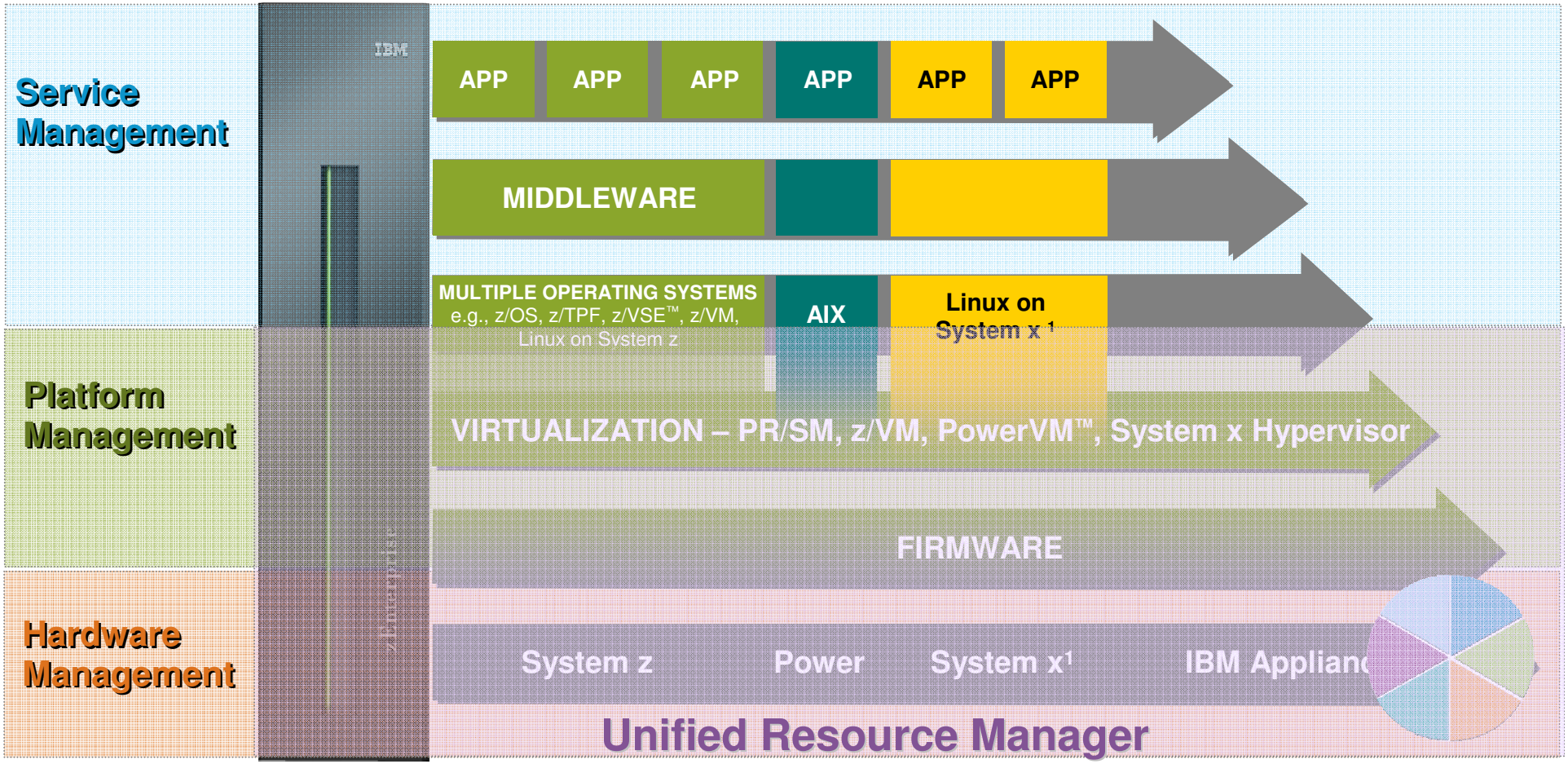




Resource Control

- zManager manages through the hypervisors
- For blades, no direct hypervisor access is provided to customers
  - Closed environments – hypervisors managed as firmware
  - Hypervisor is (just) a management control point
- For z/VM, direct hypervisor access is permitted (e.g., via the CLI)
  - Difficult to take away
  - Allows mixing and matching existing capabilities with zManager functions
  - Permits some inconsistency
    - e.g., Virtual server created outside of zManager must be added to managed set via UI to be visible
- Virtual server perspective
  - Hypervisor provides additional interfaces
  - z/VM has a rich set, many of which are intended for SVM use
- Requirement for programmatic interfaces to zManager well understood
  - Will enable support for additional management software at the operating system, middleware, and application layers

Management Stack – Innovation At Every Level



Focused, collaborative innovation

A "complete systems" approach

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

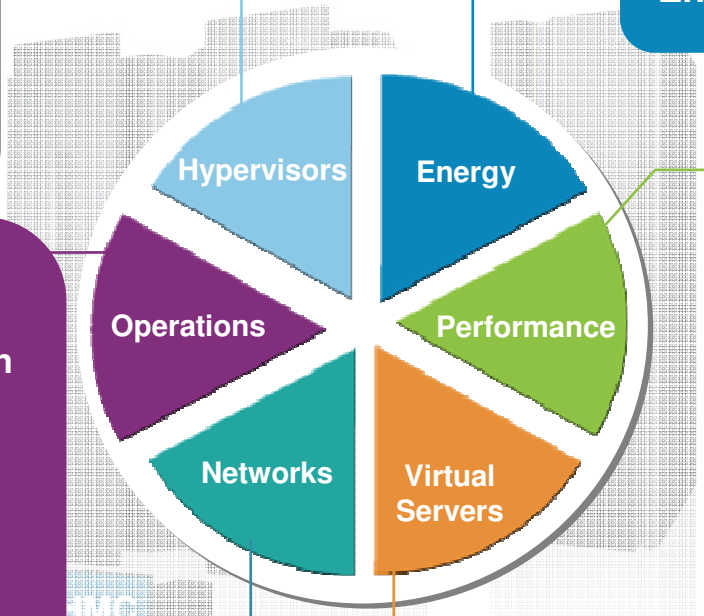
… Value Made Possible By the Unified Resource Manager

Simplified installation of hypervisors

Gain significant time to market with improved speed of deployment

Simplified energy management

Energy cost savings



Save time, cost and simplify asset management

Decrease problem determination and resolution time for cross-platform resources

Improve and simplify cross-platform availability procedures

Enable broader and more granular view of resource consumption

Allow critical workloads to receive resources and priority based on goal-oriented policies established by business requirements

Smart business adjustments based on workload insight

Provide deep insight into how IT resources are being used

Factory installed and configured network

Improved network security with lower latency, less complexity, no encryption/decryption

Gain flexibility, consistency and uniformity of virtualization

Provide the business with faster time to market

Simplified network management for applications

IBM zEnterprise System:

A revolutionary change has come to IT bringing a new dimension in computing

- Redefining IT frameworks to bring change to operational silos and extend System z governance to z/VM virtual machines and blades
- Driving business decisions based on insight rather than hindsight
- Improving agility to compete with consolidation and simplification
- Delivering consistent business controls across applications and platforms
- Focused on integration and collaboration to fuel business growth

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