HP Partitioning Continuum

hp world #432

Hewlett-Packard

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HP Partitioning Continuum for Always On

dynamic and optimized usage of compute power with uptime

agenda

why is partitioning important?

definition of partitioning

HP Partitioning Continuum for Always On

new: HP Virtual Partitions

workload management tools (PRM/ HP-UX WLM)

HP's competitive advantage

summary

resources

Why is partitioning important?

Pressure to offer service level guarantee at reasonable costs

Under utilization of servers

Address high fluctuation of Web and App traffic

Flexibility with privacy and high availability

HP Partitioning Customer Benefits

Meet service level agreements with best return-on-investment

80-90% + Utilization of compute power

Fast and dynamic implementation of changing requirements

"right" level of application isolation with uptime

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 Always On

HyperPlex
hard partitions with multiple nodes
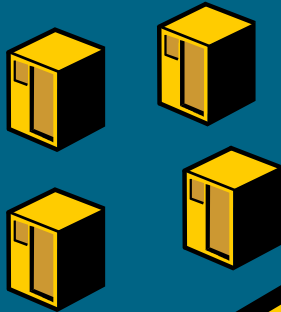
nPartitions
hard partitions within a node

Virtual Partitions
within a hard partition

PRM with psets
resource partitions within a single OS image

New!!

OS image with HW isolation

OS image with HW isolation

OS image with HW isolation

hard partition

OS image with SW isolation

OS image with SW isolation

OS image with SW isolation

1 OS image

Application 1
with guaranteed compute resources

Application 2
with guaranteed compute resources

Application n
with guaranteed compute resources

Based on CPUs or percentages

`hp-ux wlm` (workload manager)
—automatic goal-based resource allocation via set SLOs

New!

Isolation
highest degree of separation

Flexibility
highest degree of dynamic capabilities

hp partitioning continuum for always-on technical positioning

Hard Partitions with multiple nodes	**Hard Partitions** within a node	**Virtual Partitions** within a hard partition	**PRM with psets** resource partitions within a single OS image
hp hyperplex	**nPartitions**	**Virtual partitions**	**PRM** (Process Resource Manager)
– complete hardware and software isolation – node granularity – multiple OS images	– hardware isolation per cell – complete software isolation – cell granularity – multiple OS images	– complete software isolation – CPU granularity – dynamic CPU migration – multiple OS images	– dynamic resource allocation – share (%) granularity – 1 OS image

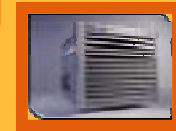**hp-ux wlm** (workload manager)

–automatic goal-based resource allocation via set SLOs

Isolation
highest degree of separation

Flexibility
highest degree of dynamic capabilities

hp 9000 enterprise server product line powering the HyperPlex architecture

SuperDome

N-Class
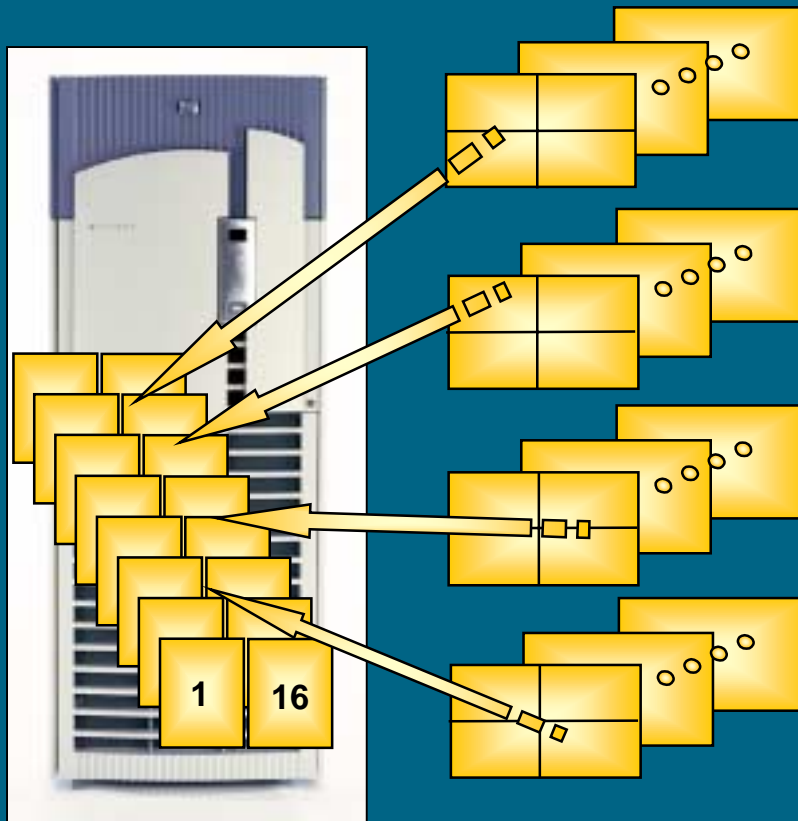
HyperPlex

L-Class

HyperPlex nodes

A-Class

HP Confidential

R-, D-, K- and V-Class on CPL until otherwise noted

nPartitions for SuperDome

Multiple applications on the same server with hardware isolation

New!

1 16

Increased system utilization

- **partitioning SuperDome into physical entities: up to16 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)**

new!

core functionality for free!

HP Virtual Partitions:
Multiple applications on the same server with software isolation

| Dept. A App 1 | Dept. A App 1' | Dept. B App 2 | Dept. B App 3 |
| HP-UX Revision A.1 | HP-UX Revision A.2 | HP-UX Revision B.3 | HP-UX Revision B.3 |

Increased system utilization

- **partitioning a single physical server or hard partition into multiple virtual partitions for L-Class, N-Class, and Superdome**

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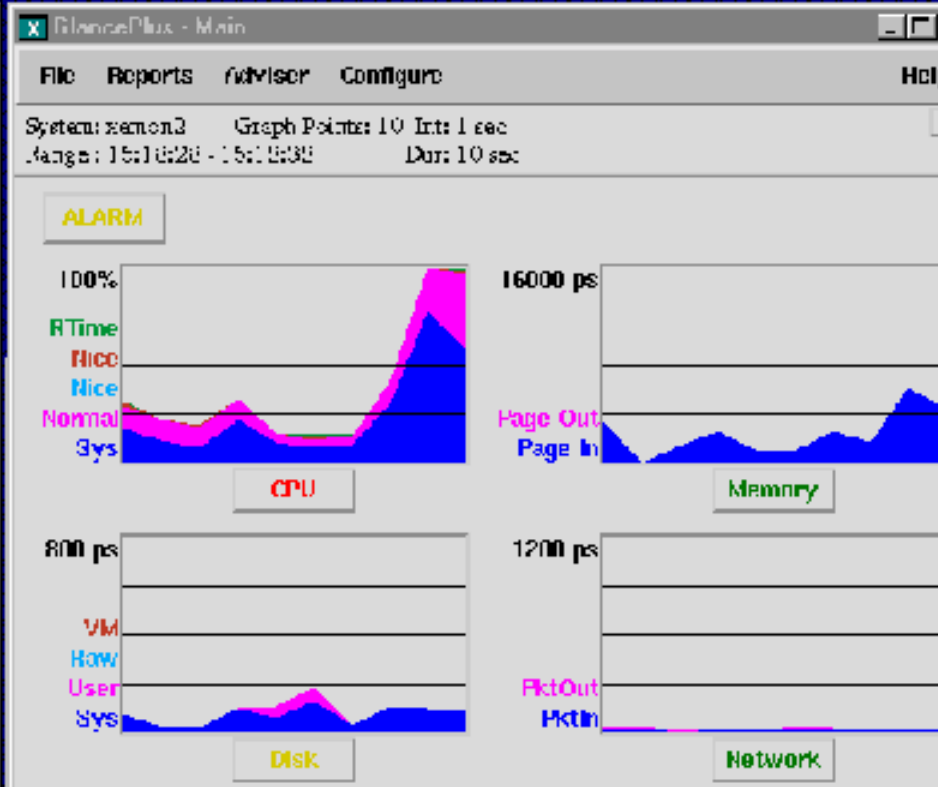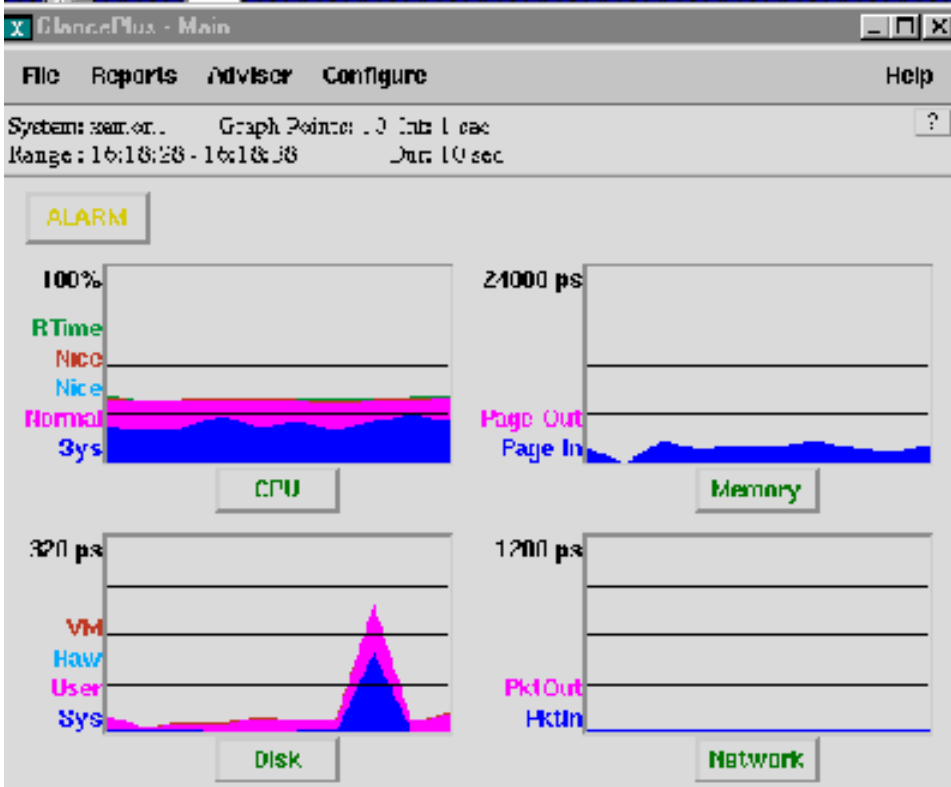
- **multiple independent instances of HP-UX**
- **dynamic CPU migration across virtual partitions**

Increased Isolation

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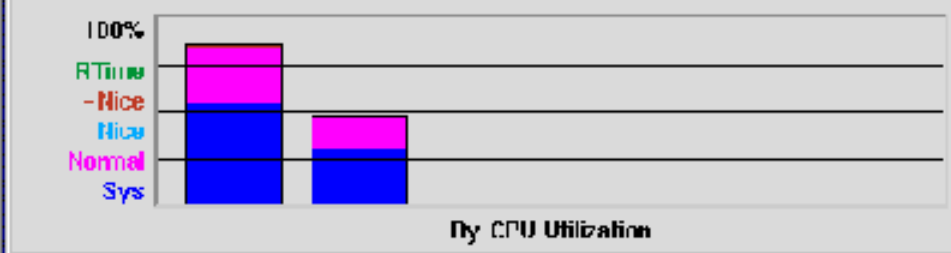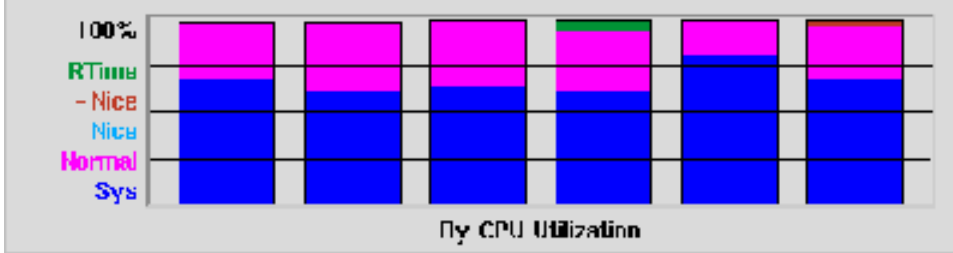- **individual reconfiguration and reboot**

Left terminal window — warp9

```
SDET result: 3109.3 scripts/sec
SDET result: 2443.8 scripts/sec
SDET result: 4933.6 scripts/sec
SDET result: 6343.6 scripts/sec
SDET result: 4413.8 scripts/sec
```

Right terminal window — warp9

```
SDET result: 5530.5 scripts/sec
SDET result: 6216.9 scripts/sec
SDET result: 4838.3 scripts/sec
SDET result: 2437.6 scripts/sec
SDET result: 3127.9 scripts/sec
```

Left GlancePlus — Main

File   Reports   Adviser   Configure   Help

System: xenon...   Graph Points: 10 Int: 1 sec
Range: 16:18:28 - 16:18:38   Dur: 10 sec

ALARM

100%
RTime
Nice
Nice
Normal
Sys
CPU

24000 ps
Page Out
Page In
Memory

320 ps
VM
Raw
User
Sys
Disk

1200 ps
PktOut
PktIn
Network

100%
RTime
- Nice
Nice
Normal
Sys
By CPU Utilization

Right GlancePlus — Main

File   Reports   Adviser   Configure   Help

System: xenon3   Graph Points: 10 Int: 1 sec
Range: 15:16:28 - 15:16:38   Dur: 10 sec

ALARM

100%
RTime
Nice
Nice
Normal
Sys
CPU

16000 ps
Page Out
Page In
Memory

800 ps
VM
Raw
User
Sys
Disk

1200 ps
PktOut
PktIn
Network

100%
RTime
- Nice
Nice
Normal
Sys
By CPU Utilization

Start | Reflection X - I... | warp9 | warp9 | GlancePlus - ... | GlancePlus ... | GlancePlus... | GlancePlus - ...   5:05 PM

warp9

SDET result: 4933.6 scripts/sec
SDET result: 6343.6 scripts/sec
SDET result: 4413.8 scripts/sec
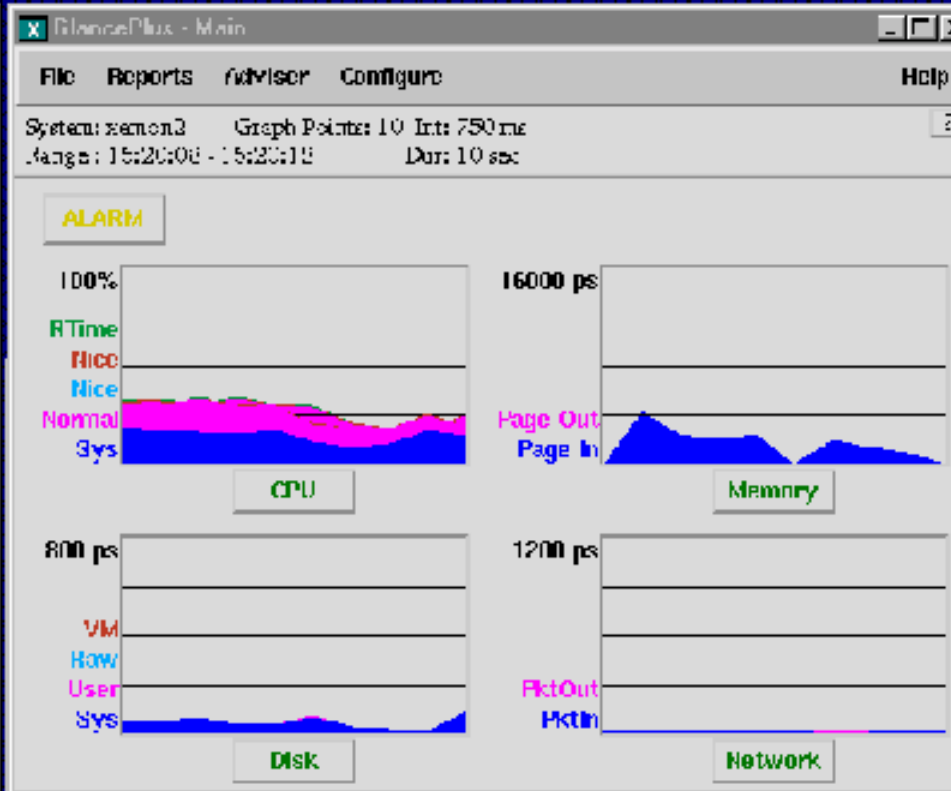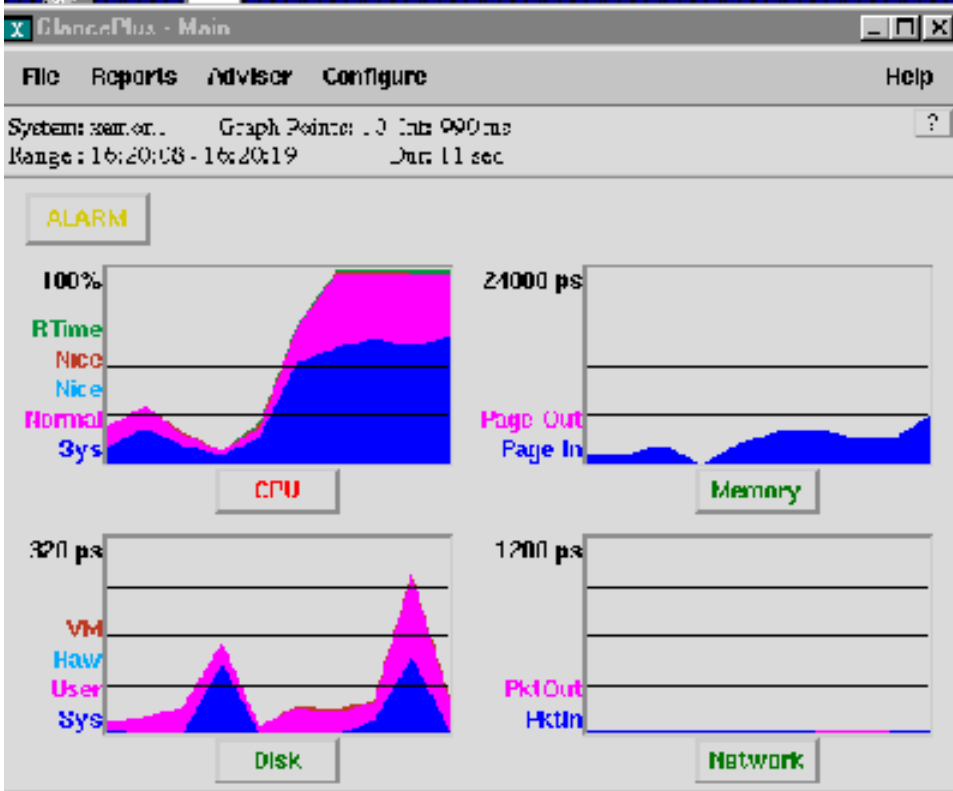SDET result: 2455.8 scripts/sec
SDET result: 2454.2 scripts/sec

warp9

SDET result: 4838.3 scripts/sec
SDET result: 2437.6 scripts/sec
SDET result: 3127.9 scripts/sec
SDET result: 6479.2 scripts/sec
SDET result: 6389.4 scripts/sec

GlancePlus - Main

File   Reports   Adviser   Configure   Help

System: xenon...   Graph Points: 10 Int: 990 ms
Range : 16:20:08 - 16:20:19   Dur: 11 sec

ALARM

100%   24000 ps
RTime
Nice
Nice   Page Out
Normal   Page In
Sys
          CPU   Memory

320 ps   1200 ps
VM
Raw
User   PktOut
Sys   PktIn
          Disk   Network

100%
RTime
- Nice
Nice
Normal
Sys
          By CPU Utilization

GlancePlus - Main

File   Reports   Adviser   Configure   Help

System: xenon3   Graph Points: 10 Int: 750 ms
Range : 15:20:08 - 15:20:18   Dur: 10 sec

ALARM

100%   16000 ps
RTime
Nice
Nice   Page Out
Normal   Page In
Sys
          CPU   Memory

800 ps   1200 ps
VM
Raw
User   PktOut
Sys   PktIn
          Disk   Network

100%
RTime
- Nice
Nice
Normal
Sys
          By CPU Utilization

Start   Reflection X - I...   warp9   warp9   GlancePlus - ...   GlancePlus - ...   GlancePlus - C...   GlancePlus - C...   5:07 PM

HP Virtual Partitions Key Features

- core functionality bundled for free with every HP-UX 11i release
- support of multiple HP-UX instances (HP-UX 11i and later)
- different virtual partitions can run different versions of HP-UX
- support of HP 9000 L-Class, N-Class, Superdome (including nPartition)
- single CPU granularity (virtual partition may contain single CPU)
  - L-Class - recommended up to 2 virtual partitions (max. 4)
  - N-Class - recommended up to 4 virtual partitions (max. 8)
  - Superdome - recommended up to 32 virtual partitions (max. 64)
- dynamic CPU migration across virtual partitions
- software fault isolation (application and OS isolation)
- Individual reconfiguration and reboot, e.g. for rolling upgrades (virtual partitions don't affect each other)
- command line interface (in future via GUI)
- single toggle console (in future consolidated console)
- compatibility with PRM, HP-UX WLM, ServiceControl Manager and MC/ServiceGuard

Shipment for L and N-Class in 3Q01(Superdome after L &N)
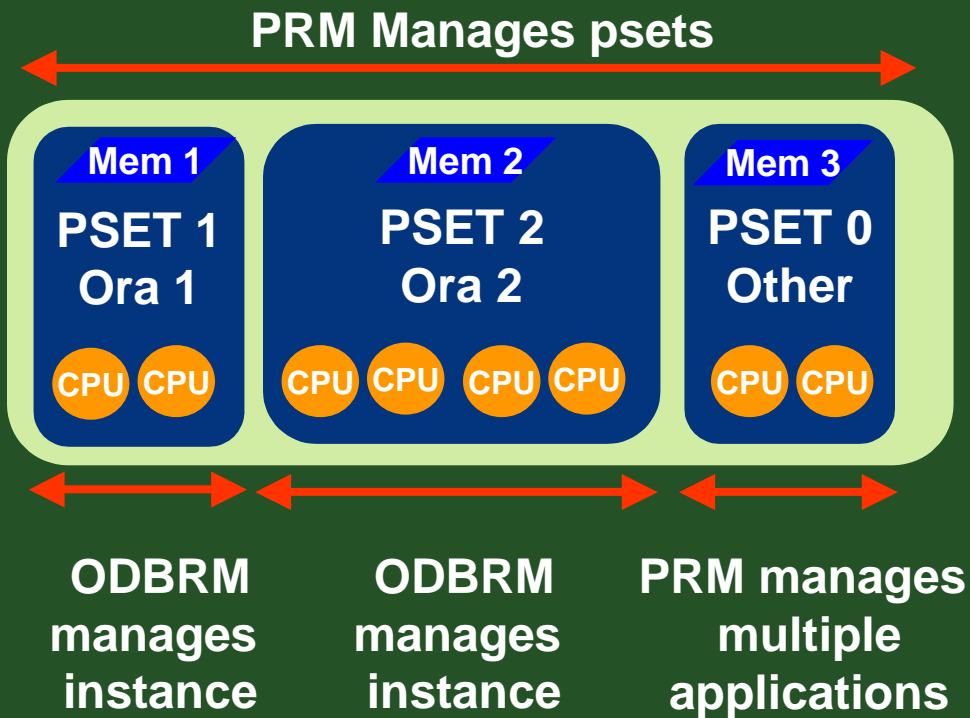
HP-UX processor sets (psets) overview

- represents a group of processors in the system

- represents a scheduling allocation domain

- provides mechanism for CPU resource management

- provides CPU resource isolation for applications and users

- does not provide fault isolation

the system may be configured into more than one processor set

HP-UX processor sets (psets) features

• dynamic creation, deletion, and reconfiguration of psets

• dynamic migration of threads and processes across psets

• ownership and access permissions for psets

• attributes to control psets behavior under different conditions

• processors are assigned to one pset at a time

• processes and threads have binding to one pset at a time

• system default pset for default users

• integration with PRM and gang scheduler

• can run PRM and ODBRM in different psets at the same time on a single system

integrated hierarchical management of Oracle on HP-UX

PRM Manages psets

Mem 1	Mem 2	Mem 3
PSET 1 Ora 1	**PSET 2 Ora 2**	**PSET 0 Other**
CPU CPU	CPU CPU CPU CPU	CPU CPU

ODBRM manages instance

ODBRM manages instance

PRM manages multiple applications

HP 9000 Server

Processor set defined by PRM
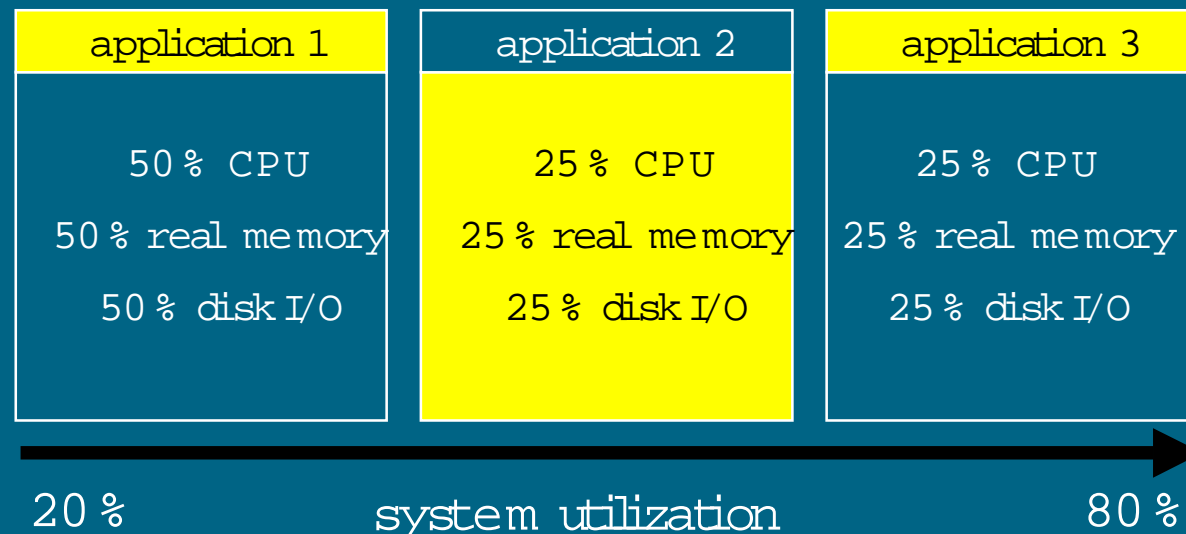
Memory allocated by PRM

PRM cooperates with Oracle 9i DB Resource Manager to manage system resources

Result: HP 9000 is the ideal Oracle consolidation platform

hp process resource manager (PRM): predictable service level management

PRM includes:

- PRM analyze to collect system accounting data for charge back and tuning

application 1	application 2	application 3
50% CPU	25% CPU	25% CPU
50% real memory	25% real memory	25% real memory
50% disk I/O	25% disk I/O	25% disk I/O

Sold >13,000 licenses

20%   system utilization   80%

PRM allows you to drive up system utilization by running more applications per server: the result is a better ROI

workload management news
new features of PRM as of june 2000

- hierarchies
  - allows allocation of system resources for subgroups

- in addition to percentage-based allocation PRM also supports shares now

- in-kernel memory (supported with HP-UX 11i)
  - improves memory allocation

- single-point administration, Java-based GUI
  - runs standalone or within a browser: HP-UX 11.x, NT 4.0
  - supports IE 5.0 or Netscape 4.7
  - allows configurations of multiple OS images from a single console

(*) PRM release 1.08 for HP-UX 11 only

HP-UX workload manager (WLM)

examples of service level objectives (SLOs)

application a	Application b	application c

response time SLO

transactions will complete in less than 2 seconds.

response time SLO

transaction will complete in less than 3 seconds

job duration SLO

batch job will finish in less than 1 hour.
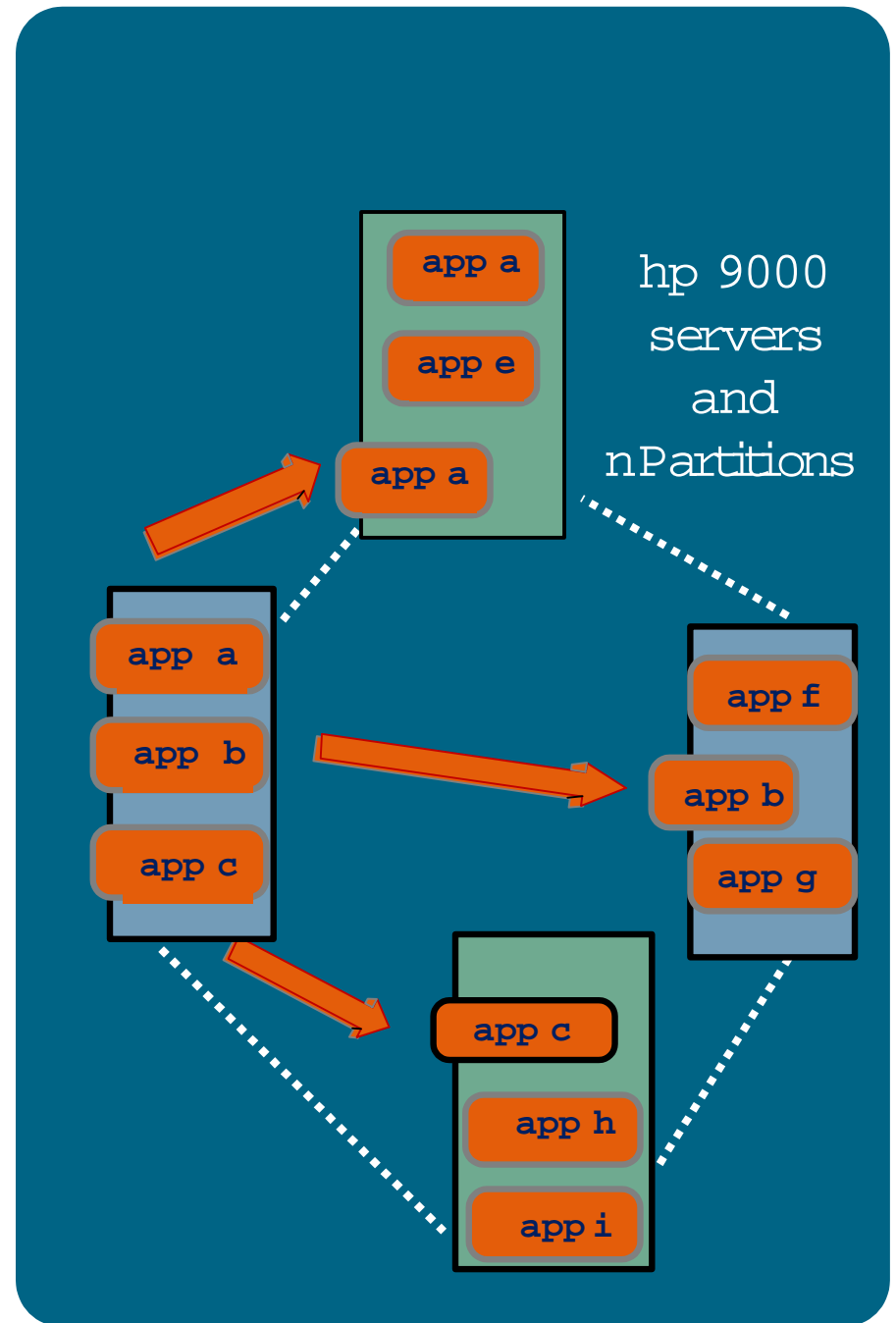
priority 1   priority 2   priority 3

HP-UX WLM automatically reconfigures CPU entitlements to satisfy SLOs in priority order

dynamic and automatic application rehosting and reallocation

with mc/serviceguard and hp-ux wlm

- minimize planned service interruptions

- hardware/software upgrades or maintenance

- goal-based resource allocation with hp-ux wlm based on set SLOs

hp 9000 servers and nPartitions

app a

app e

app a

app a

app b

app c

app f

app b

app g

app c

app h

app i

hp-ux workload manager (WLM) - new release: hp-ux WLM 1.1 Features

Shipment Dec 2000

- Application Response Measurement (ARM) Integration Toolkit (ARM-IT)
  - Enables automatic management of ARM'ed applications with WLM
- Improved Data Collection Capabilities
  - Command line interfaces enable data collection with script languages
- MC/ServiceGuard Integration
  - Workload management with a single configuration file throughout a MC/ServiceGuard cluster
- Selective Capping
  - Allows user-selected workloads to share CPU entitlements when not in use while limiting others to their entitlements.
- Latest version of PRM (release 1.08) included
  - hierarchies, in-kernel memory, and shares

growing within a system or partition

payments
time >>>

payments
time >>>

application A
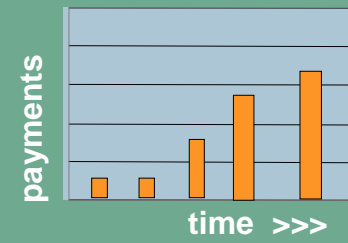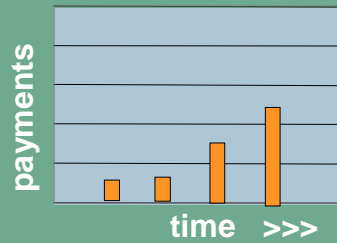
application B

CPU CPU
CPU CPU
CPU CPU
CPU CPU

application A

application B

CPU CPU
CPU CPU
CPU CPU
CPU CPU

CPU — iCOD CPUs

CPU — active CPUs

CPU — iCOD CPUs turned on

iCOD notification:
WLM turns the iCOD CPUs on in order to manage the workload

HP-UX Workload Manager (WLM) New Release:
HP-UX WLM 1.2 Features

Shipment June 01

- Oracle Tool kit for hp-ux WLM

  - collection of the performance metrics for Oracle made easy

- Integration with ServiceControl Manager

  - launch WLM from the SCM GUI for rapid deployment

- iCOD notification

  - to alert the system administrator for more iCOD reserves needed to meet the SLOs

managing
hp partitioning
continuum

the integrated power of servicecontrol and openview

servicecontrol manager

single-point multi partition management for fast deployment and consistency

partition manager
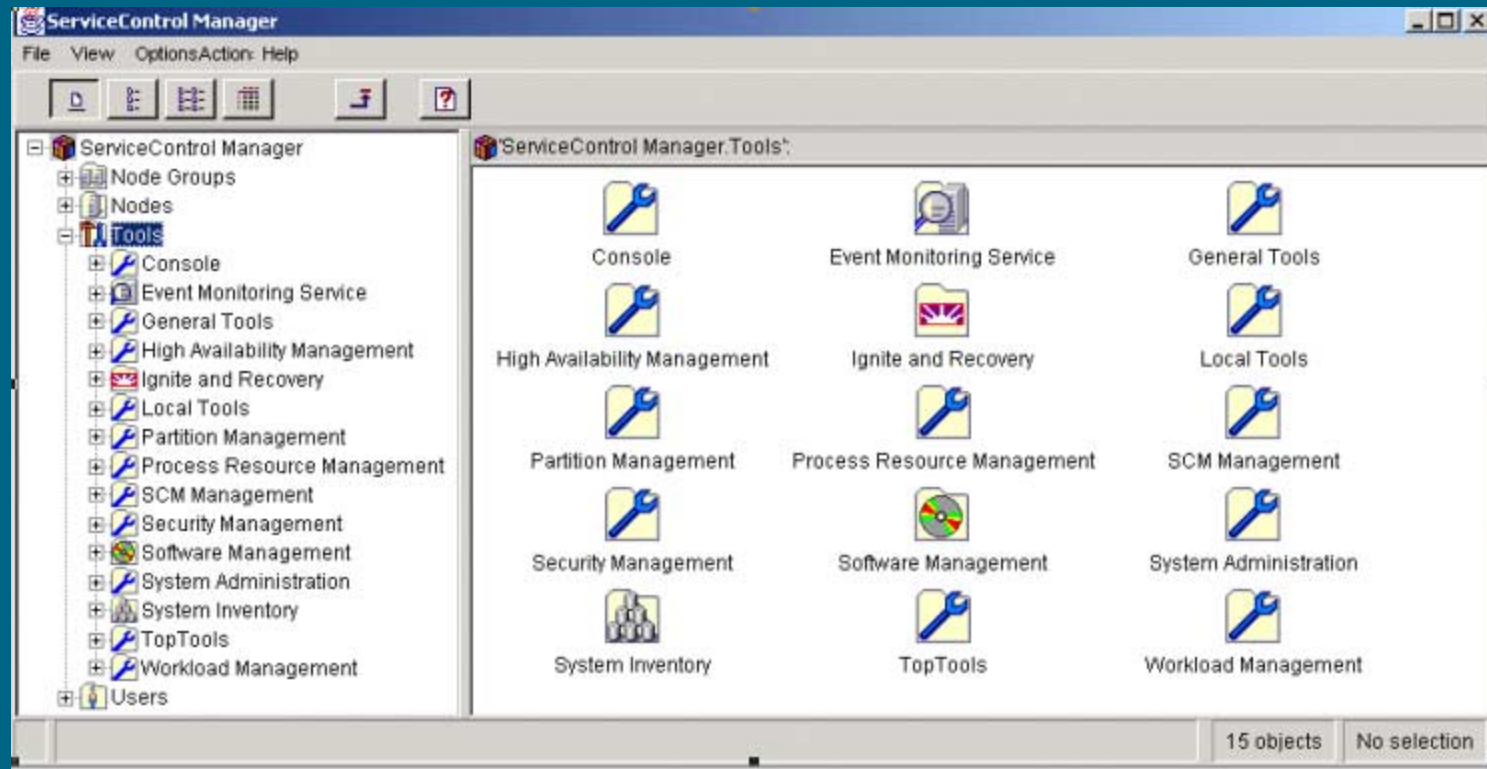**setup partitions**
map partition architecture

openview glanceplus pak

performance monitoring of each partition

openview vp operations
monitor events on each partition

servicecontrol manager tools – news manage multiple partitions

All hp-ux manageability tools are integrated - in addition to toptools for device management and Linux agent support to manage Linux-based server nodes

TopTools (Aug 2001)   Central Web Console (Sep 2001)
Process Resource Manager (Sep 2001) Partition Manager (Sep 2001)
Serviceguard Manager (Sep 2001)   SCM Management (Oct 01)

servicecontrol manager new release:
new scm 2.0 features

shipment
june 2001

increased scalability – 16x
– up to 1024 managed nodes per managed cluster

increased security
– public/private key authentication
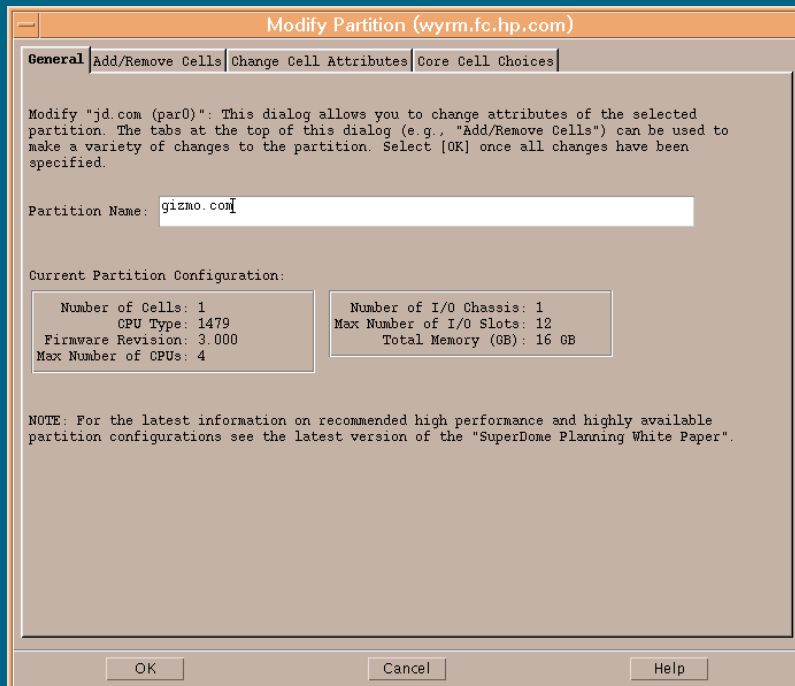– "on the wire" encryption by using HP IPSEC product

increased productivity
– toptools event log viewer
– node group authorization

investment protection
– direct upgrade path from scm 1.0 and 1.1 to 2.0

partition manager

Modify Partition (wyrm.fc.hp.com)

General | Add/Remove Cells | Change Cell Attributes | Core Cell Choices |

Modify "jd.com (par0)": This dialog allows you to change attributes of the selected partition. The tabs at the top of this dialog (e.g., "Add/Remove Cells") can be used to make a variety of changes to the partition. Select [OK] once all changes have been specified.

Partition Name: gizmo.com

Current Partition Configuration:

Number of Cells: 1
CPU Type: 1479
Firmware Revision: 3.000
Max Number of CPUs: 4

Number of I/O Chassis: 1
Max Number of I/O Slots: 12
Total Memory (GB): 16 GB

NOTE: For the latest information on recommended high performance and highly available partition configurations see the latest version of the "SuperDome Planning White Paper".

OK   Cancel   Help

Note: GUI for nPartition, GUI for virtual partitions planned

- Create & modify partitions
- Display a complete hardware inventory
- Display status of key complex components
- Check for problem or unusual complex conditions
- Manage power to cells & I/O chassis
- Turn on/off attention indicators for cells, I/O chassis, I/O cards & cabinets

Keystone Systems Consolidation Sample Configuration

nPartition 1
for test environment

nPartition 2
for production environment

Virtual partition 1
for customer 1
with 1 or more
applications

Virtual partition 2
for customer 2
with 1 or more
applications

Test and production environment with hardware isolation

2 production environments with complete software isolation for different customers
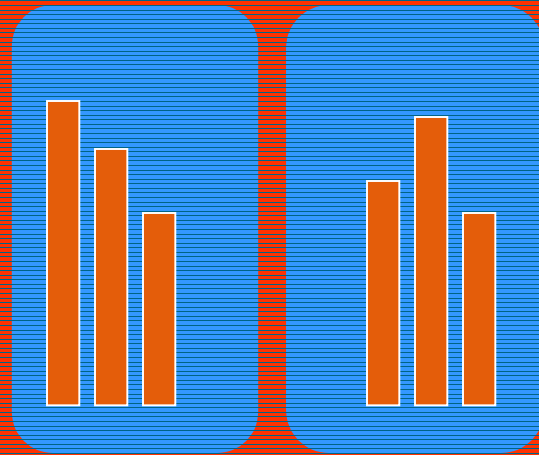
Managing Partitions

nPartition 1
for test environment

nPartition 2
for production environment

Glance Plus Pak
performance monitoring of partitions

Parmgr

To create and configure partitions

ServiceControl Manager

Manages partitions for fast deployment and consistency

hp **partitioning** continuum for always-on
THE competitive advantage

	HP-UX	Sun (Solaris)	IBM (AIX)
Resource partitioning	**Yes** prm with integrated psets (Sep 2001)	**Yes** psets not integrated with srm $$	**Yes** psets not available
Goal-based resource partitioning	**Yes** MC/Serviceguard and iCOD integration	**No**	**No**
Virtual partitions with S/W isolation	**Yes**	**No**	**No**
Hard partition within a node	**Yes**	**Yes** Less HA	**No**
Hard partition with multiple nodes	**Yes**	**Yes** No high speed connect	**Yes** $$

HP Partitioning Continuum for Always On – Summary

Point	Customer Benefits	Competitive Differentiation
• Broadest partitioning offering – Multiple OS images with HW & SW isolation and individual resource allocation	• "right" level of application isolation with uptime	• SUN Solaris and IBM AIX offer only subset – HP only UNIX vendor with virtual partitions
• Optimization through multiple applications on the same servers	• 80–90% + Utilization of compute power	• SUN Solaris and IBM AIX with significant lower utilization
• Dynamic and automatic resource allocation based on set SLOs	• Fast and dynamic implementation of changing requirements	• SUN Solaris and IBM AIX have NO automatic resource allocation solution

Only with HP – meet service level agreements with best ROI

HP Partitioning Continuum for Always On

dynamic and optimized usage of compute power with uptime

backup

HP Partitioning Continuum for Always On
Decision Criteria

	HyperPlex	nPartitions	Virtual Partitions	PRM HP-UX WLM
Hardware isolation need	SMP node	Cell	future	
Software isolation need	YES – multiple OS images	YES – multiple OS images	YES – multiple OS images	NO – 1 OS image
Granularity	SMP node	Cell	CPU	Share (%)
Dynamic Resizing		Yes (for PCI I/O for cells – future)	Yes	Yes

← **Isolation**
highest degree of separation

Flexibility →
highest degree of dynamic capabilities

Customer Reference

"Siemens Business Services will be enabled with **HP Virtual Partitions** *to further* **optimize the system utilization** *by running multiple applications on the same HP 9000 server with complete software isolation.This new system consolidation capability will result in less servers to be managed in a* **more flexible** *way and ultimately* **lower total cost of ownership."**

Helmut Kutzberger
UNIX System Management
Siemens Business Services

workload management success
PRM customers

- sixth largest bank in USA

- more than 16 million customers who expect 24x7 access to account information.

- mission-critical solutions: 60% of the 330 hp 9000 v-class and k-class enterprise servers run mc/serviceguard

"First Union has had measurable success using HP's Process Resource Manager to manage multiple Oracle databases for traditional and web applications."

"The goal-based capabilities of Workload Manager will further enhance our e-serviceCenter's ability to deliver the service levels our customers demand."

- Rob Young
First Union Corporation
December 1999