



Workload Manager Hand's On Tutorial Plus Global Workload Manager Intro



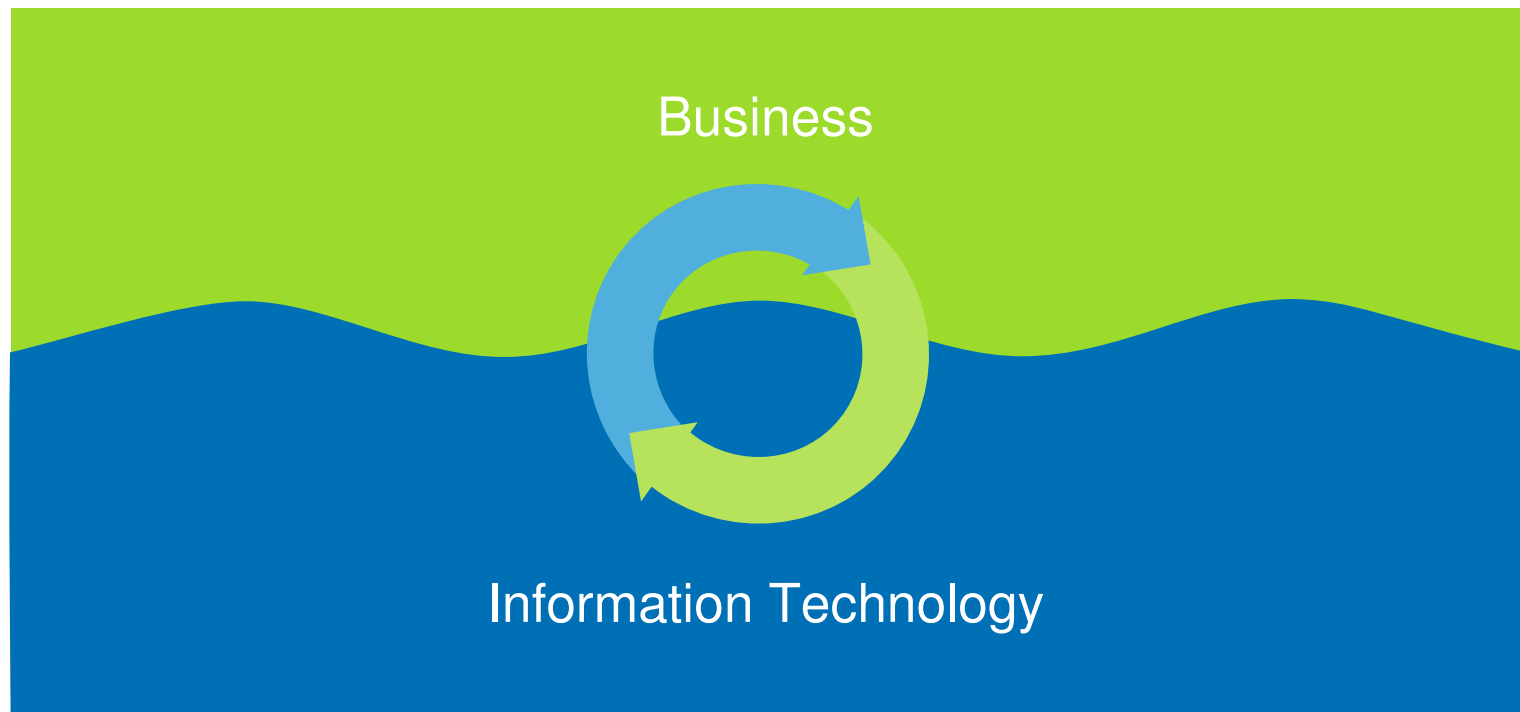
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Hewlett-Packard

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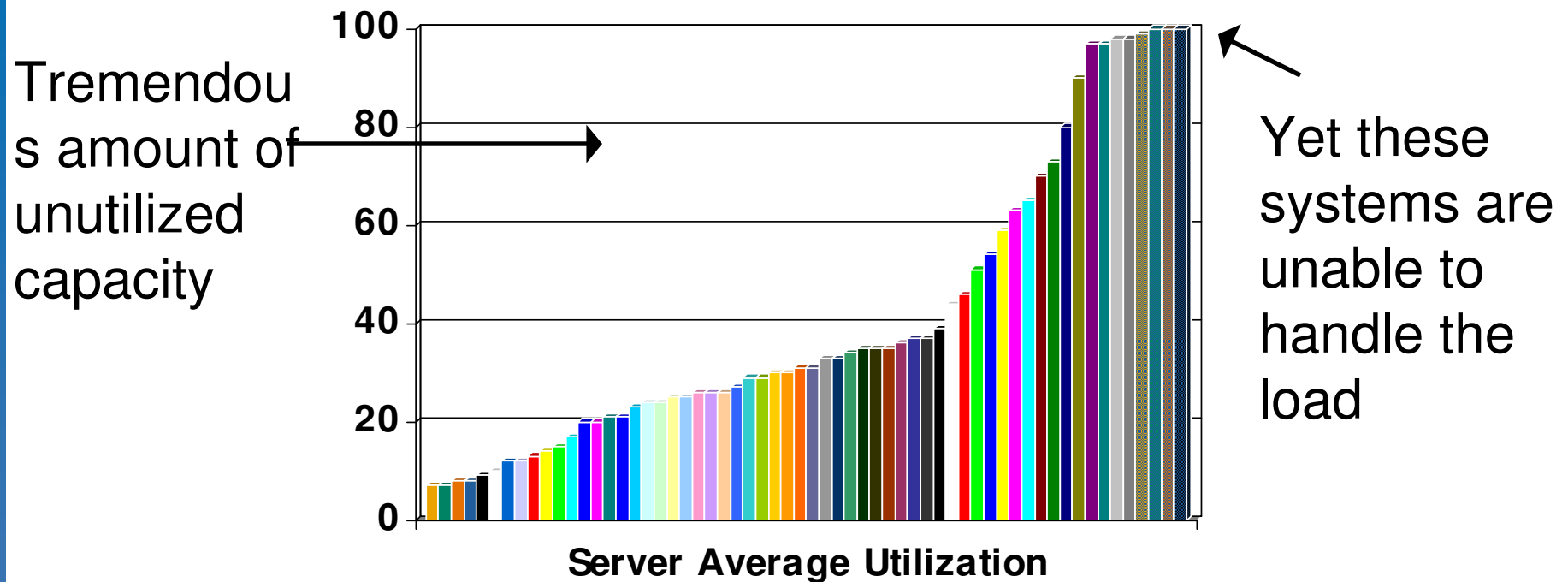
The Adaptive Enterprise

Business and IT synchronized to capitalize on change



Business benefits: simplicity, agility, value

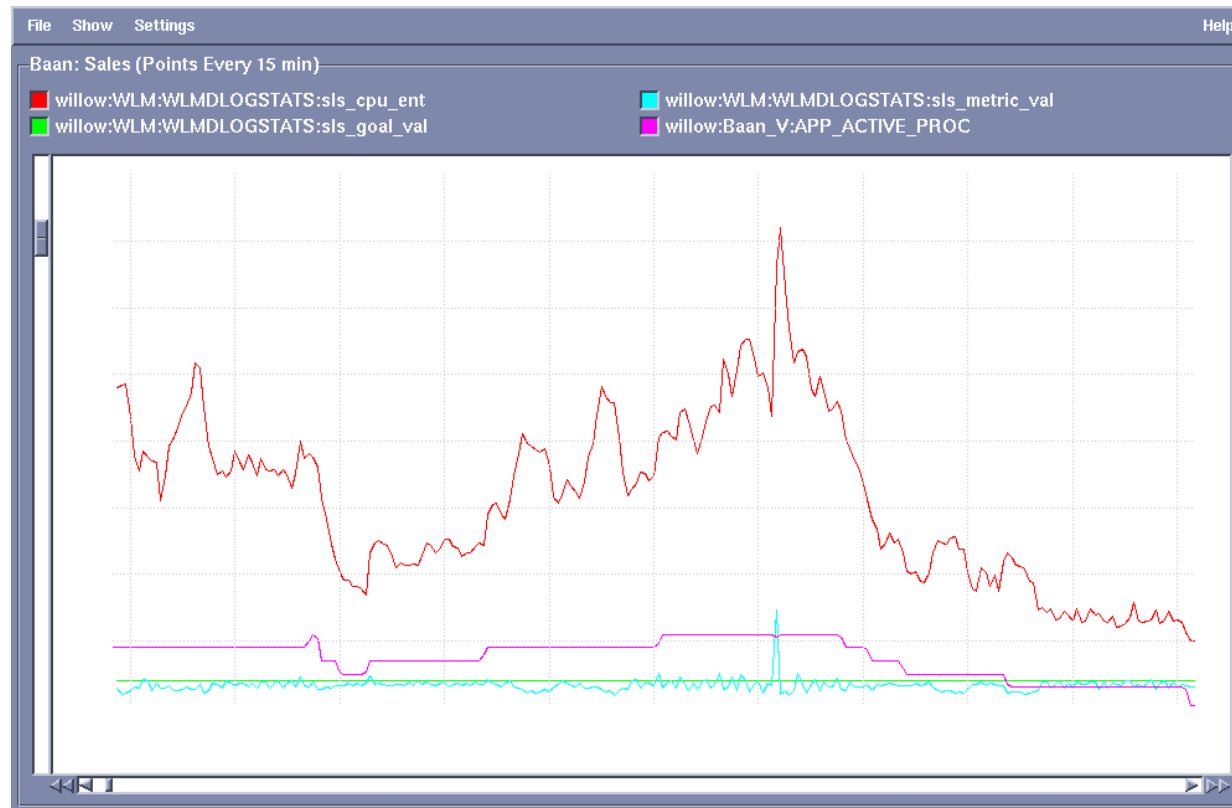
Why You Need an Adaptive Infrastructure



- Most reports put average utilization at approximately 30%
- Some applications still not able to meet performance requirements

Why Utilization is So Low

- Mission Critical applications have peaks in load that require spare capacity



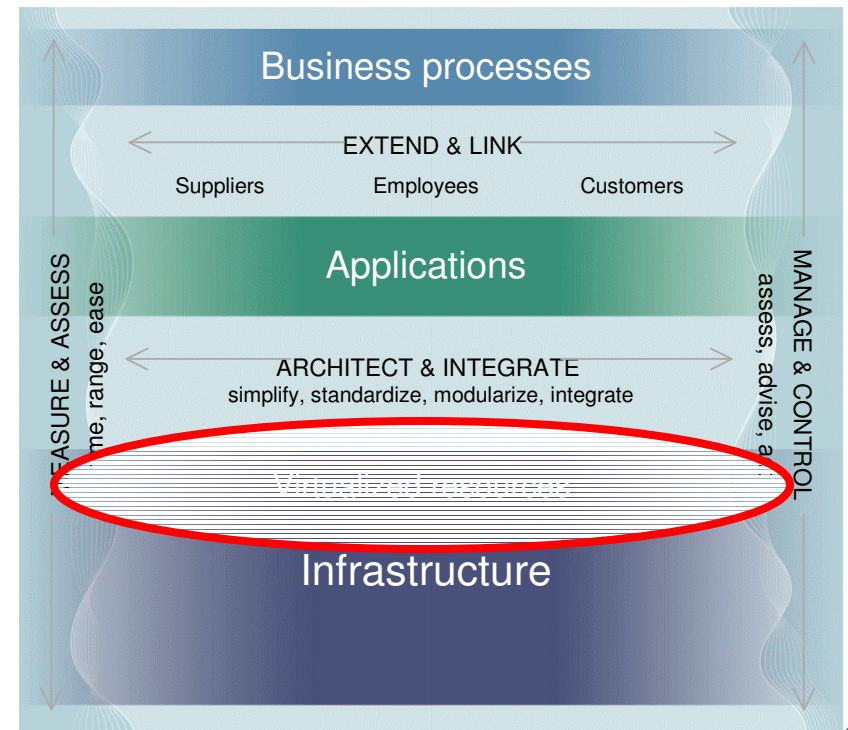
New Alternatives to Overprovisioning

- Build an Adaptive Infrastructure that can dynamically react to application peaks
- Implement Application Consolidation
 - Run many workloads on a small number of servers
- Share Spare Capacity
 - Provide spare capacity for multiple apps on the same system or systems – 40% reduction in spare capacity requirements
- Consolidation requires virtualization solutions to ensure applications are isolated from each other

Adaptive Enterprise vision

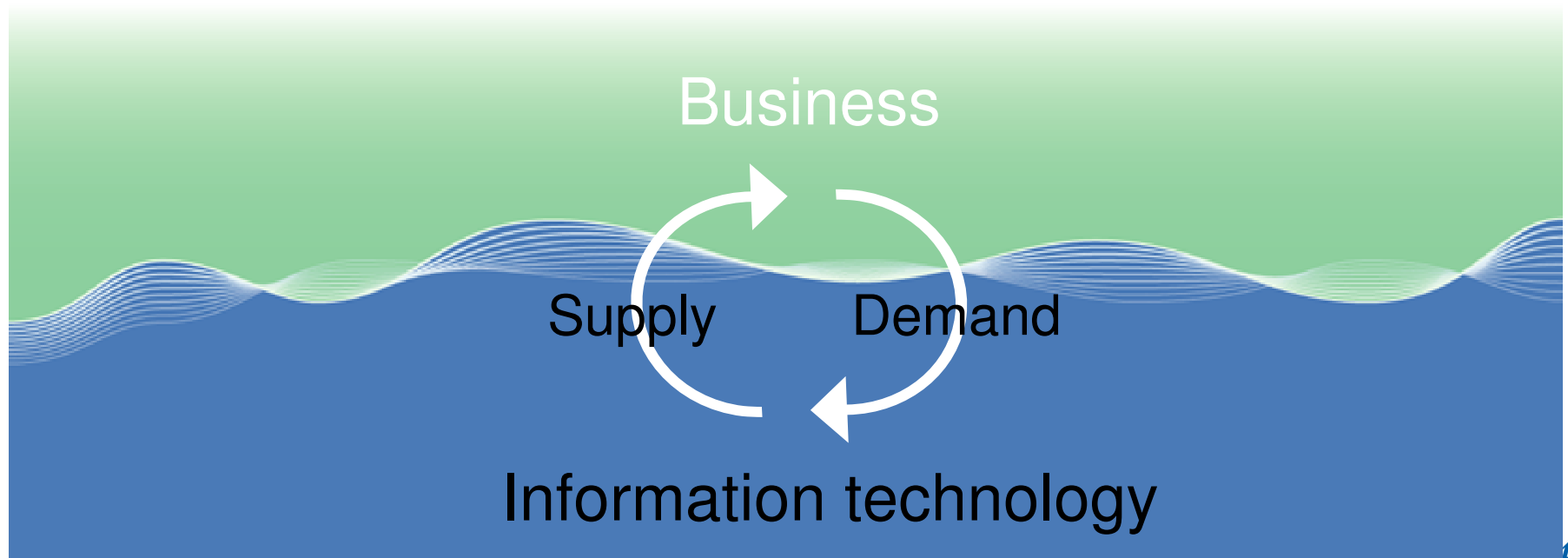
Business and IT synchronized to capitalize on change

1. Measure, assess and maintain a dynamic link between business and IT
2. Architect and integrate heterogeneous IT environments
3. Extend and link business processes across suppliers and customers
4. Manage and control business processes, applications and the whole IT environment

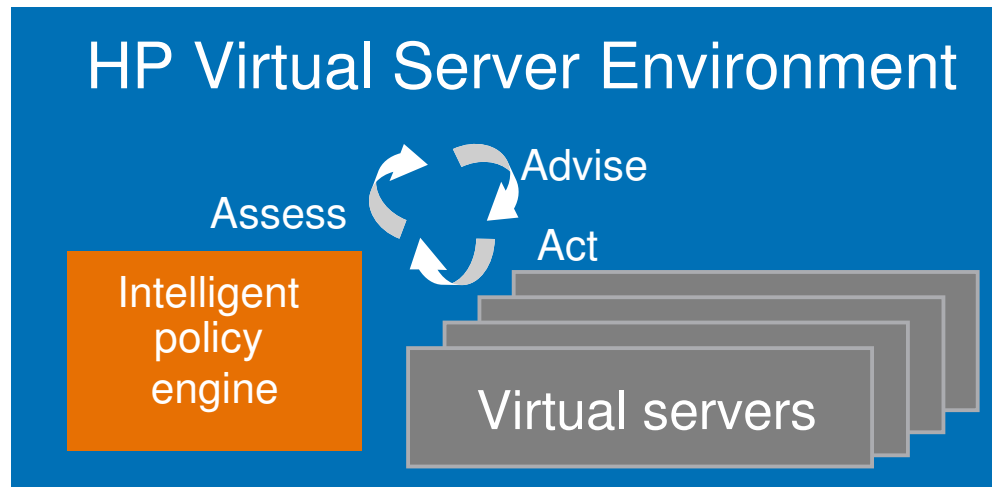


HP's Definition of Virtualization

An approach to IT that pools and shares resources
so utilization is optimized and
supply automatically meets demand



HP Virtual Server Environment for HP-UX 11i



Expands and shrinks
virtual servers
in real time
based on business
priorities

- Better RoIT through optimized resource utilization
- Increased business agility through the capability to allocate resources on the fly
- Ensuring service levels through continuous real time assessment, advice, and action

HP Virtual Server Environment Technologies

HP Virtual Server Environment

Adaptive Enterprise Technologies



- Dynamically reconfigurable partitions
 - nPars with iCOD
 - Virtual Partitions
 - Resource Partitions
- Capacity on Demand
 - iCOD
 - iCOD Temporary Capacity (TiCOD)
 - Pay Per Use (PPU)
- VSE Management Tools
 - Systems Insight Manager and ParManager
 - HP-UX Workload Manager
 - Serviceguard

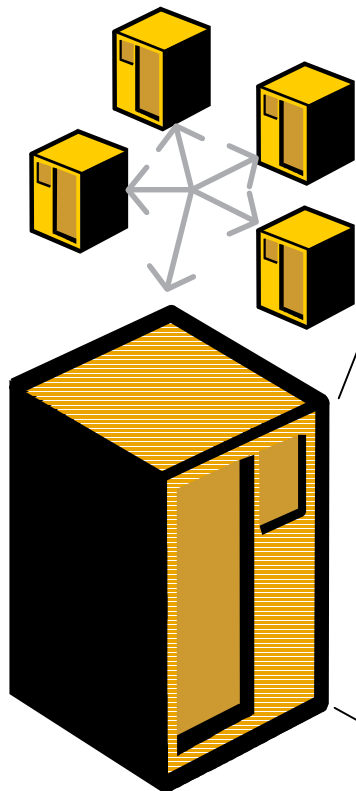


Definition of Partitioning

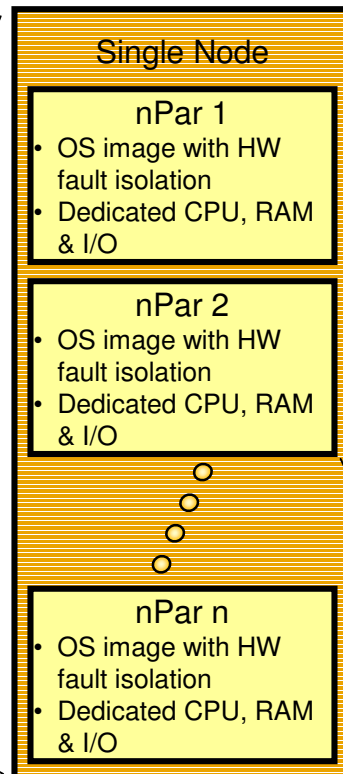
Partitions are physical or logical mechanisms for
isolating operational environments
within single or multiple
servers to offer the
flexibility of dynamic resizing
while ensuring that
applications can enjoy
*protection from
unrelated events*
that could otherwise cause disruption,
interruption, or performance degradation.

HP Partitioning Continuum for HP-UX 11i

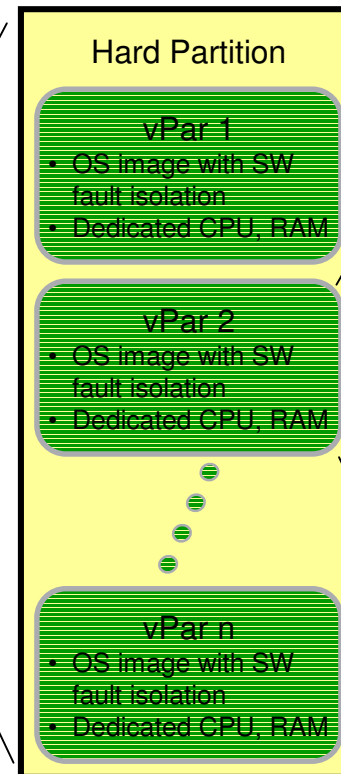
Single Physical Node
single OS image per node
within a cluster



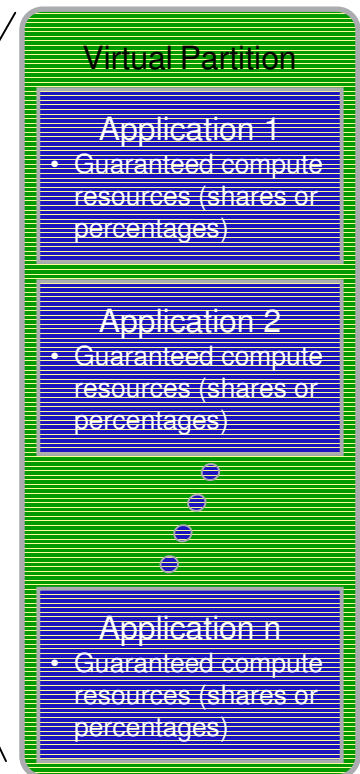
nPartitions
hard partitions
within a node



Virtual Partitions
within a hard partition



Resource Partitions
partitions within a single
OS image

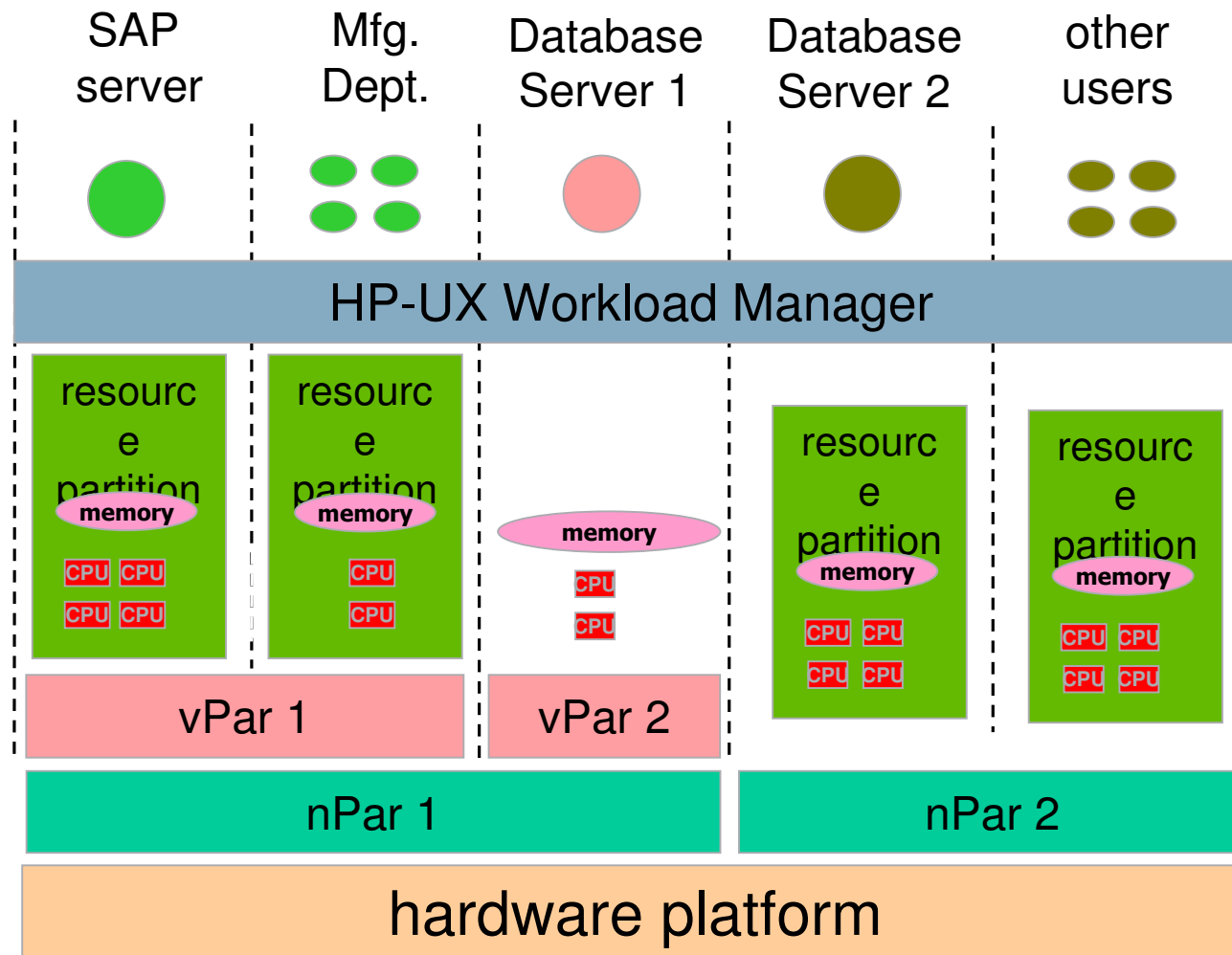


HP-UX WLM

(workload manager)

- automatic goal-based resource allocation via set SLOs

HP-UX = Broadest Partitioning Portfolio



application space

WLM to automatically resize partitions

Adaptive Resource Partitions inside of an OS image

vPars

nPars

hp 9000



HP-UX On-Demand Technologies

- Instant Capacity on Demand (iCOD)
 - Activate new permanent capacity when needed
- Instant Capacity on Demand – Temporary Capacity (TiCOD)
 - Activate/deactivate new temporary CPU capacity when needed
- Pay-per-Use Utility Computing – (PPU)
 - Lease systems based on CPU utilization

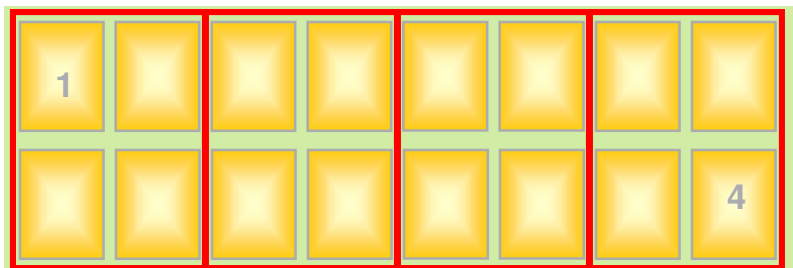
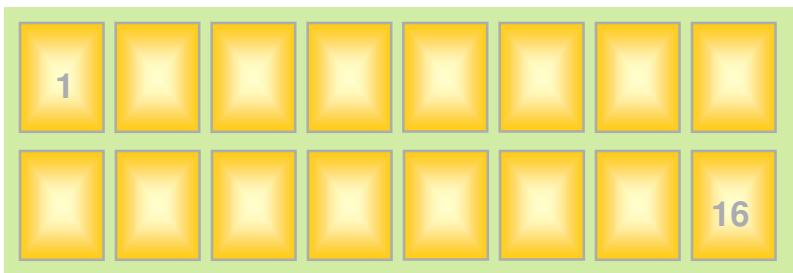
VSE Management Tools

- HP Systems Insight Manager
 - Single Management Interface for HP-UX, Windows and Linux systems management
- HP-UX Workload Manager
 - Automated reallocation of resources based on business priorities and real-time workload performance or load
- HP Serviceguard
 - Industry-Leading High-Availability Clustering Solution

nPars

nPartitions

Multiple applications on the same server with full electrical isolation between partitions

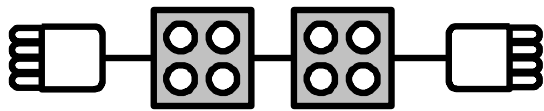


- **Increased system utilization**
 - partitioning Superdome into physical entities: up to 16 nPartitions
- **Increased Flexibility: Multi OS**
 - Multi OS support: HP-UX, Linux (*), Windows (*)
 - Multi OS version support
 - Multiple patch level support
- **Increased Uptime**
 - hardware and software isolation across nPartitions
 - MC/ServiceGuard support (within Superdome or to another HP 9000 server)

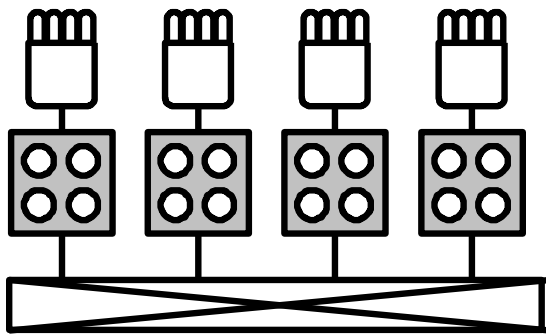
hp's cellular architecture is very flexible



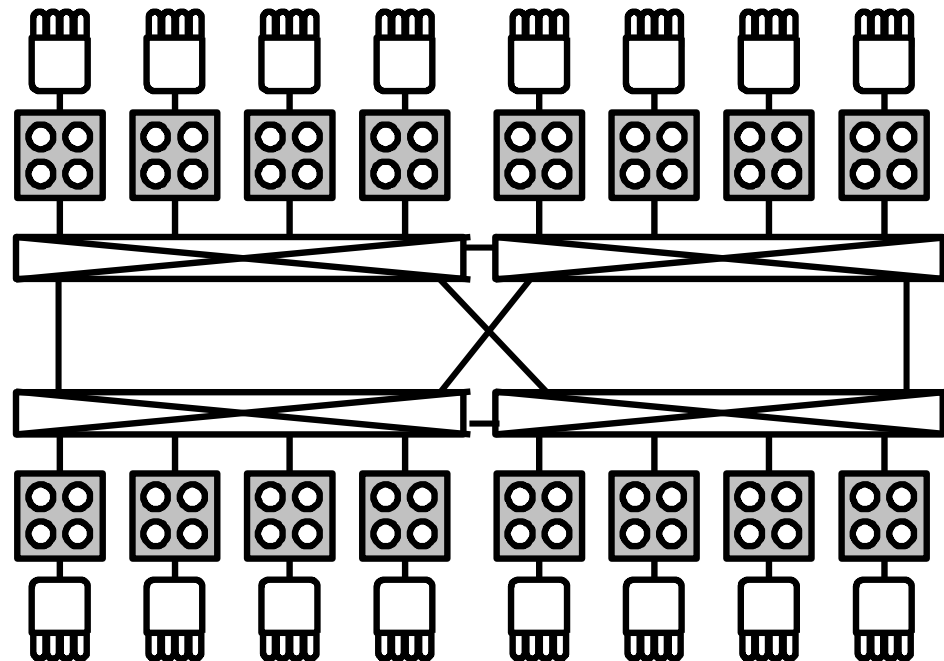
8 Socket system



16 Socket system



64 Socket system



Legend



Two crossbar
switches

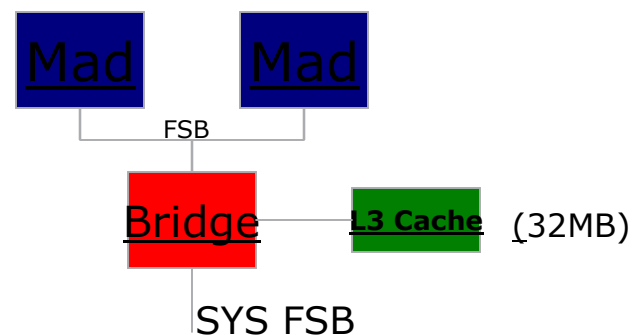
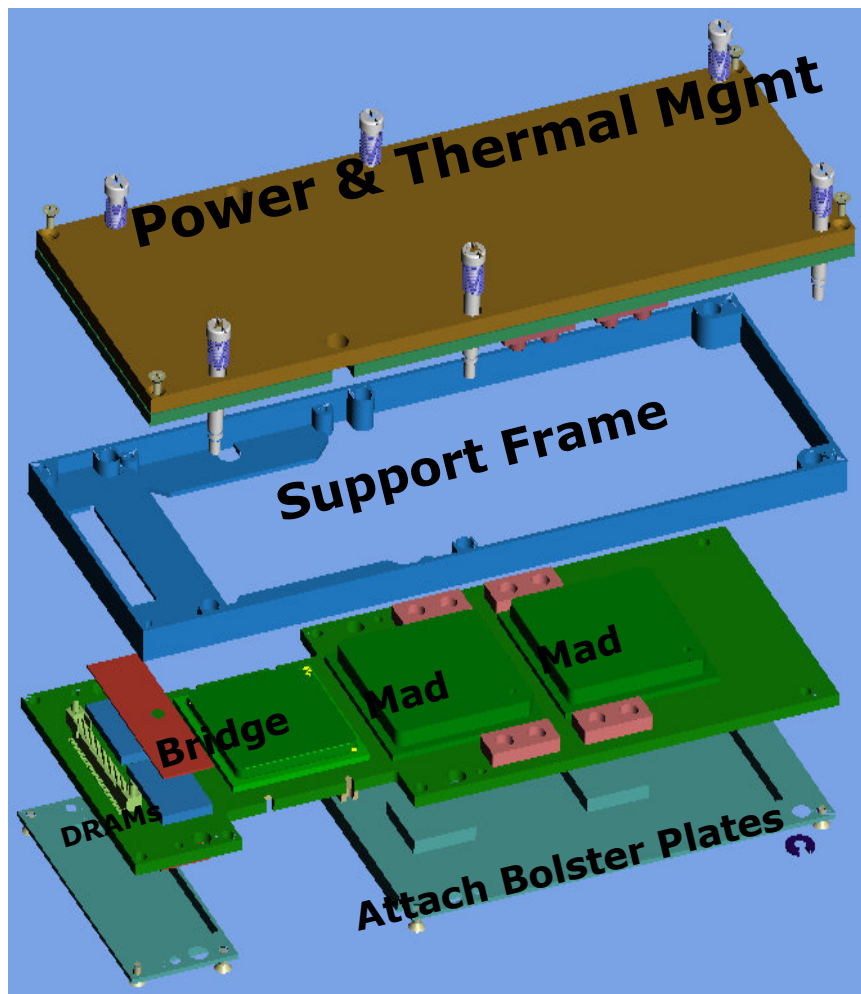


4 Socket Cell



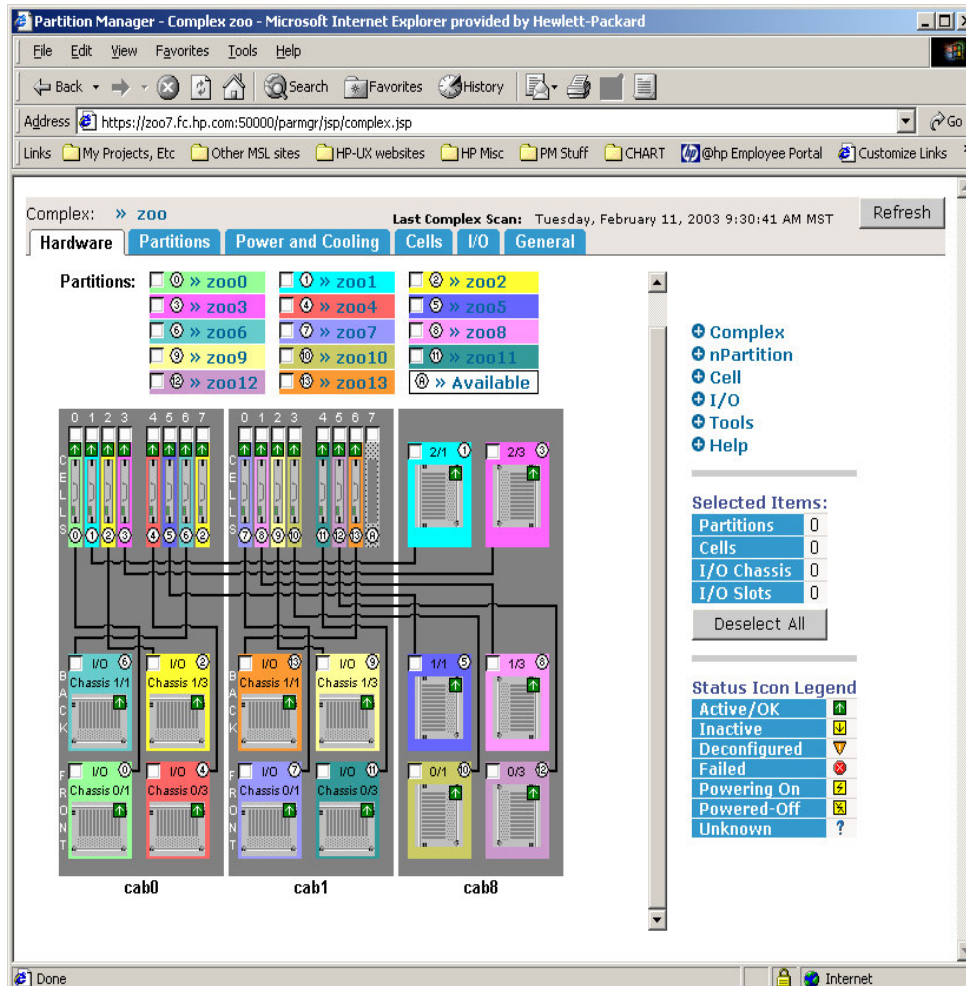
I/O Backplane

MX2 System Daughtercard



Partition Manager New Features

Significant Changes from ParManager on HP-UX 11i

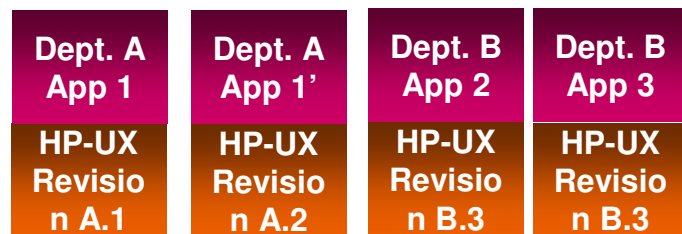


- ✓ New web interface
- ✓ Graphical “big picture” views of
 - nPars
 - Hardware in complex
- ✓ Supports new OS/HW features
 - Cell local memory for HP-UX 11i v.2 partitions
 - nPartition configuration privilege
- ✓ Remote admin of Superdome complex
- ✓ Compatible with iCOD/pay-per-use
- ✓ Native on Windows (2H 2004)

vPars

HP-UX Virtual Partitions

Multiple HP-UX instances
running on the same system
or in the same nPar



Increased system utilization

- partitioning a single physical server or hard partition into multiple virtual partitions for rp5405, rp5470, rp7400, Superdome, rp8400, rp7410, rp8420, rp7420

Increased Flexibility

- multiple independent instances of HP-UX
- dynamic CPU migration across virtual partitions

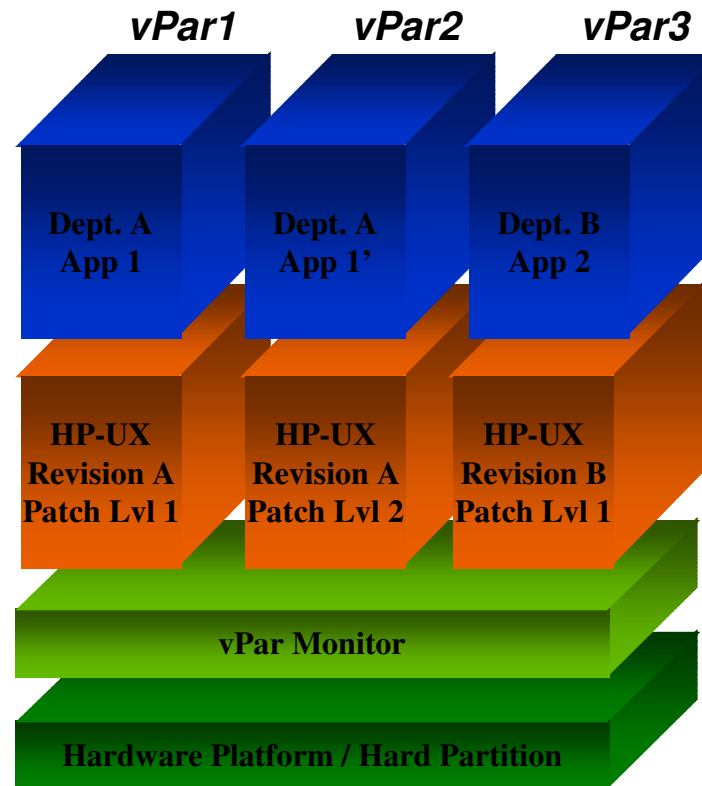
Increased Isolation

- application isolation across virtual partitions
- OS isolation
- individual reconfiguration and reboot

vPars logical overview

- multiple applications or multiple instances or versions of the same application
- provides name space and resource isolation

- creates illusion of many separate hardware platforms
- manages shared physical resources
- monitors health of operating system instances



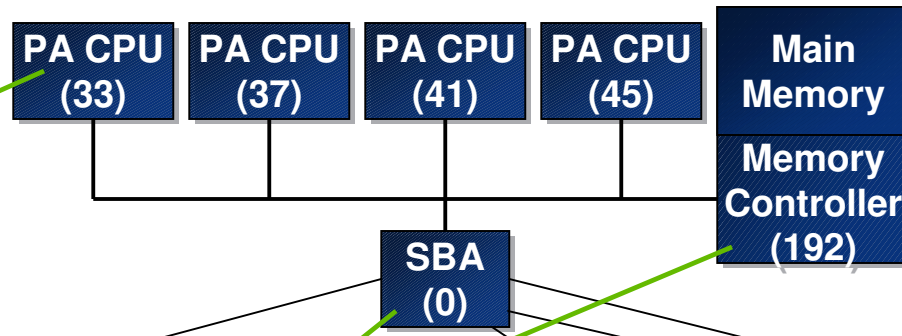
- each operating system instance tailored specifically for the application(s) it hosts
- operating systems instances are given a user-defined portion of the physical resources
- provides name space and resource isolation
- supported on rp5470, rp7400, Superdome, rp8400, rp7410, rp8420, rp7420 systems
- no additional platform support required

Partitionable Resources

- CPUs may be “bound” to a single partition or allowed to “float” among partitions

- bound CPUs require a partition reboot to be reassigned among partitions

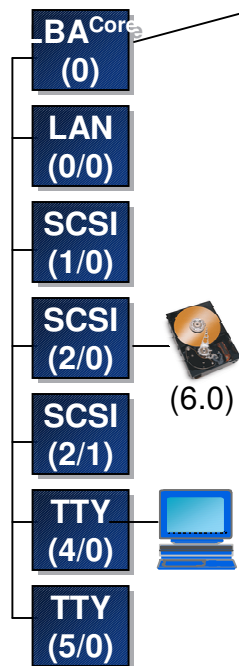
- unbound CPUs may be dynamically reassigned among partitions



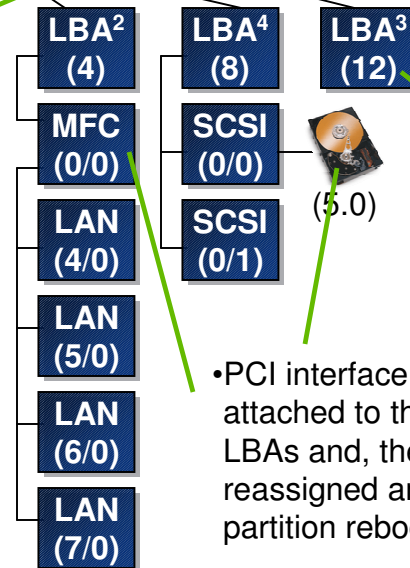
- main memory is allocated to partitions in multiples of 64MB ranges

- adding or removing memory to or from a partition requires a partition reboot

- SBAs and memory controllers are owned by the vPar Monitor and are not assigned to partitions



- the system console may be multiplexed among partitions; an escape-sequence (CTRL-A) allows the user to toggle among partitions



- LBAs are bound to a single partition

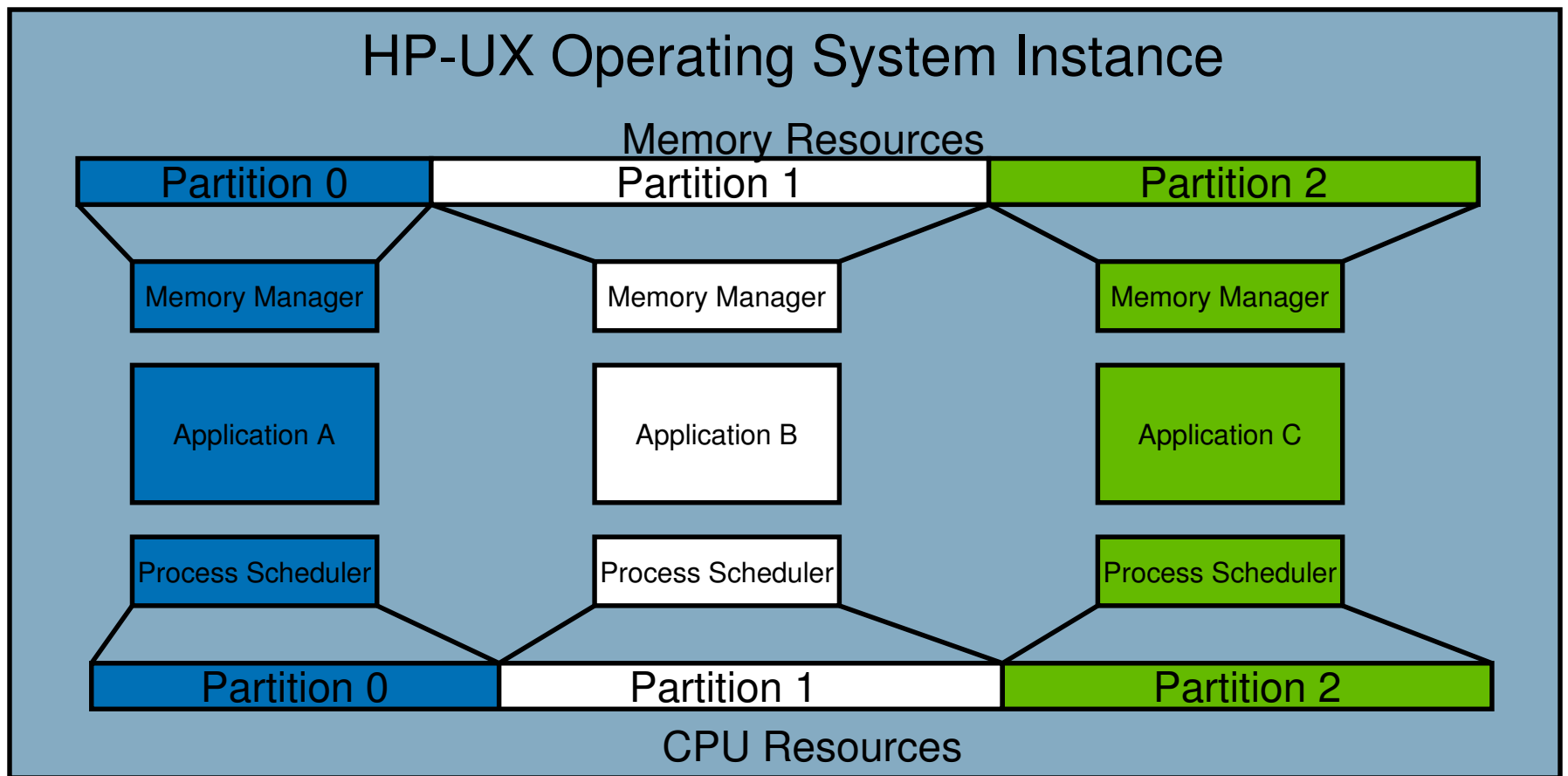
- adding or removing LBAs to or from a partition requires a partition reboot

- PCI interface cards and the devices attached to them are connected through LBAs and, therefore, cannot be logically reassigned among partitions without a partition reboot

Resource Partitions

Resource Partitions

Apps are running in the same OS, but have separate process schedulers and separate memory managers



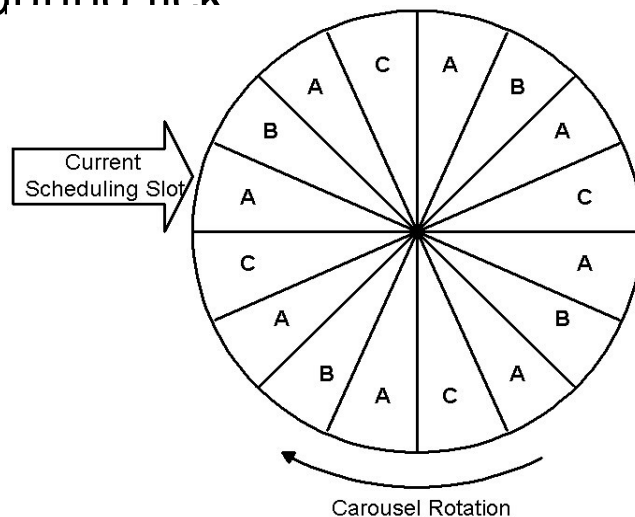
Resource Partitioning Features

- Resource controls:
 - CPU Controls
 - CPU allocation by percentage, shares, or whole processors
 - Optional capping in FSS partitions
 - Concurrent FSS and PSETs
 - Real memory controls
 - Each partition gets a separate memory manager in 11i
 - Disk bandwidth
 - Both LVM and Veritas VxVM Volume Groups
 - Automatic process assignment to partition
 - Users/Groups
 - Executable path/Process name
 - Children automatically run with parent by default

PRM CPU Scheduling

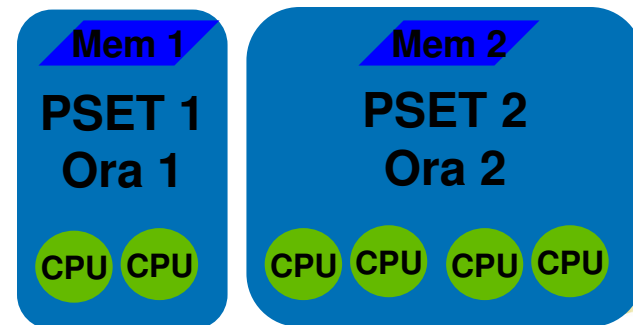
Fair Share Scheduler

- Shares become slots in a carousel
- Each slot is 10ms CPU tick
- FSS allows Standard Unix scheduler to schedule processes from current partition during tick



Processor Sets

- CPU is allocated on whole CPU boundaries
- Standard Unix scheduler allocates CPU within a PSET
 - Separate process schedulers for each partition
 - Processes in the partition are scheduled on the CPUs in the PSET assigned to the partition





HP-UX Resource Partitions

Key Features and Benefits

- Controls allocation of CPU, real-memory and disk I/O bandwidth based on user-specified policies
- Applications do not require modification to work with PRM
- Configuration can be changed at any time - even under load
- Supports resource policies based on users and applications
- Supports the configuration of both FSS and PSET based partitions on the same system
- Tight integration with HP-UX systems management and workload management tools

On-Demand

HP Instant Capacity On Demand (iCOD)

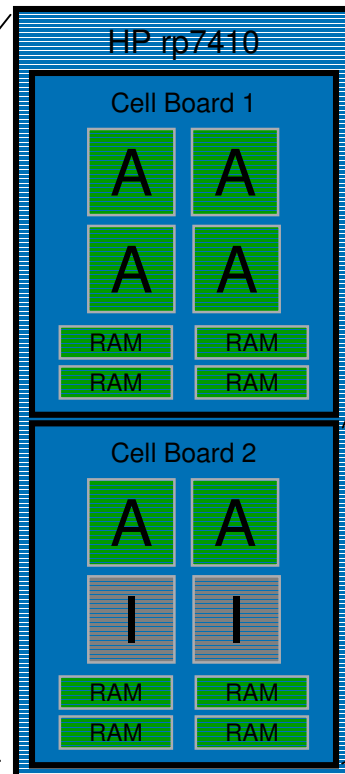


Single Physical Node
e.g. single 8-CPU HP rp7410



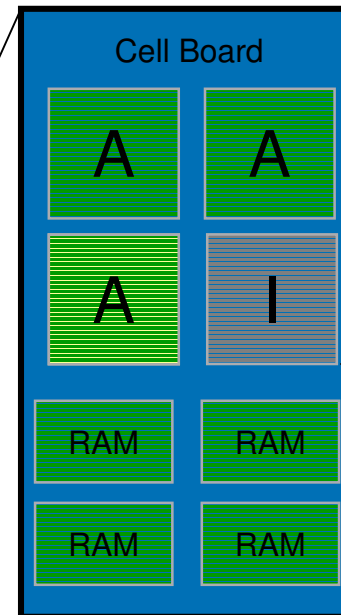
Cell Board iCOD

Inactive cell board containing four dormant CPUs



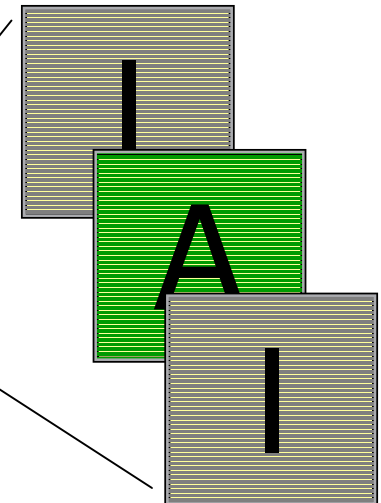
iCOD

One or more inactive CPUs per cell board



TiCOD

Temporary use (30 days/
720 hours) of iCOD CPUs



Granularity / Flexibility



Instant Capacity on Demand (iCOD)

- System acquired with inactive processors
- Processors are paid for when they are activated
 - Price paid is current price when activated
- CPUs can be activated on-line – no reboot required
- Excellent solution for expected growth
- iCOD is licensed for an entire complex
- CPUs can be deactivated in one nPar and activated in another – without reboot

iCOD Temporary Capacity (TiCOD)

- Alternative purchasing model for iCOD processors
- Temporary Capacity is purchased in 30 Day increments
 - 30 CPU-Days = 43,200 CPU-Minutes
- Any number of iCOD CPUs can be activated
- Activating processors causes the iCOD software to deduct minutes from the “bank”
- Deactivating the iCOD processors stops the deductions
- Excellent solution for:
 - Short term peaks in application load
 - Lower cost failover server - Activation of additional capacity upon failover of a large workload onto a failover server

Pay-per-Use Utility Computing (PPU)



- Type of lease
- Acquire a system with peak capacity required
- Monthly charge based on base payment plus a variable payment based on actual resource usage
- 2 utilization measurement models
 - Active CPU – CPUs are activated/deactivated and variable payment is based on how long CPUs were active
 - Percent Utilization – All CPUs are active and the system is monitored for CPU utilization – variable payment is based on average utilization of all CPUs
- Excellent solution for highly variable loads, especially revenue generating loads because costs are in line with revenues

Workload Manager

HP Workload Manager

- HP WLM is a state-of-the-art dynamic workload manager for HP-UX servers
 - It automatically adapts the partition configuration based on the loads on the applications running in those partitions and your business priorities
 - Supports:
 - Resource partitions and vPars and nPars with iCOD
 - Automatic activation/deactivation of iCOD and pay-per-use CPUs
 - Resource partition memory reallocation when workloads are activated/deactivated due to failover or batch job activation
- WLM helps you comfortably increase utilization while still ensuring that your mission critical applications maintain their performance requirements

WLM Service Level Objectives

SLO's use goals, constraints, and conditions.

An SLO consists of:

- A workload (partition)
- Constraints (min, max cpu)
- A goal
- Priority
- Conditions (time of day, event, etc)

Group A

Min CPU: 20%

Max CPU: 50%

Group A receives 3 shares for each additional user.

Policy applies 9am to 5pm AND
when ServiceGuard Package XYZ

WLM goal types

- Any of the following can be used to allocate resources to a workload:
 - resource utilization
 - CPU entitlement based on utilization of current entitlement
 - Easiest to configure – no data required
 - direct measurement of the performance of the workload
 - response time
 - throughput
 - measurement of load on application
 - number of users/processes
 - queue length

WLM Major Features

- 11i and 11iV2 support on PA and Integrity
- Support for Resource Partitions, vPars and nPars with iCOD
- Support for PPU and TiCOD
- Out of the box support of any workload with CPU Utilization controls
- Goal-based Service Level Objective Support based on any available data value
- Out of the box toolkits to support Oracle, Weblogic, Glance, Apache, Job duration/SAS, Serviceguard
- Command line and GUI utilities for configuration and monitoring
- Auditing (billing) utilities – utilities that accumulate the actual usage of resources by each workload over time
- Advisory mode - to allow customers to monitor their workloads without turning on active WLM controls

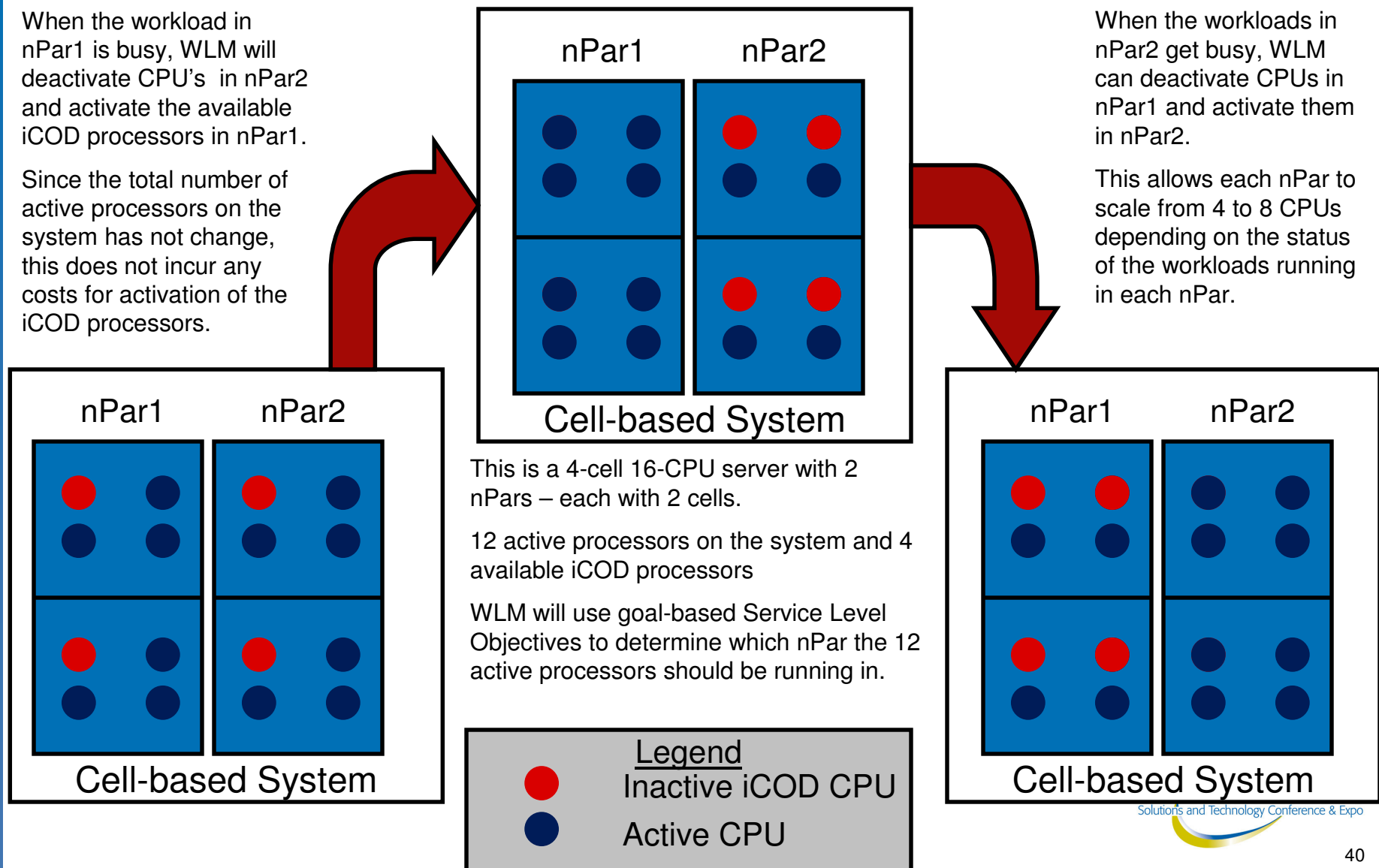
WLM support for Hard Partitions (nPars)

When the workload in nPar1 is busy, WLM will deactivate CPU's in nPar2 and activate the available iCOD processors in nPar1.

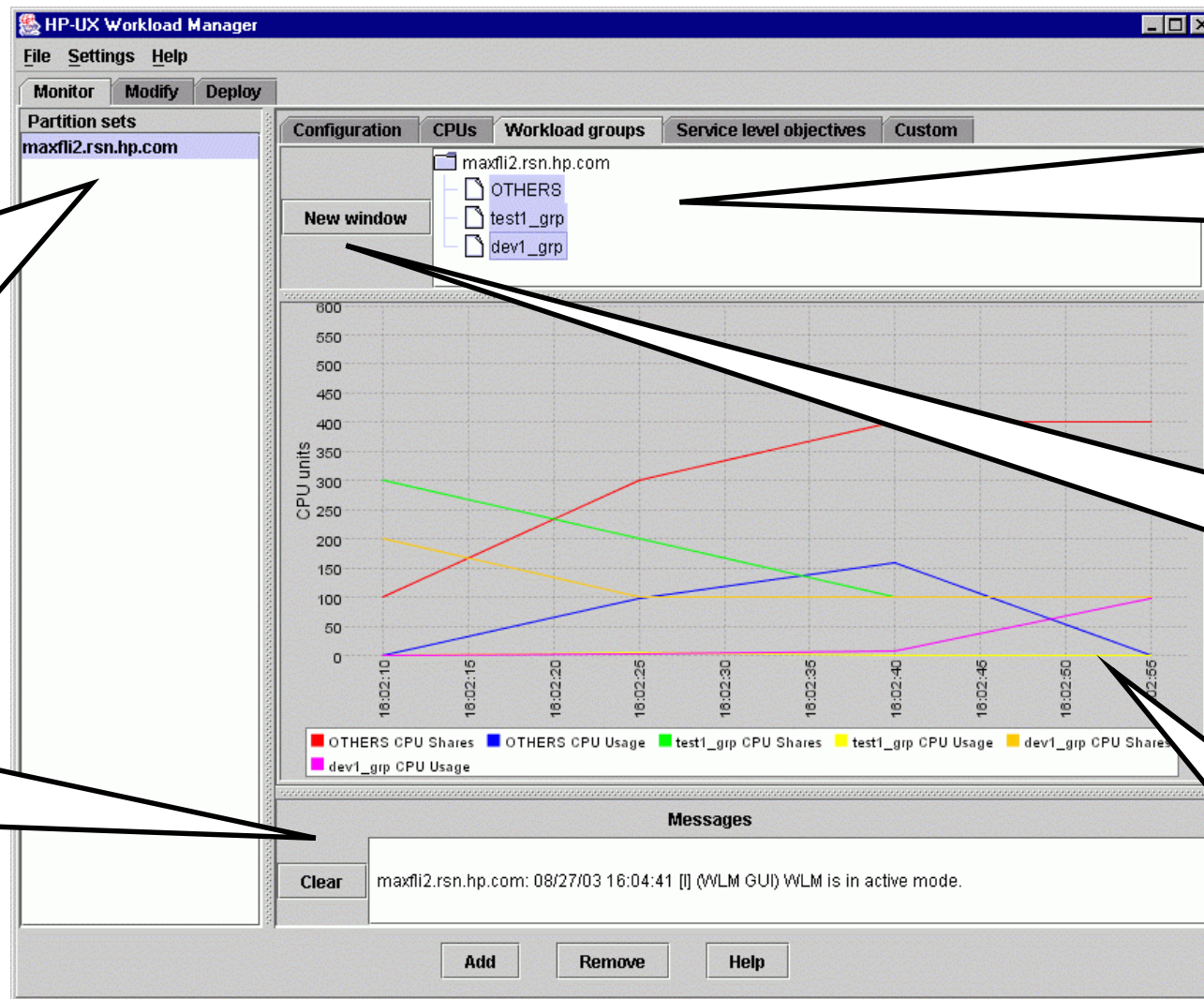
Since the total number of active processors on the system has not change, this does not incur any costs for activation of the iCOD processors.

When the workloads in nPar2 get busy, WLM can deactivate CPUs in nPar1 and activate them in nPar2.

This allows each nPar to scale from 4 to 8 CPUs depending on the status of the workloads running in each nPar.



Remote Monitoring GUI



User Defined Sets of HP-UX partitions running WLM

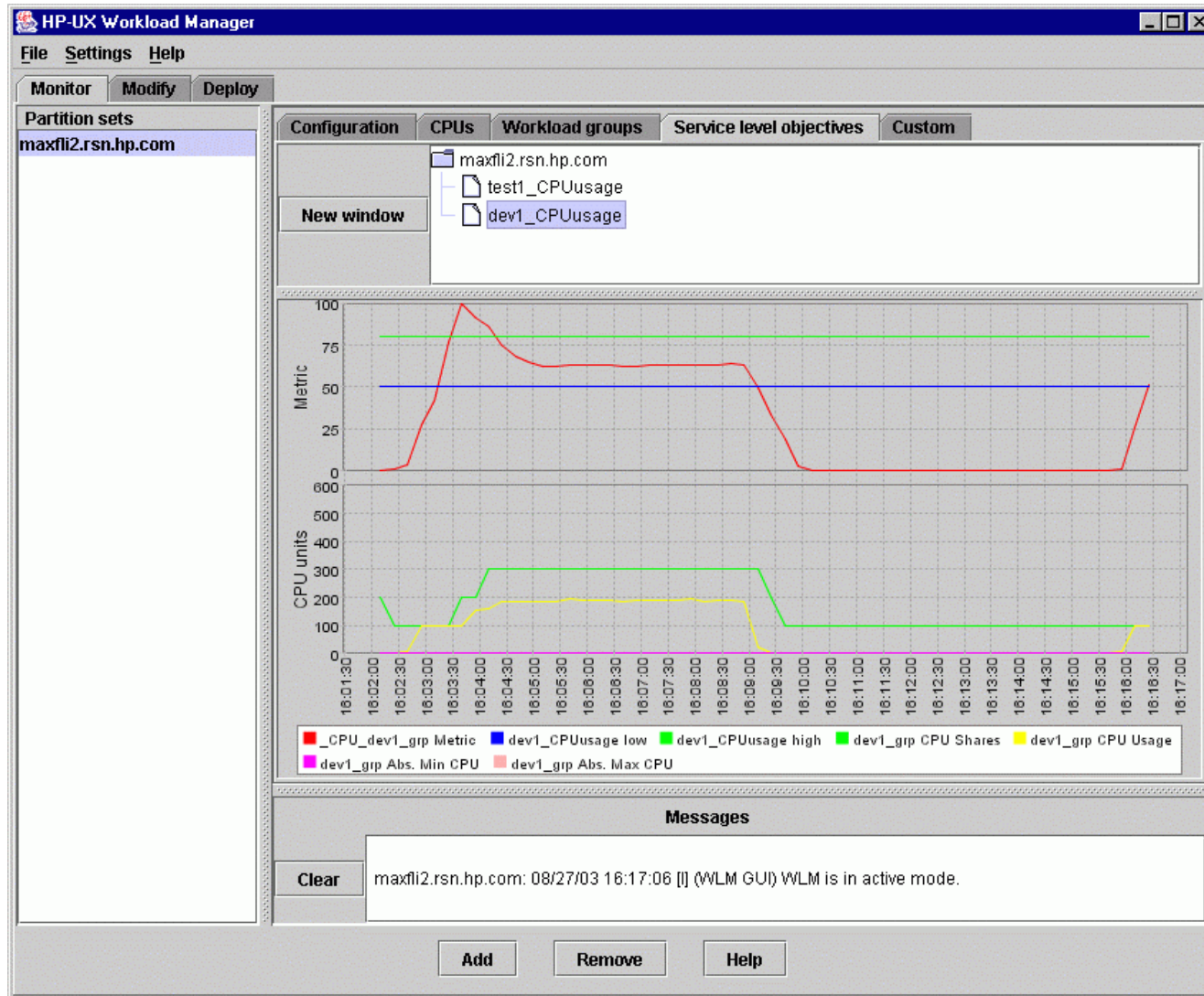
User selected partitions for each graph

Opens the graph in a separate window

Remote WLM messages displayed here

Graph data displayed here

Remote Monitoring GUI

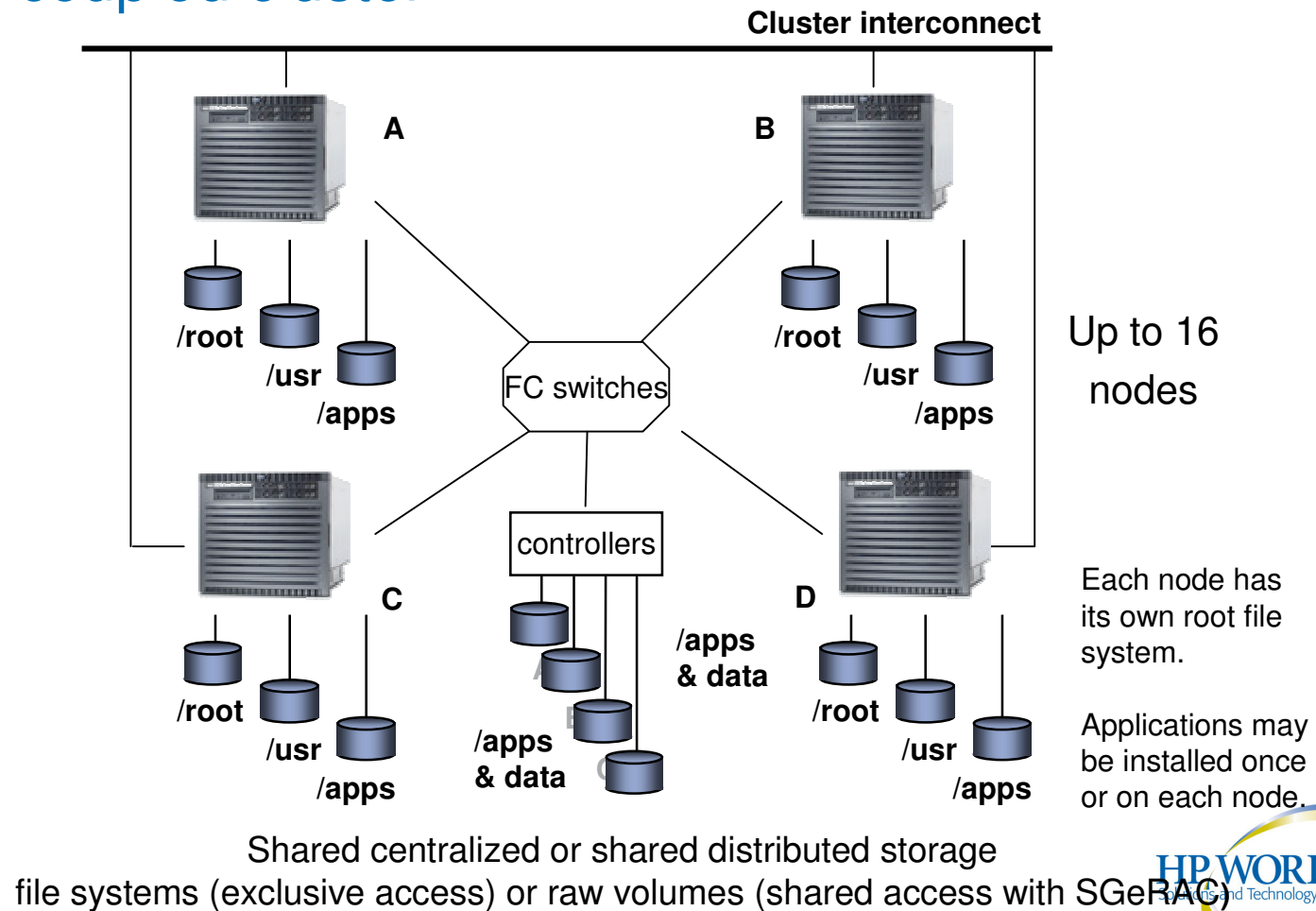


Serviceguard

HP Serviceguard

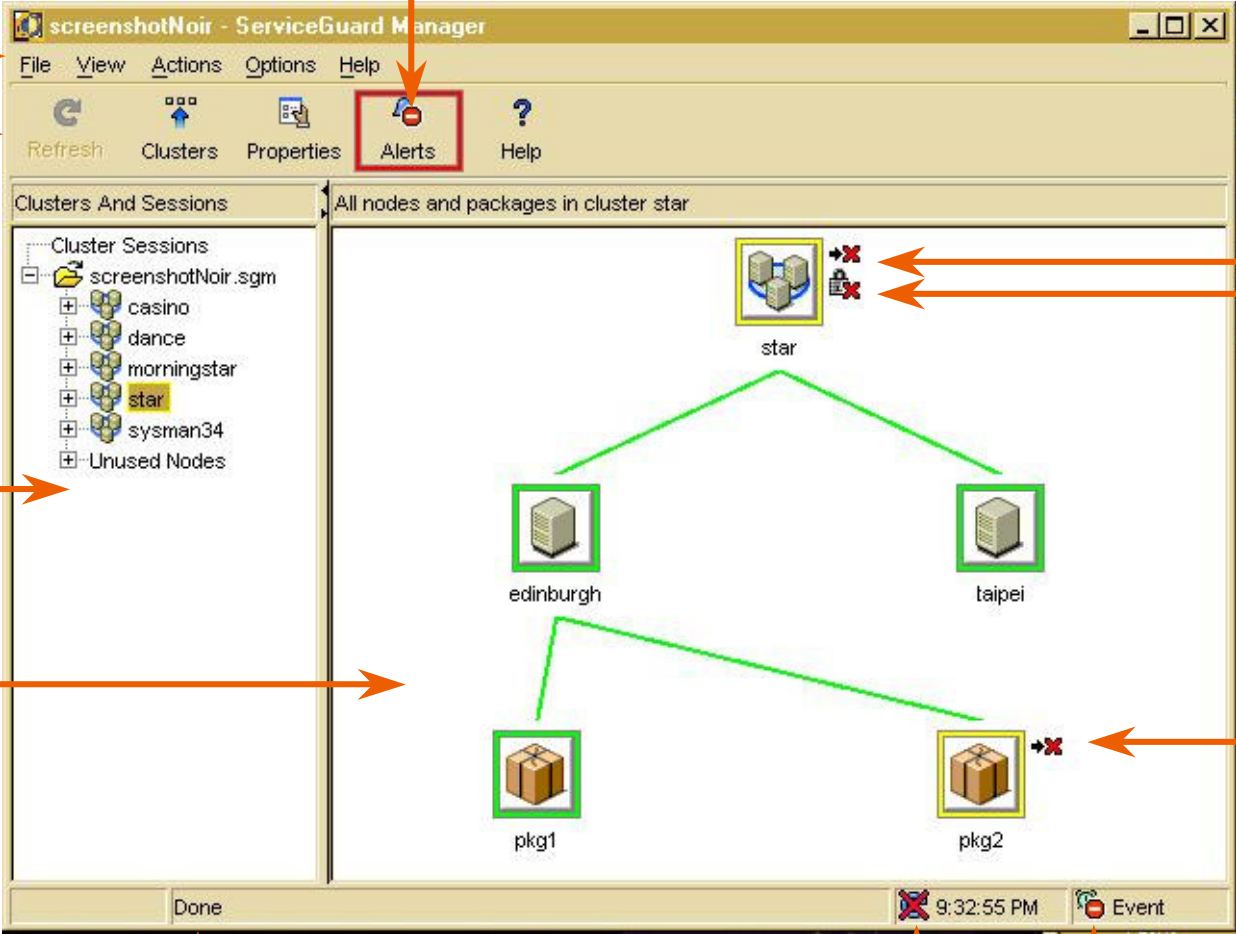
Foundation high availability clustering

Loosely-coupled cluster



HP Serviceguard Manager

A serious event reported in this session



The screenshot shows the HP Serviceguard Manager interface. The title bar reads "screenshotNoir - ServiceGuard Manager". The menu bar includes File, View, Actions, Options, and Help. The toolbar contains icons for Refresh, Clusters, Properties, Alerts (highlighted with a red box), and Help. The left pane, titled "Clusters And Sessions", shows a tree view with "Cluster Sessions" expanded, listing "screenshotNoir.sgm", "casino", "dance", "morningstar", "star", "sysman34", and "Unused Nodes". The main pane, titled "All nodes and packages in cluster star", displays a hierarchical diagram of the cluster "star". The cluster "star" is at the top, connected to nodes "edinburgh" and "taipei". Node "edinburgh" is connected to packages "pkg1" and "pkg2". The "star" node, "pkg2", and the "Alerts" toolbar button are marked with red "X" icons. Annotations with orange arrows point to various elements: "Menus" points to the menu bar; "Toolbar" points to the toolbar; "Tree showing just one session" points to the "star" session in the tree; "Map of one cluster in the session" points to the cluster diagram; "Progress" points to the "Done" button at the bottom left; "Polling is turned off" points to a red "X" icon at the bottom center; "A serious event reported" points to the "Event" icon at the bottom right; "A package has no failover" points to the "pkg2" node; "Cluster lock down" points to the "star" node; and "No failover" points to the "pkg2" node.

Menus →

Toolbar →

Tree showing just one session

Map of one cluster in the session

Progress ↑

Polling is turned off ↑

A serious event reported ↑

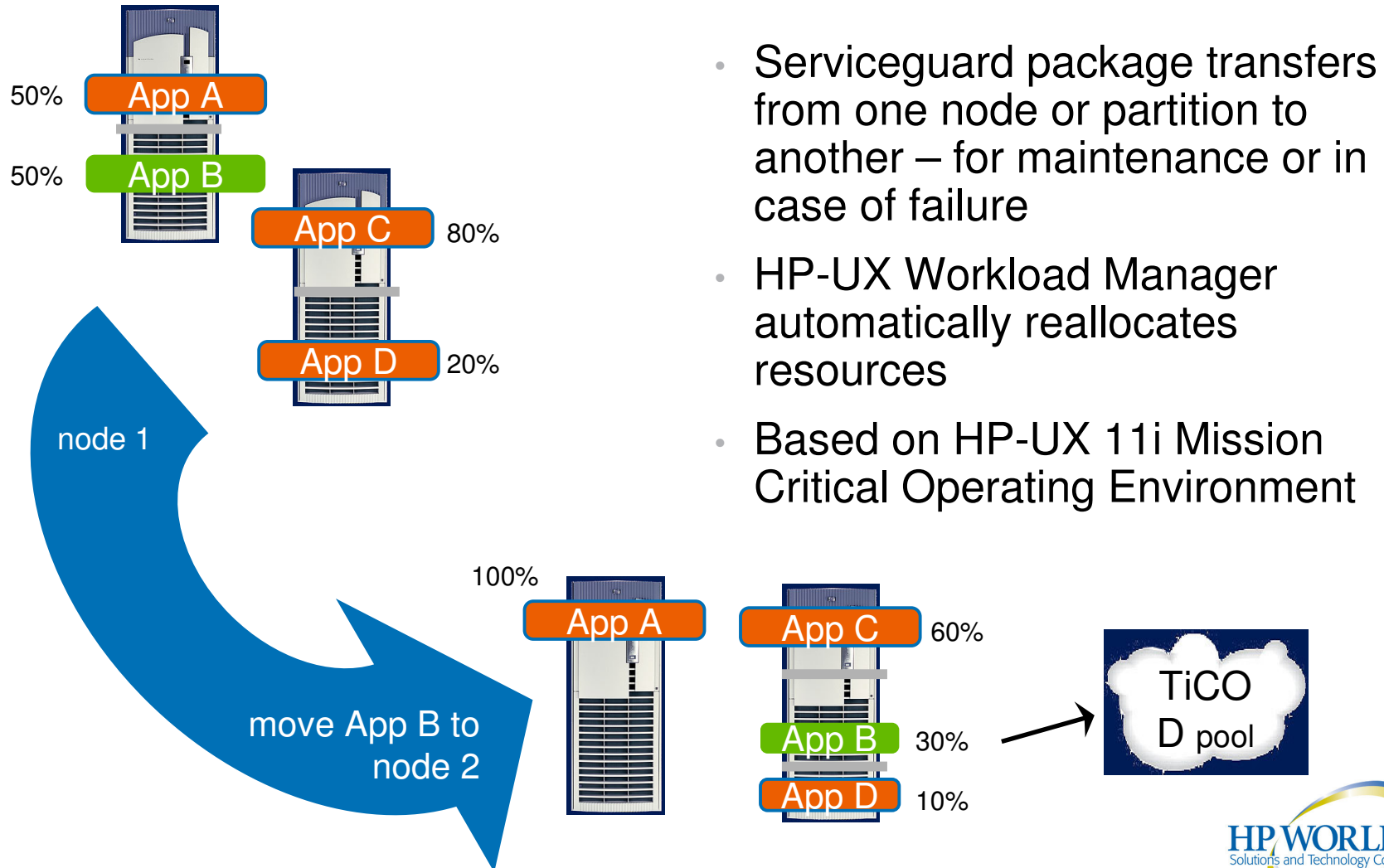
A package has no failover

Cluster lock down

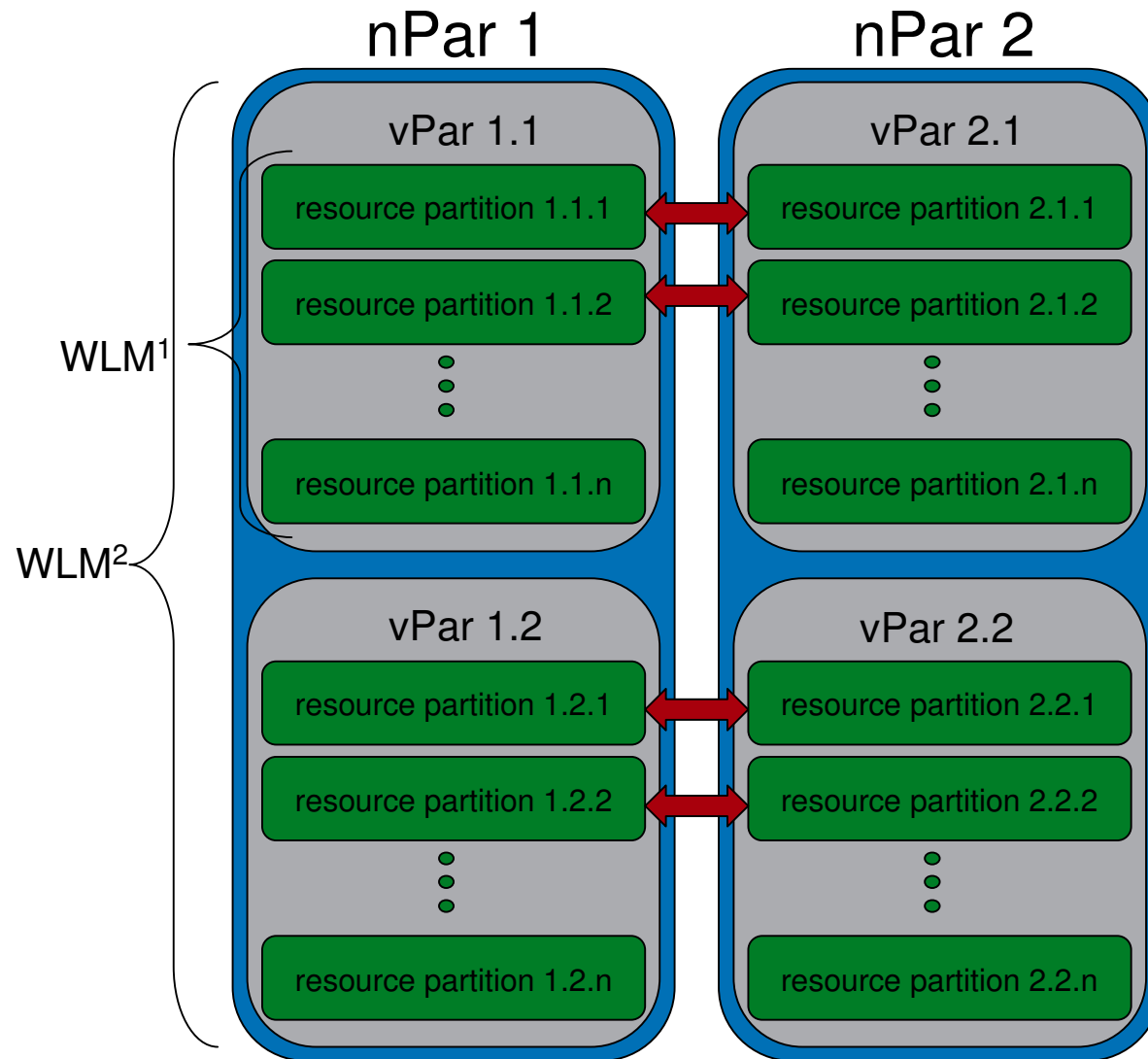
No failover


The Virtual Server Environment in Action

HP Virtual Server Environment in action: Optimized utilization in a clustered environment



Resource management of your adaptive infrastructure



- 2 nPars provides
 - hardware fault isolation
- 2 vPars within each nPar provides
 - software fault isolation
 - OS version isolation
- Any number of resource partitions (one for each major application, or group of same priority minor applications) in each vPar provides:
 - resource isolation
- WLM¹ automatically allocates CPU resources as needed to resource partitions
- WLM² automatically allocates CPUs as needed to vPars
- Failover across nPar boundary (indicated by ) provides
 - HA for both hardware and software faults
 - WLM will reallocate resources upon failover



The Next Generation

Introduction to
the Global
Workload
Manager (gWLM)

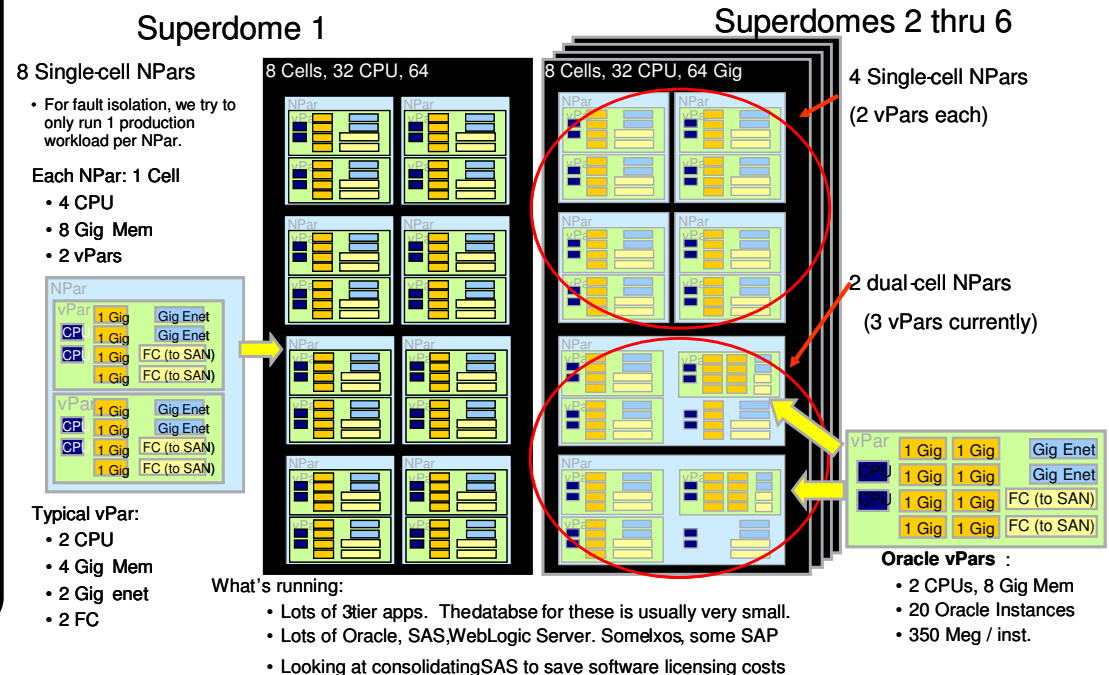
gWLM Vision



gWLM enables utility computing by supporting centralized resource-sharing policies (definition, enforcement and monitoring) on HP servers.

- Across different partitioning and virtualization approaches
- Across multiple systems – datacenter wide
- Supporting different operating systems (HP-UX, Linux, Win)
- For scale up and scale out utilities

The gWLM Design Center



- Simplicity through pre-defined policies, central management, ease of use
- Increased agility by dynamically allocating server resources on-the-fly to meet customer's changing demands
- Delivering additional value by enabling more efficient utilization of shared servers

Ease of Use

- Easy to understand & configure
 - Discovery of the infrastructure
 - Out of the box support for most common use cases
 - Fixed, OwnBorrow, Utilization Policies
 - Easier to understand how much CPU each workload will get
 - UI to visualize what it's doing and why
 - Configuration Wizard
- Quick time-to-value
 - Factory supplied policies
 - Canned reports
- Easy to manage **very** large numbers of workloads
 - A single policy can be applied to a large number of workloads
 - Most sites will only need a handful of policies
 - Role-based access allows Sr. staff to define policies and other sys admins can apply and monitor them

Dynamism with Confidence

- Features to help you ensure that the tool is configured as planned and will behave as expected
 - Advisory mode
 - Realtime Reporting
 - Historical reports
- Help application owners trust dynamism
 - CPU resources can be guaranteed
 - Fixed Policy
 - OwnBorrow (PolicyMin,owned)
 - Utilization (PolicyMin)
 - Audit reports to prove each workload got what was guaranteed

gWLM Out of the Box Policies

- OwnBorrow
 - Specify minimum, maximum and “owned” resources
 - gWLM will ensure there is enough resource to satisfy all workloads at the “owned” level
 - Workloads can share unused resources, but are guaranteed access to the owned amount if needed
- Fixed
 - Specify a fixed amount of resource for this workload
 - No sharing will be allowed
- Utilization
 - Specify minimum, maximum and a utilization target
 - If actual utilization is higher than target, policy will request more, if below target policy will request less

gWLM Canned Reports

- Troubleshoot a poorly performing workload
- Get periodic capacity and performance report
- Produce a resource audit report for internal customers
- Police my internal customers – identify resource hogs
- Find capacity for a new workload
- Right-size a workload's entitlement

HP Systems Insight Manager - Microsoft Internet Explorer provided by Hewlett-Packard

File Edit View Favorites Tools Help

Address: https://sawdust.rsn.hp.com:50000/mxportal/home/MxPortalFrames.jsp

Updated: Friday, January 30, 2004 9:45:31 AM CST

HP Systems Insight Manager

Home Logout

Uncleared Event Status 0 0 0 0

Tools Deploy Configure Diagnose Optimize Reports Logs Options Help

Manage new hosts

Description: Configure and manage gWLM workloads on new hosts

Step 4 of 5

- ✓ Enter hosts
- ✓ Select container type
- ✓ Review SRD names
- Assign policies**
- Review summary

Assign a policy to each default workload

The wizard has created default workloads, one for each container being managed. Modify workload names or [policy](#) (defined below) assignments if desired.

Prev Next

Shared Resource Domain: maxfli SRD (Control Mode: Managed)

Workload (container)	Policy	Container
maxfli.rsn.hp.com_vpar_wkld	_DEFAULT_Utilization	maxfli.rsn.hp.com (vPar)
maxfli2.rsn.hp.com_vpar_wkld	_DEFAULT_Utilization	maxfli2.rsn.hp.com (vPar)

Shared Resource Domain: ritz SRD (Control Mode: Advisory)

Workload (container)	Policy	Container
ritz.rsn.hp.com_vpar_wkld	_DEFAULT_Fixed	ritz.rsn.hp.com (vPar)
ritz1.rsn.hp.com_vpar_wkld	_DEFAULT_Fixed	ritz1.rsn.hp.com (vPar)
ritz2.rsn.hp.com_vpar_wkld	_DEFAULT_Fixed	ritz2.rsn.hp.com (vPar)

NOTES:

Legend

- ✖ = Critical
- ✓ = Normal
- ⚠ = Major
- ❓ = Unknown
- ⚡ = Minor
- ℹ = Informational

Applet com.hp.mx.portal.applet.folders.FoldersUIApplet started

Local intranet

Integrated with HP Systems Insight Manager

Task oriented graphical user interface

Each shared environment is a Shared Resource Domain

Multiple shared resource domains can be managed from the central management station

Integrated event system to track SLO violations

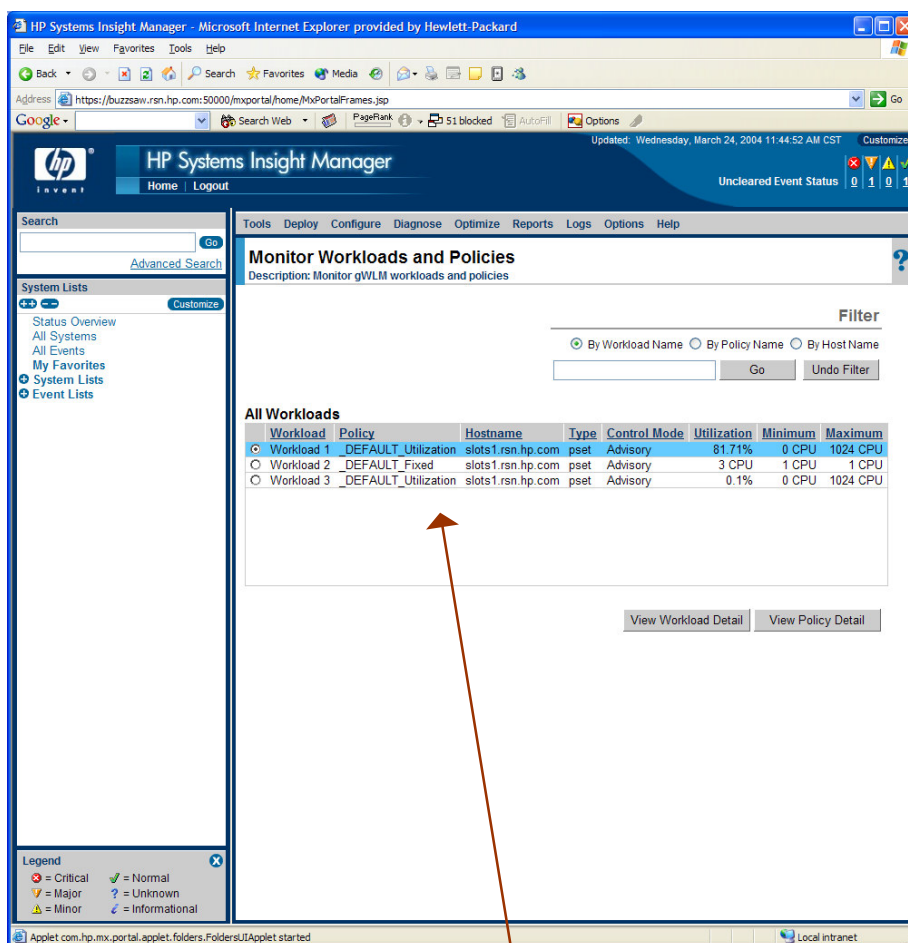
Configuration panel, monitoring panels also available

Factory-defined policies simplify configuration of shared domains

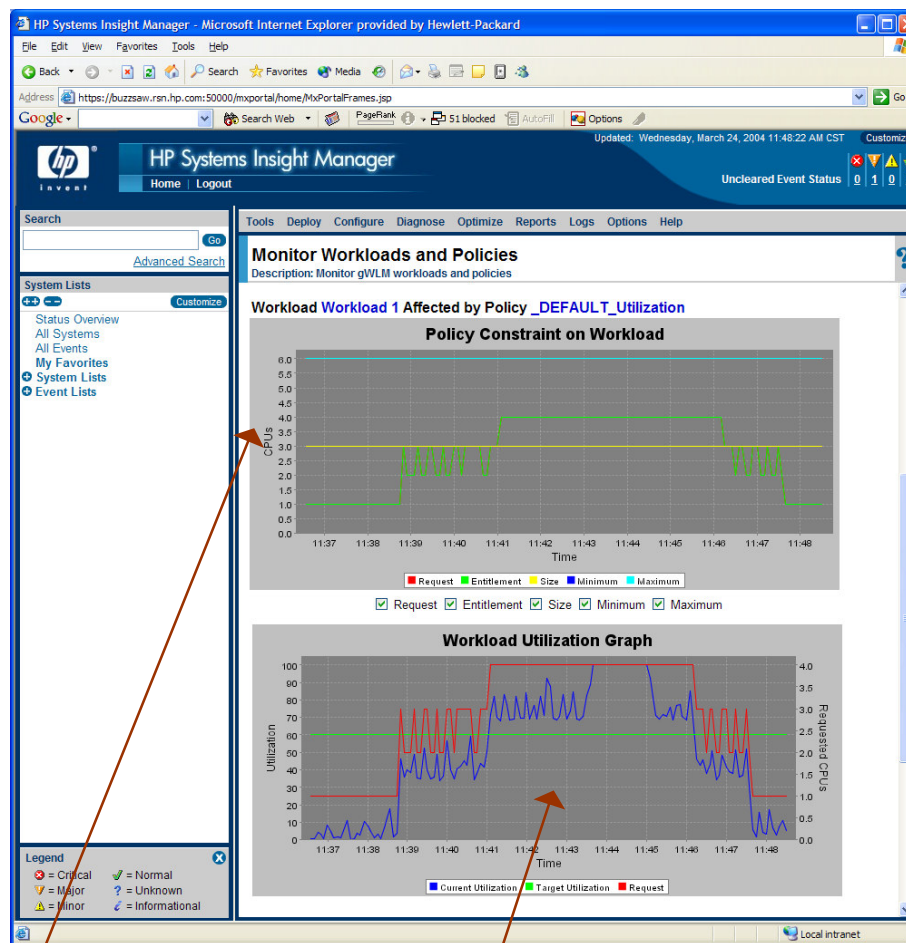
Abstraction of different types of containers, vpars, psets, ...

Auto-discovery of containers

gWLM – utilization monitoring



Selection screen for monitoring capabilities with gWLM



Graphs with performance against policy

Real-time and historical utilization graphs for each workload

gWLM Demo

The Demo Scenario

- IT manages a server utility with 20 servers each set up with 3 vPars
- They offer the infrastructure as a managed service to their business units
- They want to increase utilization so they are allowing the sharing of unused resources by the workloads on each server
- Each workload owns a certain number of CPUs and that is how the business units are charged for the service

The Demo System

- 3 vPar-based Workloads on an 8 CPU server
 - A Production Sales Application
 - Owns 3 CPUs – Max 6
 - A Production Finance Application
 - Owns 4 CPUs – Max 6
 - A Dev/Test Environment
 - Owns 1 CPU – Max 6
- We will show 2 demos:
 - Configuring gWLM to manage these workloads
 - Monitoring gWLM's allocation of CPUs as the loads on the applications changes

Getting Started with Workload Manager

Objectives

Learn to:

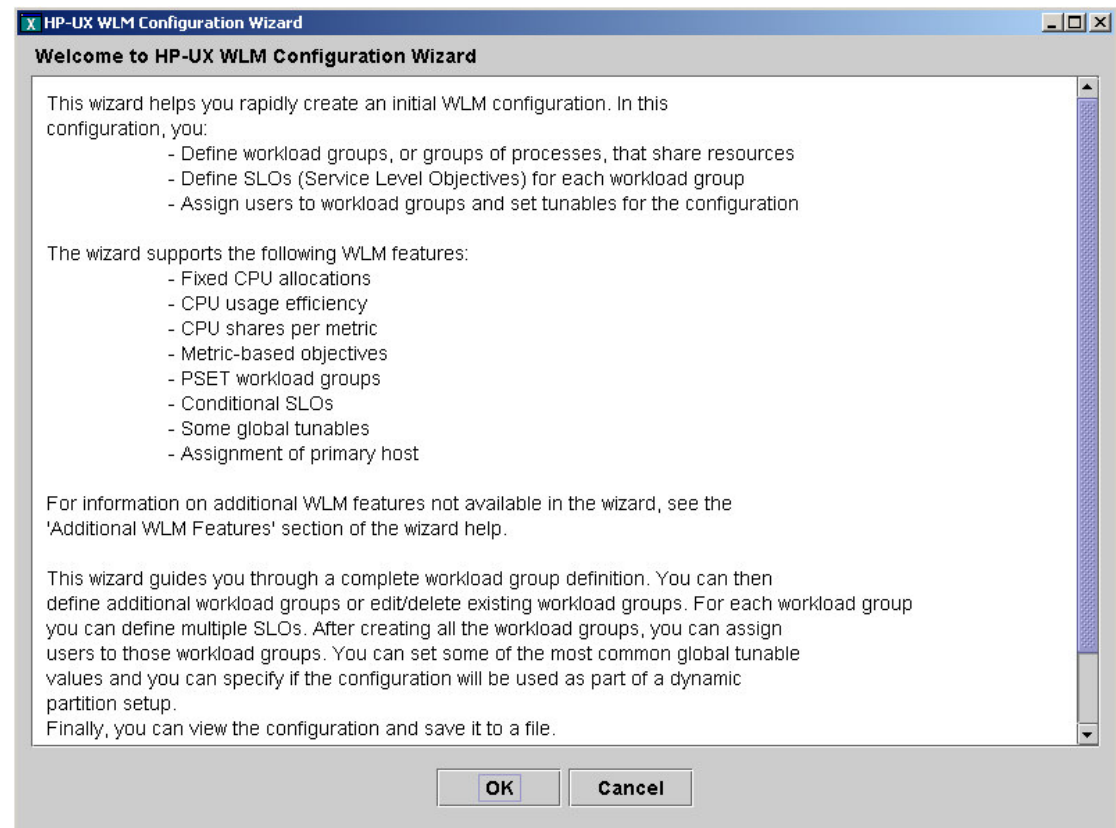
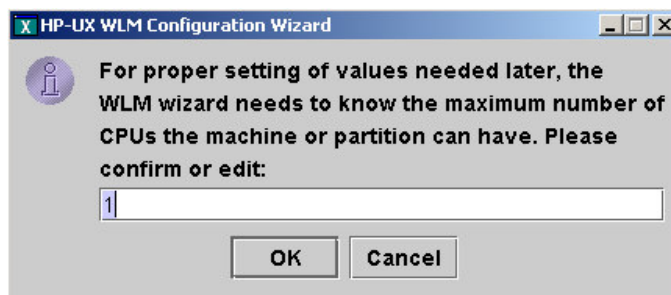
- Set up initial configuration using the Configuration Wizard
- Use `wlmd` to enable WLM
- Monitor WLM

WLM Configuration Wizard

- The Configuration Wizard is useful for creating an initial WLM configuration if you prefer not working directly with the configuration file
- Any editing done to the initial configuration produced by the wizard can be done manually or with the WLM GUI

Starting the Configuration Wizard

```
# /opt/wlm/bin/wlmcw
```

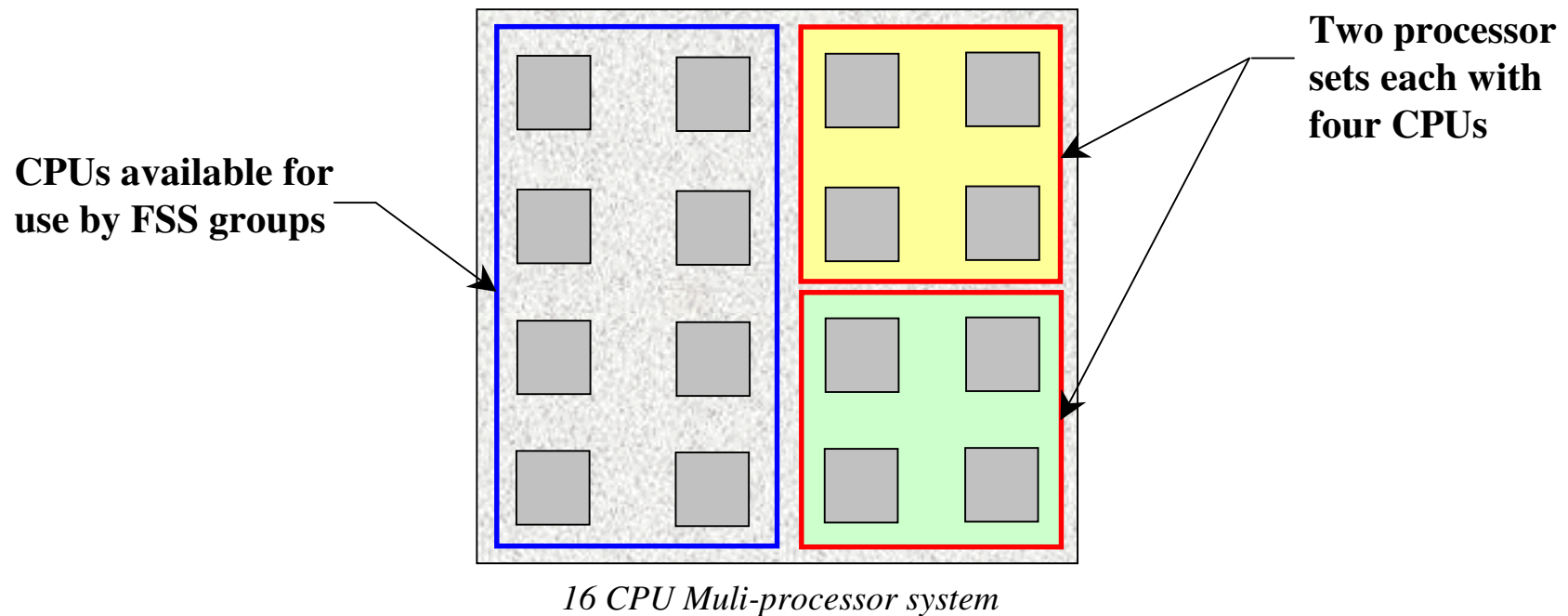


Configuration Wizard steps

1. Define the Workload Group
2. Define SLO
3. Define additional or Edit/Delete existing workload groups or Commit current workload group
4. Define Additional or Edit/Delete Existing Workload Group
5. Assign Users
6. Set Global Tunables
7. Set Primary Host
8. View and Save Configuration

Specifying workload groups

- There are two types of workload groups: FSS and PSET



Reserved workload groups

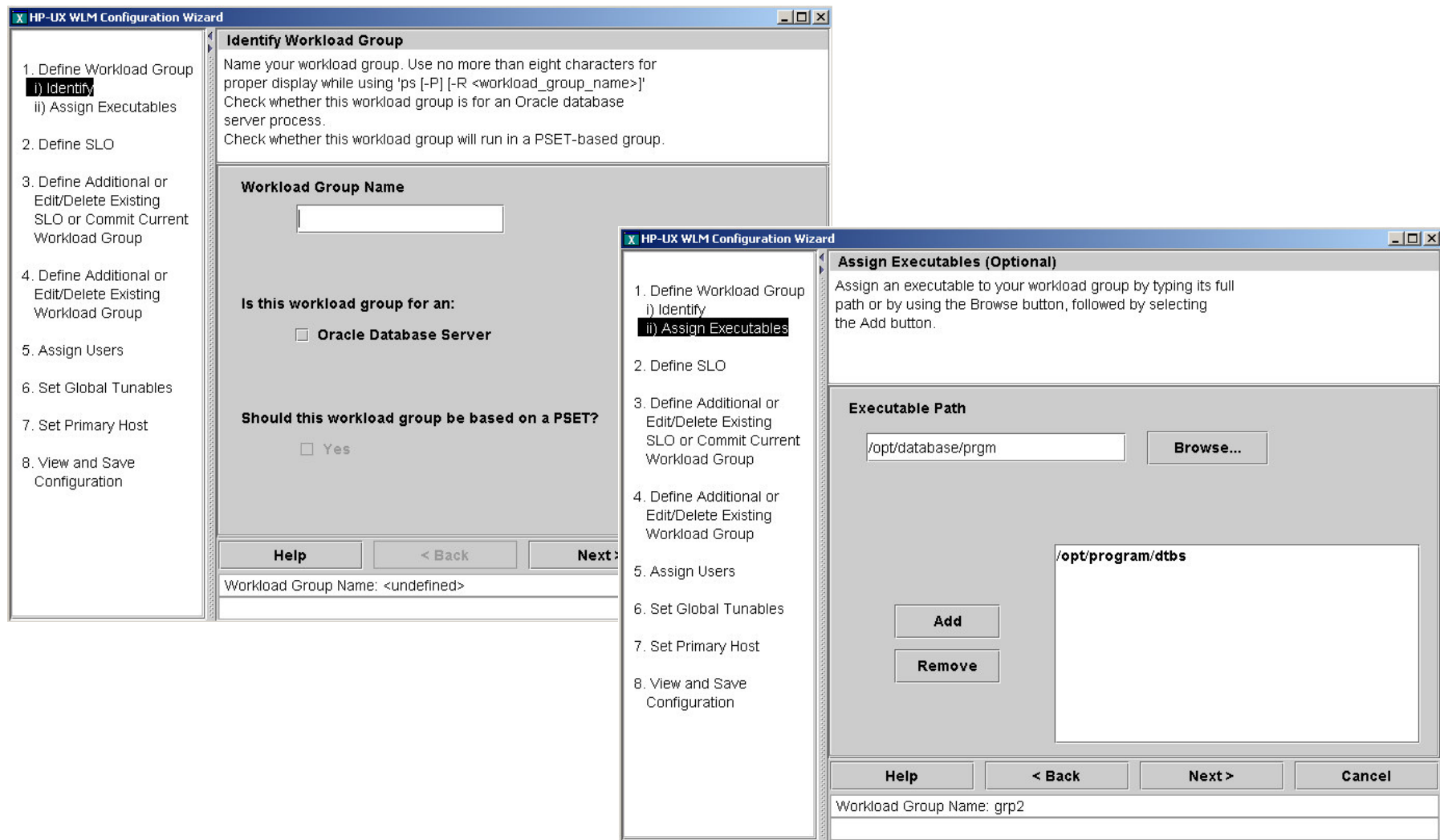
PRM_SYS (ID 0)

- Default workload group for system processes
- Can automatically use up to 50% CPU
- The CPU cycles that **PRM_SYS** doesn't use make up the 100% that is divided among workload groups according to their allocations
- **PRM_SYS** is created automatically but can be explicitly defined in the WLM configuration file

OTHERS (ID 1)

- Default workload group for non-system processes
- Receives any leftover CPU resources by default
- Created automatically but can be explicitly defined
- Must be defined in the WLM configuration file if memory or disk bandwidth allocations are specified

Defining the workload group



The image displays two overlapping screenshots of the HP-UX WLM Configuration Wizard. The background window is at the 'Identify Workload Group' step, and the foreground window is at the 'Assign Executables (Optional)' step.

Identify Workload Group (Background Window):

- 1. Define Workload Group**
 - i) **Identify** (selected)
 - ii) Assign Executables
- 2. Define SLO
- 3. Define Additional or Edit/Delete Existing SLO or Commit Current Workload Group
- 4. Define Additional or Edit/Delete Existing Workload Group
- 5. Assign Users
- 6. Set Global Tunables
- 7. Set Primary Host
- 8. View and Save Configuration

Workload Group Name: [Text Field]

Is this workload group for an:

☐ Oracle Database Server

Should this workload group be based on a PSET?

☐ Yes

Buttons: Help, < Back, Next >

Workload Group Name: <undefined>

Assign Executables (Optional) (Foreground Window):

- 1. Define Workload Group**
 - i) Identify
 - ii) **Assign Executables** (selected)
- 2. Define SLO
- 3. Define Additional or Edit/Delete Existing SLO or Commit Current Workload Group
- 4. Define Additional or Edit/Delete Existing Workload Group
- 5. Assign Users
- 6. Set Global Tunables
- 7. Set Primary Host
- 8. View and Save Configuration

Executable Path: /opt/database/prgm **Browse...**

Executable List: /opt/program/dtbs

Buttons: Add, Remove

Buttons: Help, < Back, Next >, Cancel

Workload Group Name: grp2

Defining the SLO

HP-UX WLM Configuration Wizard

Prioritize the SLO

Set a priority for this SLO.
Assign a higher priority (closer to 1) to more critical SLOs.

SLO Name

grp2_slo

SLO Priority

Low(100) High(1) 1 Reset

Help < Back Next > Cancel

Workload Group Name: grp2

Non-Metric Based CPU allocation (1/2)

- Fixed Allocation:
 - Has explicit allocation request
 - No goal is specified
- CPU usage:
 - Usage goals specify a CPU utilization range
 - Has maximum and minimum CPU request bounds
 - WLM internally tracks the workload group's actual CPU usage versus its CPU allocation
 - Useful when you want to automatically size the allocation based on what a workload needs

Non-Metric Based CPU allocation (2/2)



HP-UX WLM Configuration Wizard

1. Define Workload Group
2. Define SLO
 i) Identify and Prioritize
 ii) Configure CPU Allocation/Control
 iii) Set Condition
3. Define Additional or Edit/Delete Existing SLO or Commit Current Workload Group
4. Define Additional or Edit/Delete Existing Workload Group
5. Assign Users
6. Set Global Tunables
7. Set Primary Host
8. View and Save Configuration

Choose CPU Allocation/Control Policy

First decide whether you want a metric based or non-metric based CPU allocation/control policy. After that select a specific allocation or control policy.

☒ **Non-Metric Based**

- ☒ **Fixed Allocation**
- ☐ **CPU Usage**

☐ **Metric Based**

- ☒ **Shares per Metric**
- ☐ **Metric Goal**

Help **< Back** **Next >** **Cancel**

Workload Group Name: grp2
SLO Name: grp2_slo Priority: 1

Metric Based CPU allocation (1/2)

- Shares per Metric
 - Specifies how many CPU shares a workload group gets per some metric
 - The CPU shares value is later multiplied by the metric to determine the workload group's allocation
- Metric Goal
 - Specifies a metric for the workload group and some value that the metric should be less than or greater than
 - WLM then manages the workload group's CPU allocation to keep the metric less than or greater than the value

Metric Based CPU allocation (2/2)

HP-UX WLM Configuration Wizard

CPU Allocation: Metric Goal

Choose/Create a metric and specify the type of comparison. Then specify a number against which the metric value will be compared. WLM will try to allocate CPU so that the comparison expression stays true.

Selected Metric Name

Select Metric...

Type of Comparison

☒ **Less than** ☐ **Greater than**

Comparison Value

Help **< Back** **Next >**

Workload Group Name: grp2
SLO Name: grp2_slo Priority: 1

1. Define Workload Group
2. Define SLO
 i) Identify and Prioritize
 ii) Configure CPU Allocation/Control
 a) Metric Goal
 b) CPU Limits
 iii) Set Condition
3. Define Additional or Edit/Delete Existing SLO or Commit Current Workload Group
4. Define Additional or Edit/Delete Existing Workload Group
5. Assign Users
6. Set Global Tunables
7. Set Primary Host
8. View and Save Configuration

HP-UX WLM Configuration Wizard

CPU Allocation: Shares per Metric

Select a metric on which to base the workload group's allocation. Then, specify a number of shares for the workload group to request per unit metric.

Selected Metric Name

Select Metric...

Number of Shares per Metric

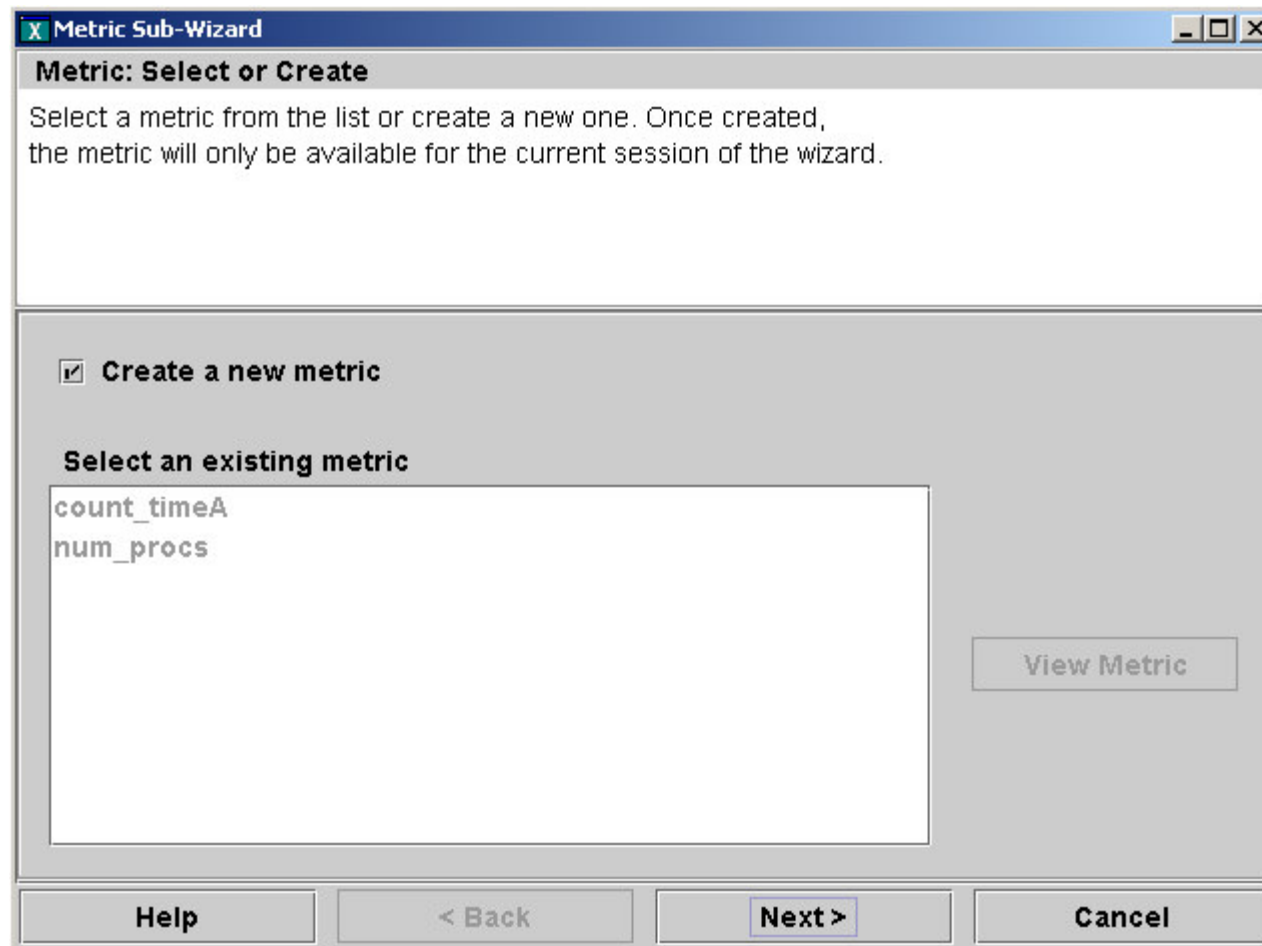
Plus (optional)

Help **< Back** **Next >** **Cancel**

Workload Group Name: grp2
SLO Name: grp2_slo Priority: 1

1. Define Workload Group
2. Define SLO
 i) Identify and Prioritize
 ii) Configure CPU Allocation/Control
 a) Shares per Metric
 b) CPU Limits
 iii) Set Condition
3. Define Additional or Edit/Delete Existing SLO or Commit Current Workload Group
4. Define Additional or Edit/Delete Existing Workload Group
5. Assign Users
6. Set Global Tunables
7. Set Primary Host
8. View and Save Configuration

Metric Sub-wizard



Metric Sub-Wizard

Metric: Select or Create

Select a metric from the list or create a new one. Once created, the metric will only be available for the current session of the wizard.

☒ **Create a new metric**

Select an existing metric

count_timeA
num_procs

View Metric

Help **< Back** **Next >** **Cancel**

Specifying the metric

Metric Sub-Wizard

New Metric: Name and Source

Provide a name for the new metric and select its source.

Metric Name

Metric Source

☐ GlancePlus

☐ Oracle

☒ Command Output

Help **< Back** **Next >**

Metric Sub-Wizard

New Metric: Specify Command Providing Output

Enter the full path and arguments (if any) of the executable or command that will send metric values to the standard output. Specify arguments as you would on the command line.

Command Path

Browse...

Arguments

Help **< Back** **Finish** **Cancel**

Specifying a condition or Serviceguard package



HP-UX WLM Configuration Wizard

1. Define Workload Group
2. Define SLO
 i) Identify and Prioritize
 ii) Configure CPU Allocation/Control
 iii) Set Condition
3. Define Additional or Edit/Delete Existing SLO or Commit Current Workload Group
4. Define Additional or Edit/Delete Existing Workload Group
5. Assign Users
6. Set Global Tunables
7. Set Primary Host
8. View and Save Configuration

Specify Condition or ServiceGuard Package (Optional)

Type a condition string (click Help to see examples).
If configuring WLM for a Serviceguard cluster, select a Serviceguard package that must be active on the system for WLM to grant CPU resources to the workload group. If no packages are listed, view the Help.

Condition String

Mon - Fri

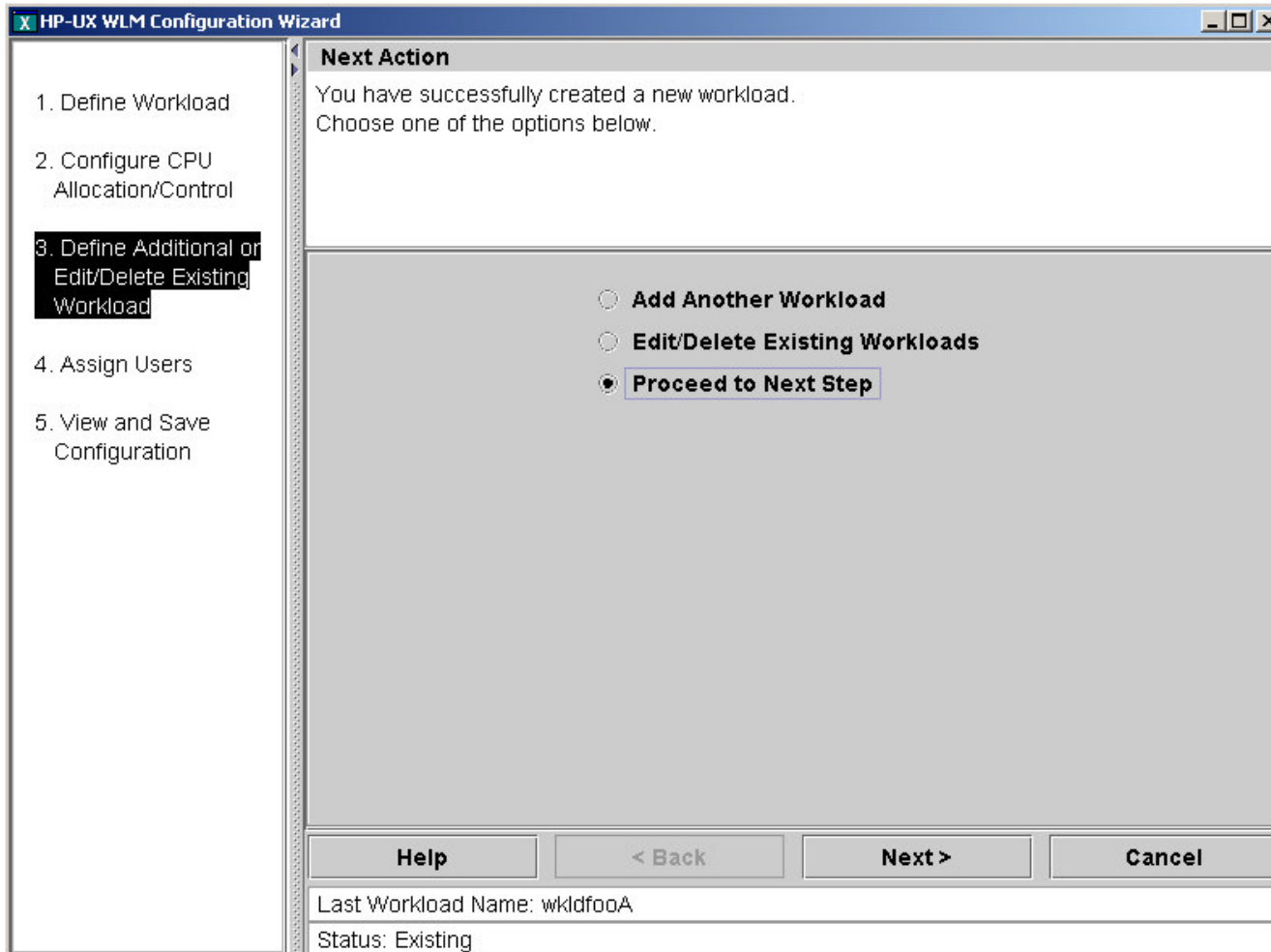
Select a Serviceguard Package

pkg1
pkg2

Help < Back Next > Cancel

Workload Group Name: grp2
SLO Name: grp2_slo Priority: 1

Add / Edit / Delete Workloads



The image shows a screenshot of the HP-UX WLM Configuration Wizard window. The window has a title bar that reads "HP-UX WLM Configuration Wizard". On the left side, there is a list of steps: 1. Define Workload, 2. Configure CPU Allocation/Control, 3. Define Additional or Edit/Delete Existing Workload (which is highlighted with a black box), 4. Assign Users, and 5. View and Save Configuration. The main area of the window is titled "Next Action" and contains the text: "You have successfully created a new workload. Choose one of the options below." Below this text are three radio button options: "Add Another Workload", "Edit/Delete Existing Workloads", and "Proceed to Next Step" (which is selected and highlighted with a blue box). At the bottom of the window, there are four buttons: "Help", "< Back", "Next >", and "Cancel". Below these buttons, there are two text fields: "Last Workload Name: wkldfooA" and "Status: Existing".

HP-UX WLM Configuration Wizard

1. Define Workload

2. Configure CPU Allocation/Control

3. Define Additional or Edit/Delete Existing Workload

4. Assign Users

5. View and Save Configuration

Next Action

You have successfully created a new workload.
Choose one of the options below.

☐ Add Another Workload

☐ Edit/Delete Existing Workloads

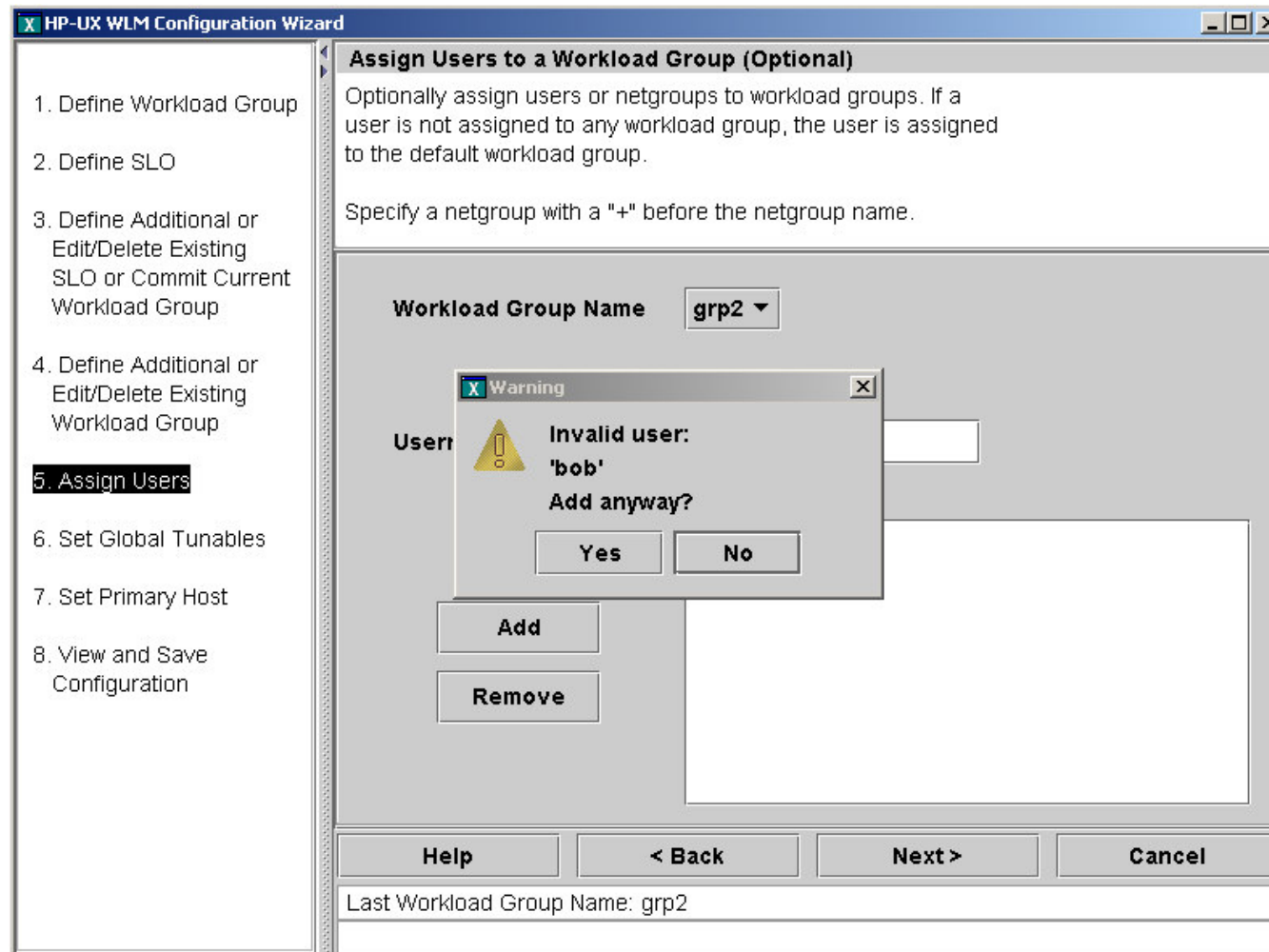
☒ Proceed to Next Step

Help < Back Next > Cancel

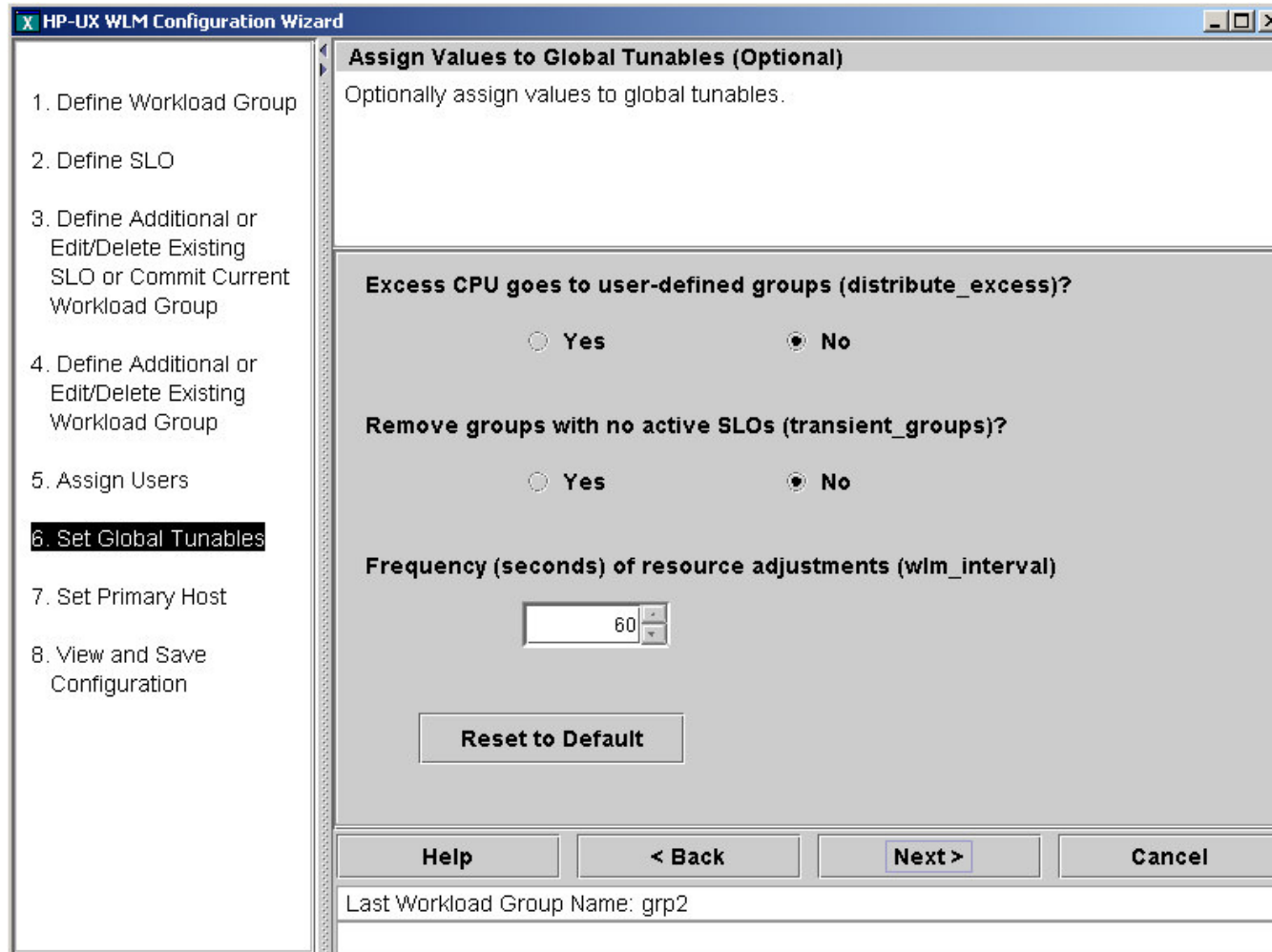
Last Workload Name: wkldfooA

Status: Existing

Assigning users to workloads



Adding global tunables

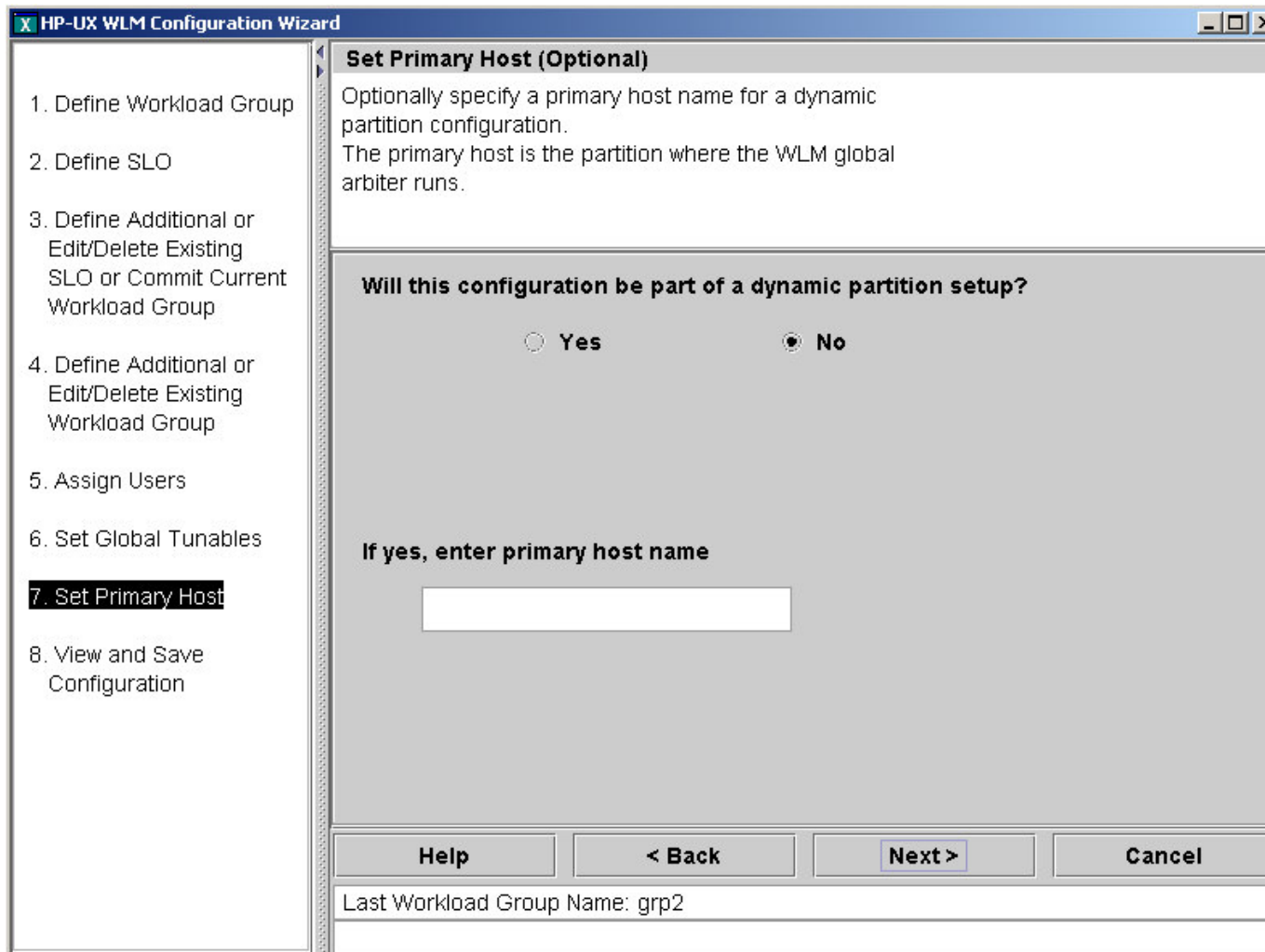


The image shows a screenshot of the HP-UX WLM Configuration Wizard window. The window has a title bar that reads "HP-UX WLM Configuration Wizard". On the left side, there is a list of steps: 1. Define Workload Group, 2. Define SLO, 3. Define Additional or Edit/Delete Existing SLO or Commit Current Workload Group, 4. Define Additional or Edit/Delete Existing Workload Group, 5. Assign Users, 6. Set Global Tunables (highlighted), 7. Set Primary Host, and 8. View and Save Configuration. The main area of the window is titled "Assign Values to Global Tunables (Optional)" and contains the following options:

- Optionally assign values to global tunables.
- Excess CPU goes to user-defined groups (distribute_excess)?**
☐ Yes ☒ No
- Remove groups with no active SLOs (transient_groups)?**
☐ Yes ☒ No
- Frequency (seconds) of resource adjustments (wlm_interval)**
A text box containing the value "60" with a spin button.
- A "Reset to Default" button.

At the bottom of the window, there are four buttons: "Help", "< Back", "Next >", and "Cancel". Below these buttons, there is a text box that reads "Last Workload Group Name: grp2".

Specifying the primary host



The image shows a screenshot of the HP-UX WLM Configuration Wizard window. The window has a title bar that reads "HP-UX WLM Configuration Wizard". On the left side, there is a list of steps: 1. Define Workload Group, 2. Define SLO, 3. Define Additional or Edit/Delete Existing SLO or Commit Current Workload Group, 4. Define Additional or Edit/Delete Existing Workload Group, 5. Assign Users, 6. Set Global Tunables, 7. Set Primary Host (highlighted), and 8. View and Save Configuration. The main area of the window is titled "Set Primary Host (Optional)". It contains the following text: "Optionally specify a primary host name for a dynamic partition configuration. The primary host is the partition where the WLM global arbiter runs." Below this text is a question: "Will this configuration be part of a dynamic partition setup?". There are two radio buttons: "Yes" (unselected) and "No" (selected). Below the radio buttons is a text field labeled "If yes, enter primary host name". At the bottom of the window, there are four buttons: "Help", "< Back", "Next >", and "Cancel". Below the buttons, there is a text field that says "Last Workload Group Name: grp2".

HP-UX WLM Configuration Wizard

1. Define Workload Group

2. Define SLO

3. Define Additional or Edit/Delete Existing SLO or Commit Current Workload Group

4. Define Additional or Edit/Delete Existing Workload Group

5. Assign Users

6. Set Global Tunables

7. Set Primary Host

8. View and Save Configuration

Set Primary Host (Optional)

Optionally specify a primary host name for a dynamic partition configuration.
The primary host is the partition where the WLM global arbiter runs.

Will this configuration be part of a dynamic partition setup?

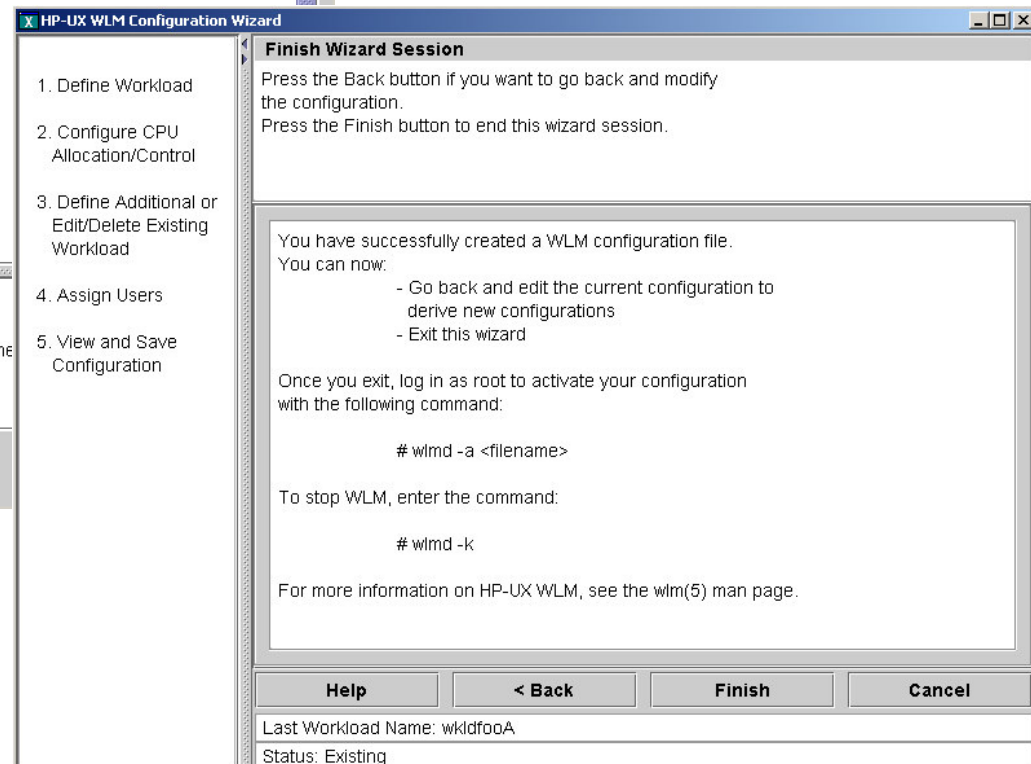
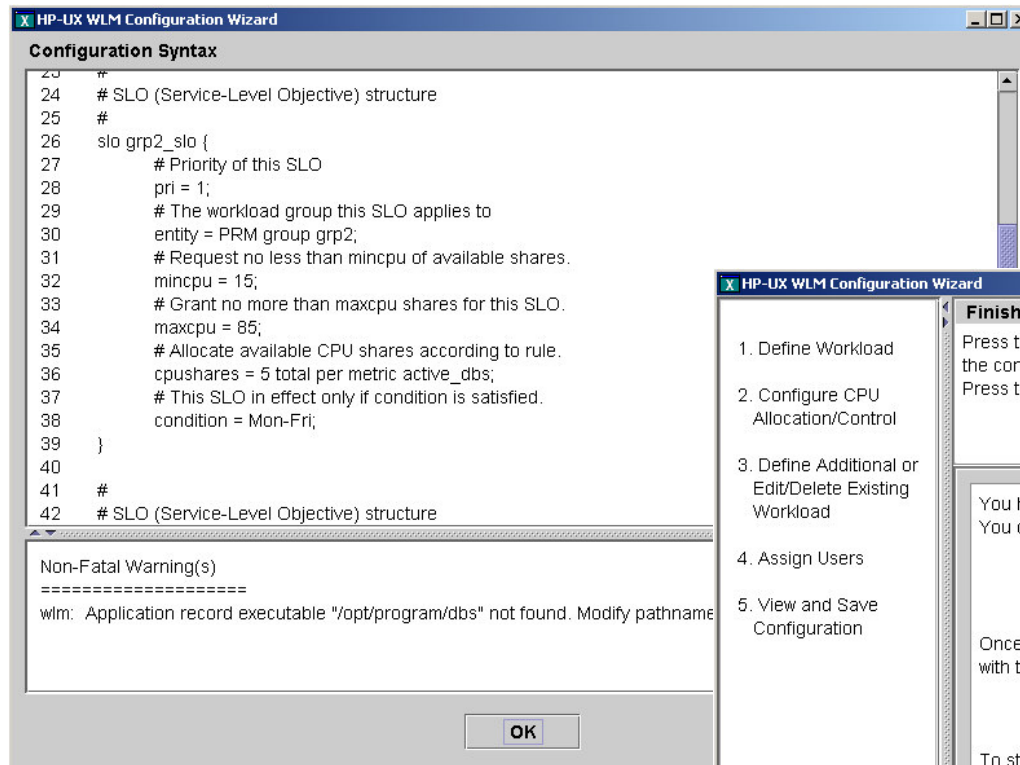
☐ Yes ☒ No

If yes, enter primary host name

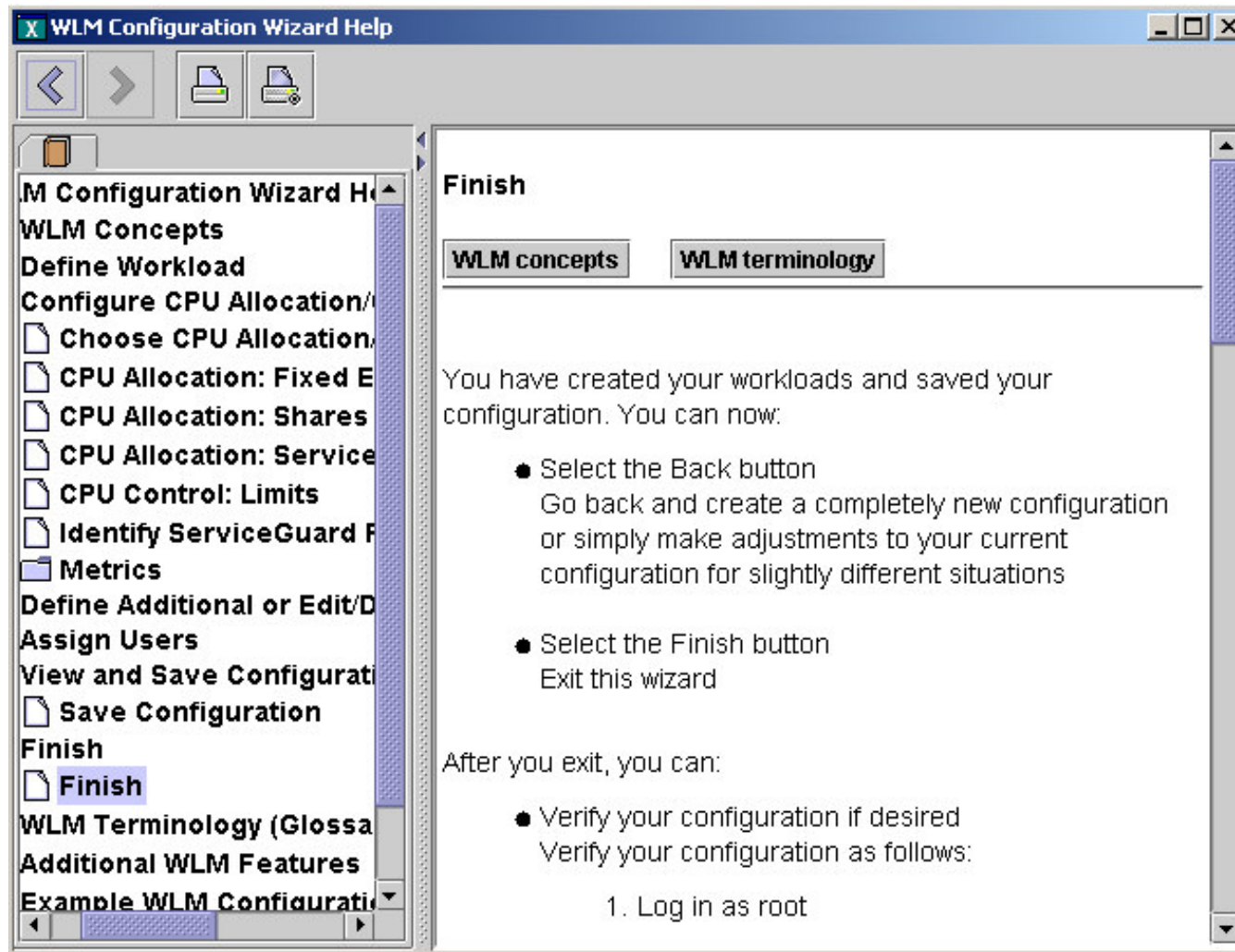
Help < Back Next > Cancel

Last Workload Group Name: grp2

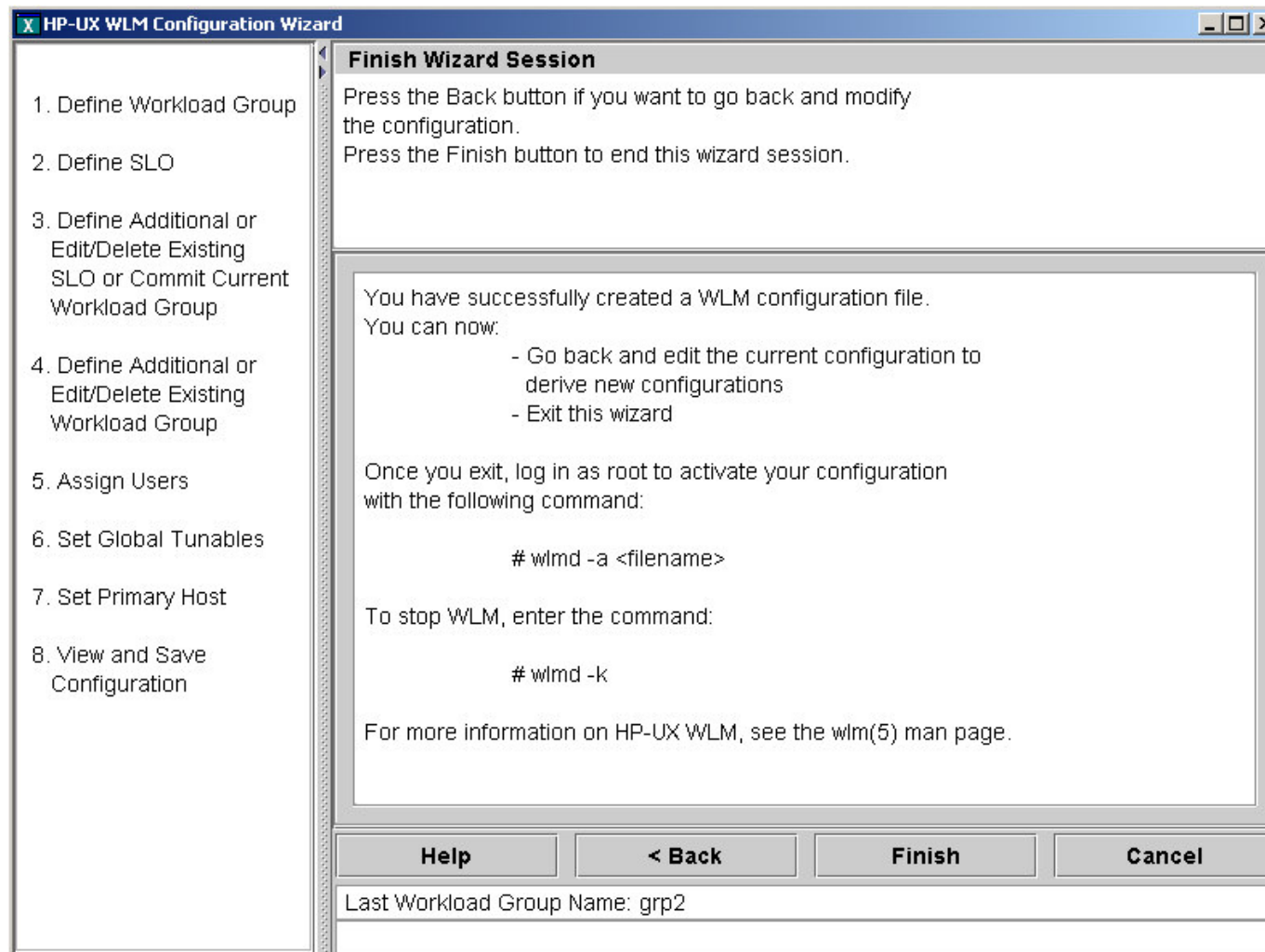
Viewing/Saving the configuration



Help!



Completing the Wizard Session



wlmd command

The **wlmd** command allows you to:

- Activate a configuration
- Validate a configuration file without altering the current configuration
- Specify **wlmd** logging options

wlmd syntax

wlmd has the following syntax and valid option combinations:

```
wlmd -h
```

```
wlmd -V
```

```
wlmd [-p] [-t] [-i] [-W] -A [-l  
logoption[=n][,...]]
```

```
wlmd [-p] [-t] [-i] [-W] -a configfile [-l  
logoption[=n][,...]]
```

```
wlmd [-W] -c configfile
```

```
wlmd -C
```

```
wlmd -k
```

Example:

WLM in passive mode

- WLM provides a passive mode that allows you to see how WLM will approximately respond to a given configuration without putting WLM in charge of your system's resources.
 - `wlmd -p -a configfile`
- Check that your configuration will behave as expected with minimal effect on your system.
- Possible uses for passive mode:
 - How does a **condition** statement work?
 - How does a **cpushares** statement work?
 - How do my goals work? Is my goal set up correctly?
 - How does a usage goal work?
 - Is my global configuration file set up as I wanted? If I used global arbitration on my production system, what might happen to the CPU layout?

Monitoring WLM with the **wlminfo** command



- **wlminfo** provides various WLM data, with reports focusing on SLOs, metrics, or workload groups.
- The command has both a command-line and graphical interface.

• The command syntax is below:

```
wlminfo -h  
wlminfo -V  
wlminfo -i  
wlminfo slo [-s slo] [-g grp] [-m met] [-l] [-o] [-v] [-b {0 | 1}]  
wlminfo metric [-m met] [-l] [-o] [-b {0 | 1}]  
wlminfo group [-g grp] [-l] [-o] [-b {0 | 1}]  
wlminfo host [-l] [-o] [-b {0 | 1}]  
wlminfo par [-h host] [-l] [-o] [-b {0 | 1}]
```

wlminfo command-line interface

```
# /opt/wlm/bin/wlminfo slo
```

```
Wed Apr 16 10:53:14 2003
```

SLO Name	Group	Pri	Req	Shares	State	Concern
slo2	g2	1	30	30	FAIL	Max
slo3	g3	1	20.5	21	PASS	

```
# /opt/wlm/bin/wlminfo group
```

```
Wed Apr 16 10:56:14 2003
```

Workload Group	PRMID	CPU Shares	CPU Util	Mem Shares	State
OTHERS	1	50.00	0.00	0.00	ON
wkldfooA	2	30.00	15.55	0.00	ON
wkldfooB	3	20.00	5.00	0.00	ON

```
# /opt/wlm/bin/wlminfo metric
```

```
Wed Apr 16 10:56:14 2003
```

Metric Name	PID	State	Value
count_time2	11337	NEW	4.000000
count_time3	11338	NEW	4.000000

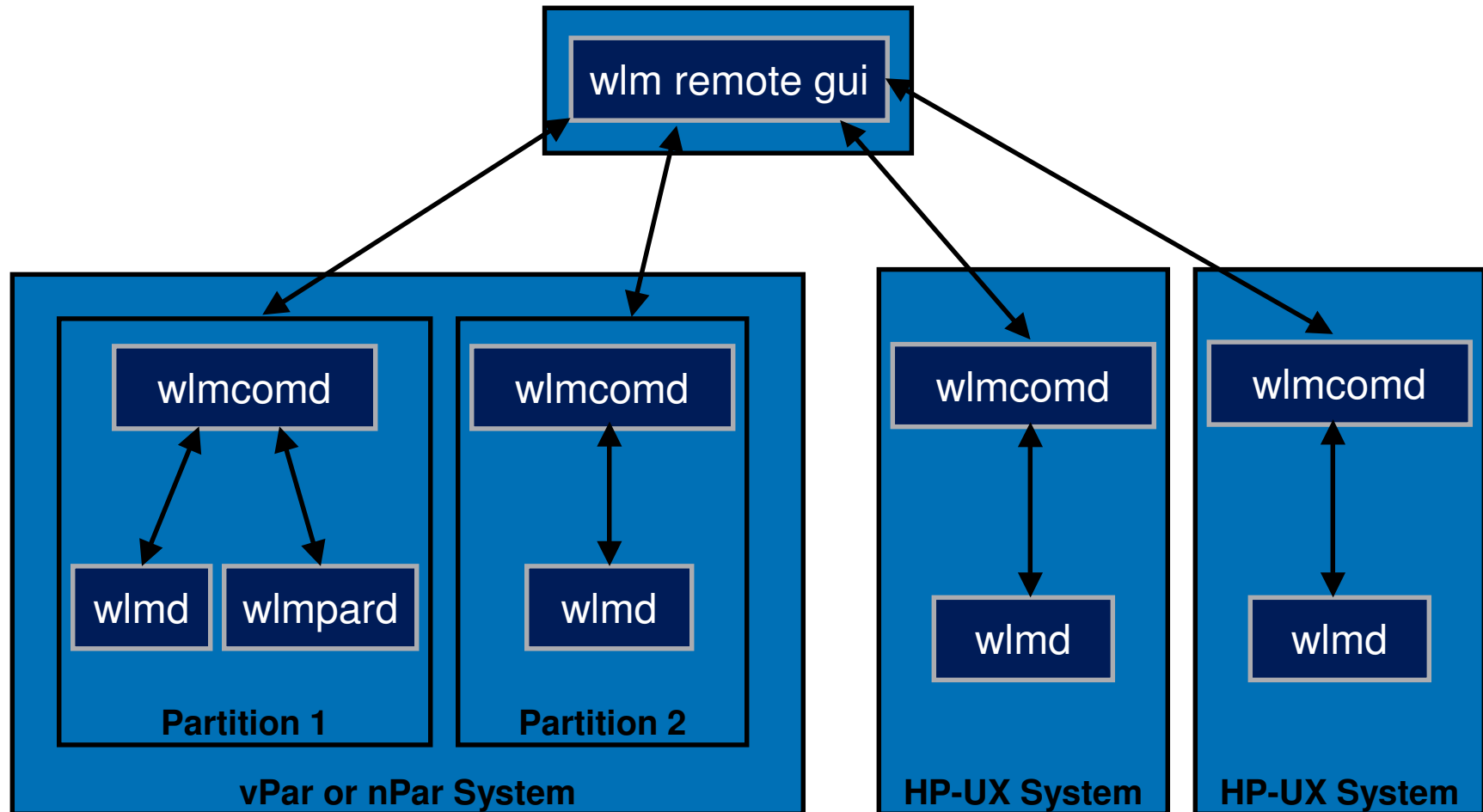
wlmgui and wlmcomd

- The WLM graphical user interface, **wlmgui**, can be used on any system that has WLM installed or has the WLMUtilities bundle installed.
- In addition to monitoring, **wlmgui** can also be used to create, edit and deploy configurations.
- The **wlmcomd** daemon provides support for **wlmgui** allowing local and remote access to the system.
- As a security measure, **wlmcomd** must be explicitly started:

```
# /opt/wlm/bin/wlmcomd
```

- You can also start **wlmcomd** at boot time by editing the `/etc/rc.config.d/wlm` file.

Remote GUI Architecture



Monitoring WLM with **wlmgui**

- **wlmgui** has five views for monitoring:
 - Configuration, CPUs, Workload Groups, Service Levels, Custom
- To invoke the GUI, use the **-i** option to **wlminfo** or the **wlmgui** command:

```
# /opt/wlm/bin/wlminfo -i
```

```
# /opt/wlm/bin/wlmgui
```
- To perform remote management of a WLM-controlled system:
 - HP-UX workstation or server
 - Install the WLMUtilities bundle
 - Invoke **wlmgui**
 - Microsoft Windows
 - Install the utility using the setup.exe file
 - Invoke through the menu:

Starting wlmgui monitoring

HP-UX Workload Manager

File Settings Help

Monitor Modify Deploy

Partition sets

Add partition set

Enter all the systems that are in a partition set.

■ Hostname =

Port =

■ Login =

■ Password =

Primary host ☐

■ denotes a required field

Add host Clear

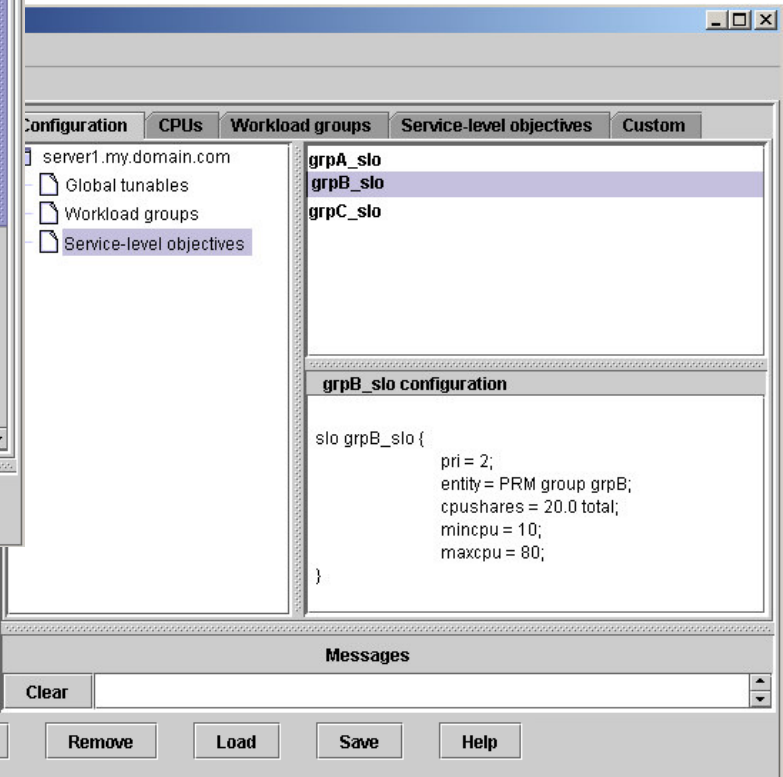
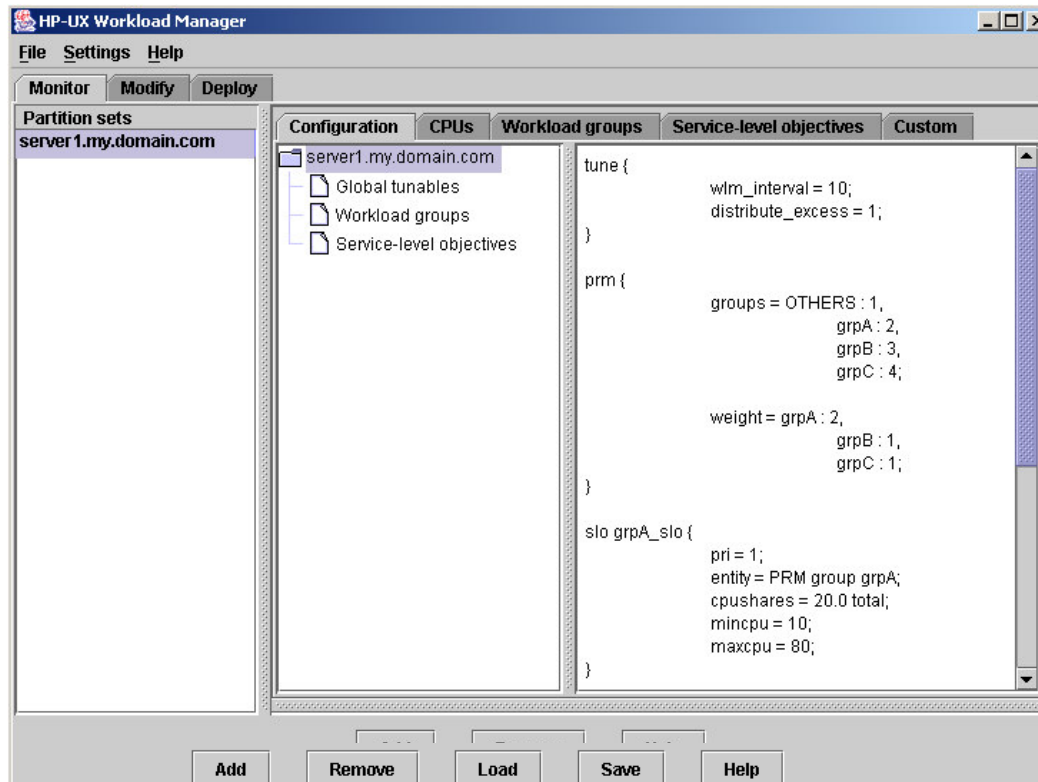
Hostname	Port	Login	Password	Primary host
server1.my...	9692	root	****	<input type="checkbox"/>

Load partitions Remove

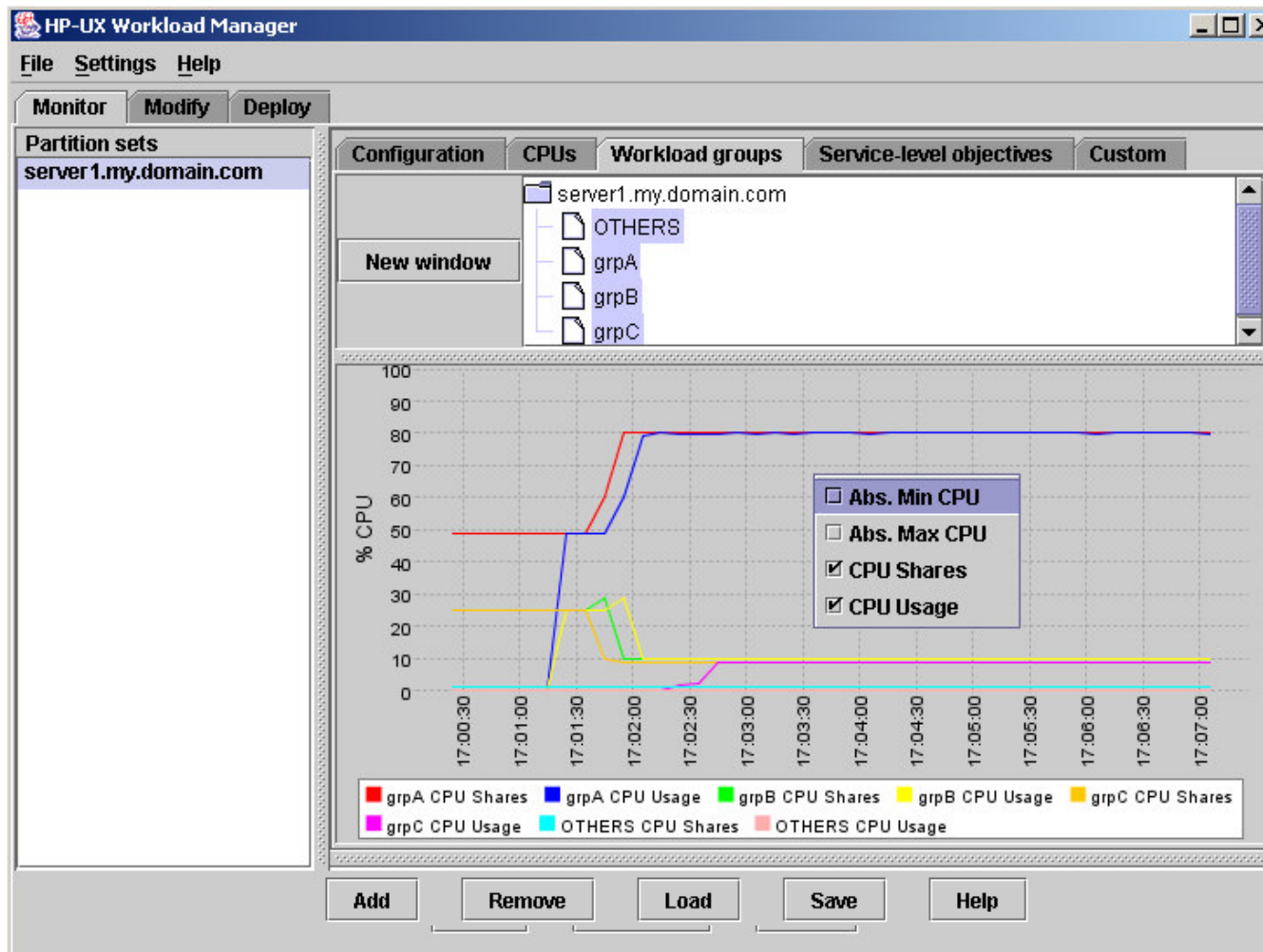
OK Cancel Help

Add Remove Load Save Help

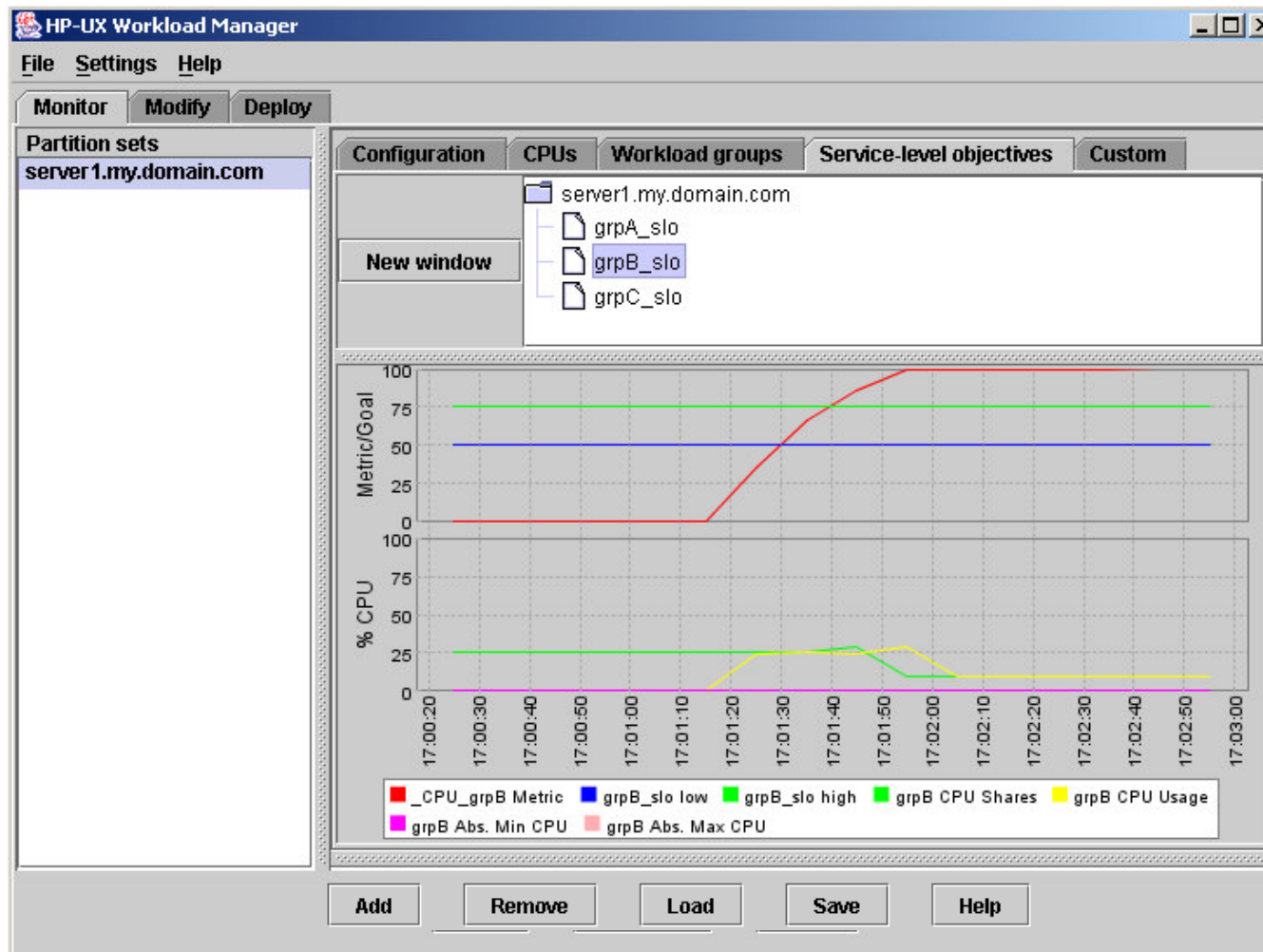
wlmgui monitoring views: Configuration



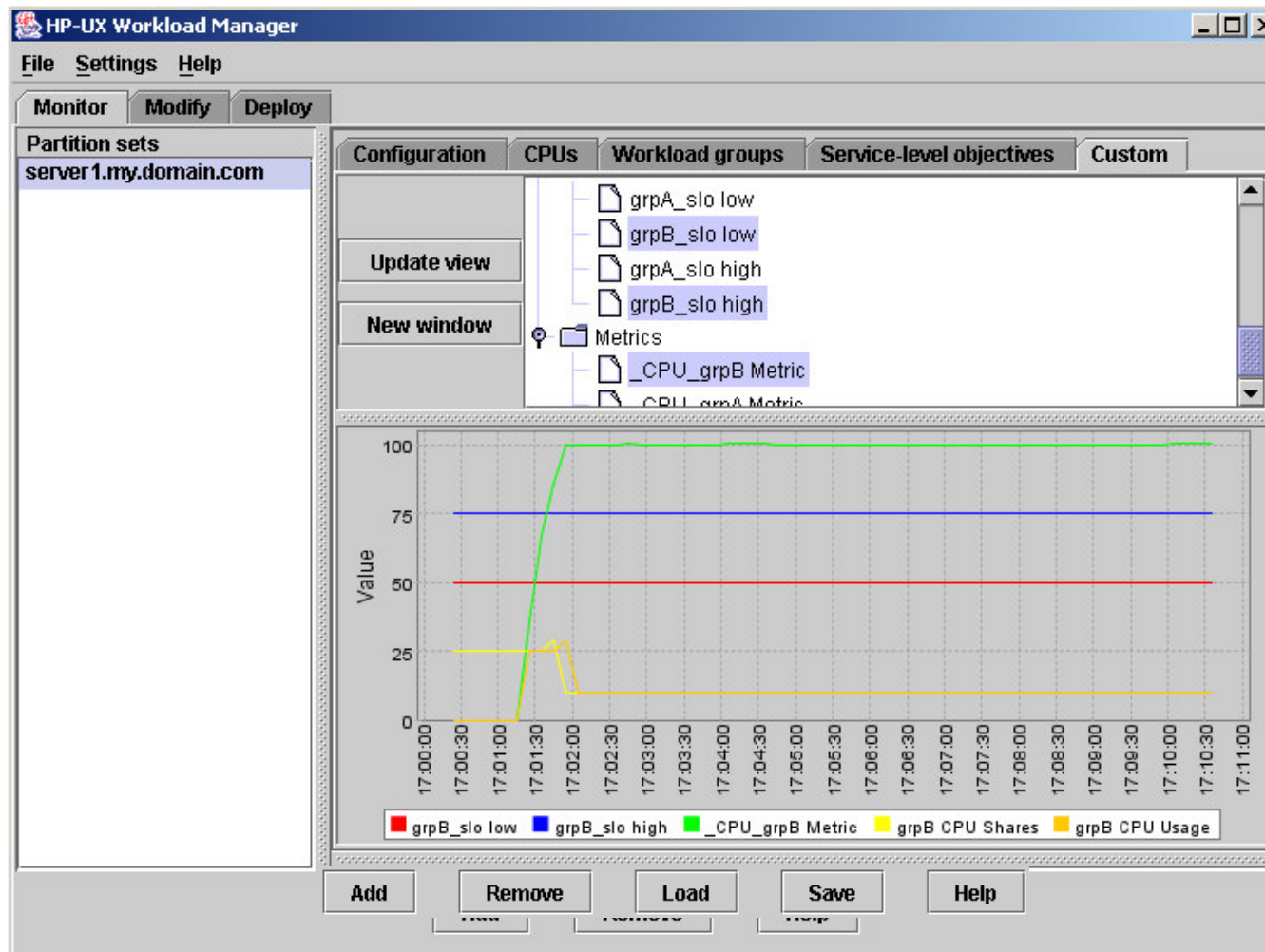
wlmgui monitoring views: Workload groups



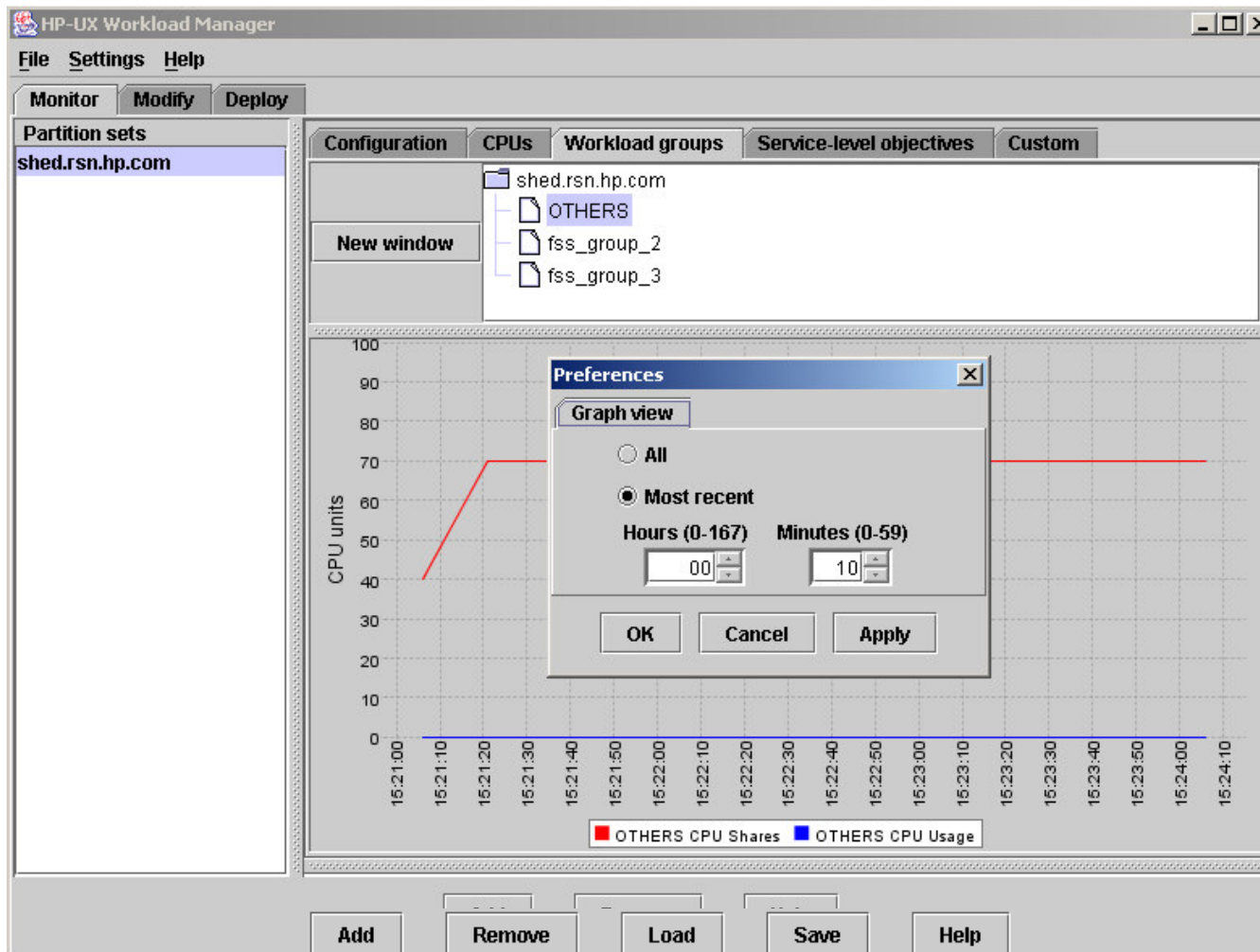
wlmgui monitoring views: Service-level objectives



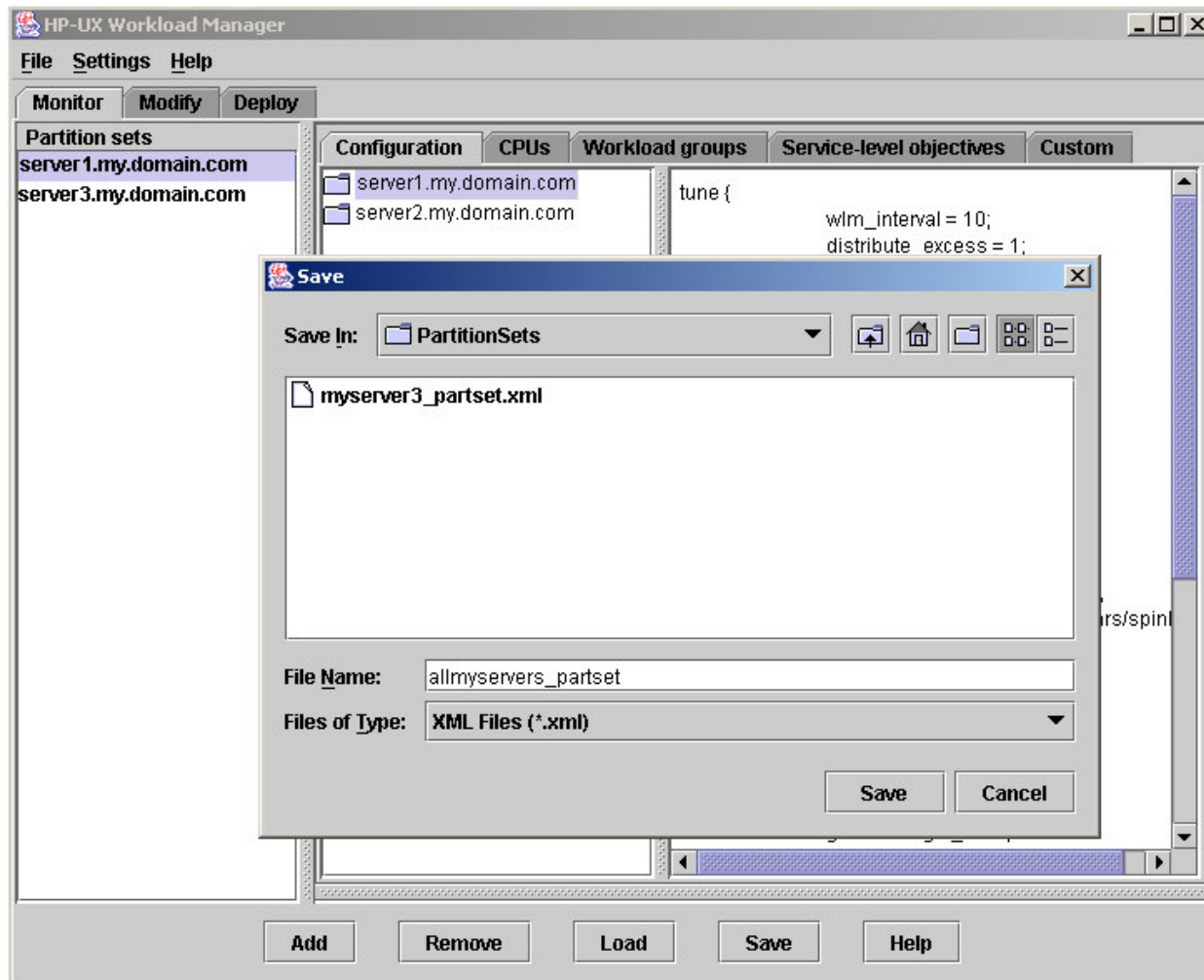
wlmgui monitoring views: Custom



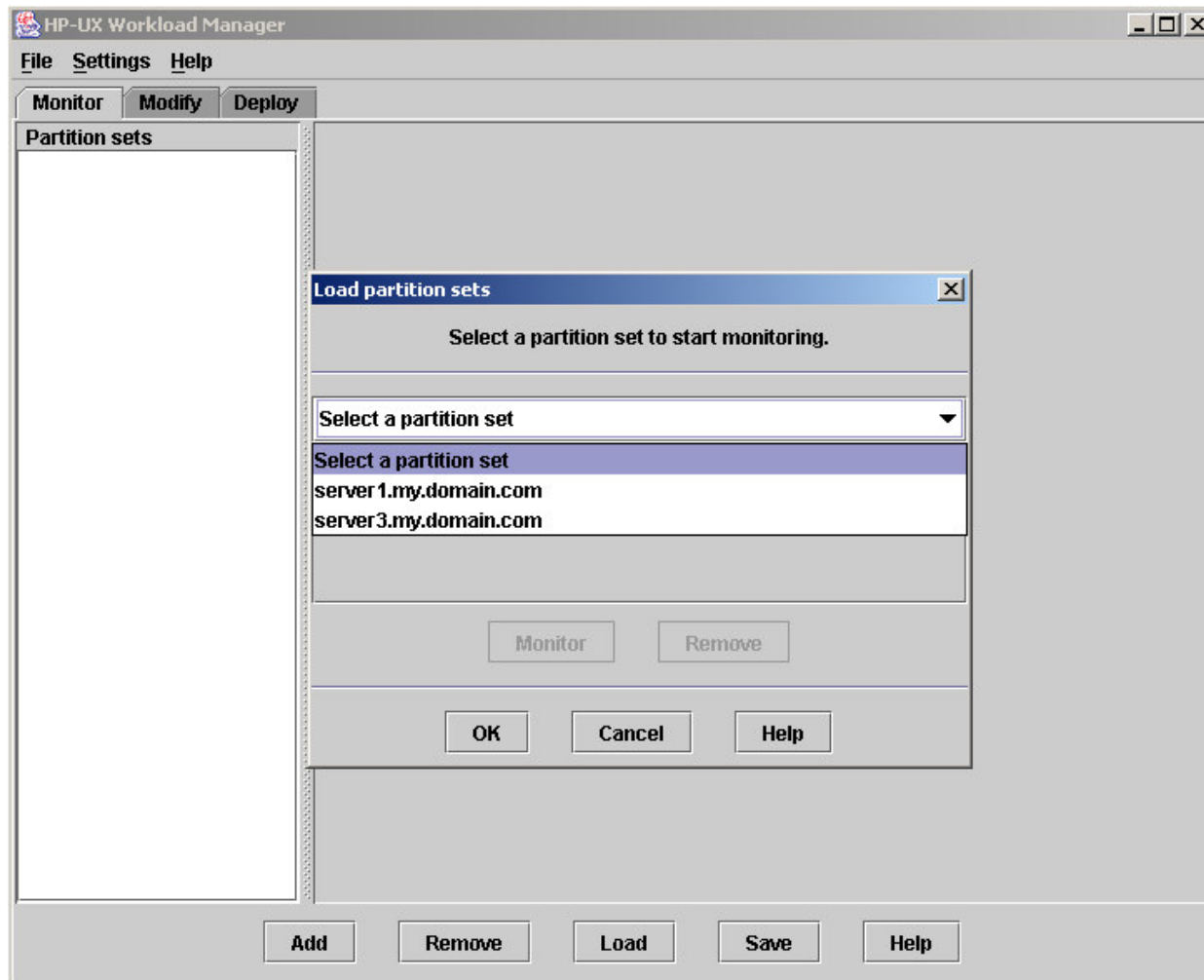
Changing graph view preferences



Saving partition sets



Loading a saved partition set definition



Reconfiguring WLM

To fine-tune an existing configuration, follow these steps:

1. Edit the WLM configuration file
2. (Optional) Activate the configuration in passive mode
3. Activate the configuration

It is not necessary to shut WLM down before activating a new configuration. Each of these steps can be done via the command line or **wlmgui**.

Setting WLM to start automatically at reboot



- For WLM to start automatically at reboot, set the **WLM_ENABLE** variable in the file `/etc/rc.config.d/wlm` to 1:

WLM_ENABLE=1

- When started at reboot, WLM by default uses the most recently activated configuration file
- To active a specific configuration at reboot, edit the following line in the `/etc/rc.config.d/wlm` file:

WLM_STARTUP_SLOFILE="*configfile*"

where *configfile* is the configuration file to use at reboot

Example configuration

- Look at the example configuration in your notes. It consists of three workload groups and three SLOs.



Module 2 Lab Exercise





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