OpenVMS virtualization

Update and Strategy

Dave Holt, D.Holt@HP.com
Senior Business/Product Manager,
Business Critical Systems
Hewlett-Packard Company

Abstract

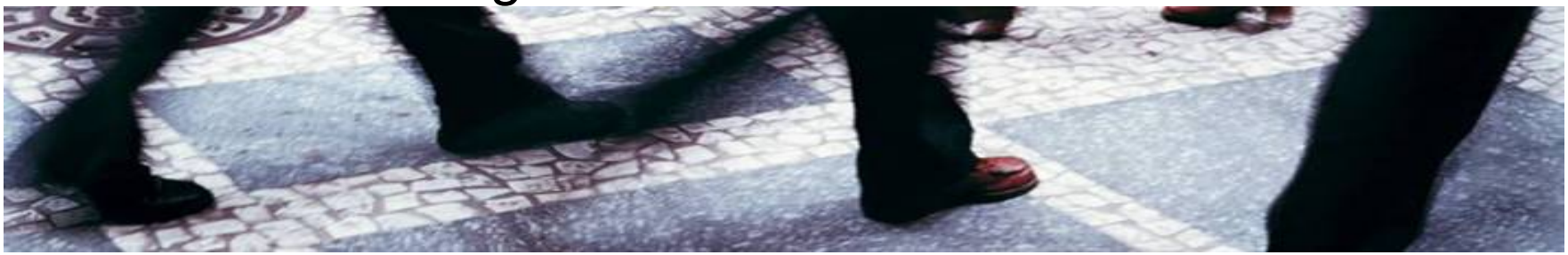
Virtualization Strategy/Plans

- OpenVMS is implementing additional technologies which will further extend its industry leadership in clustering, virtualization and resource management capabilities

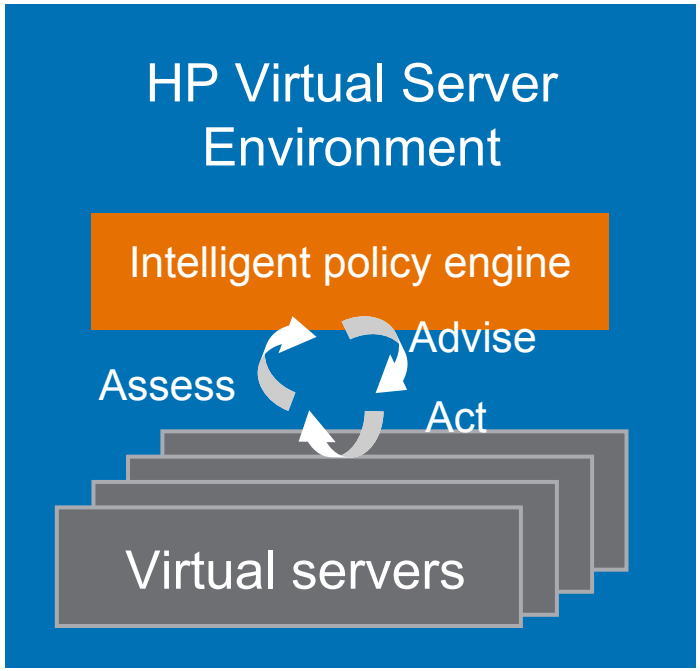
- The HP merger has enabled OpenVMS to leverage significant Virtualization and Management technologies developed for HP-UX, Linux and Windows, thereby assisting us to bring these benefits to our customers faster

Agenda

1. Virtualization with the Virtual Server Environment
2. Global Workload Manager (gWLM)
3. Utility Pricing:
   - Instant Capacity (iCAP) and Temporary Instant Capacity (TiCAP)
   - Pay Per Use (PPU)
4. Ongoing Developments
5. Virtualization/Partitioning – Integrity Virtual Machine
6. Other Technologies under consideration



HP Virtual Server Environment:
Integrated Virtualization for HP Integrity Servers



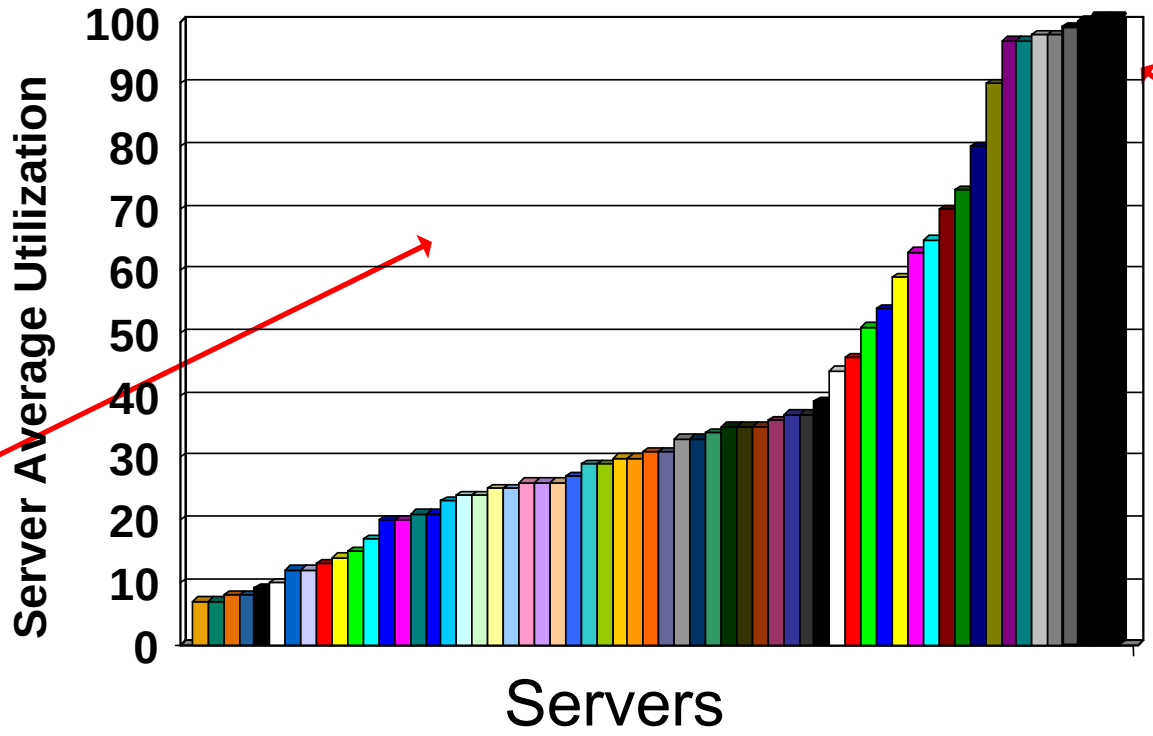
- Pool and Share Resources
- Potential to double resource utilization
  - Dynamic resource allocation in a multi-OS environment
- Maintain continuous service levels
  - Simple policy management and highly available
- Pay only for what you use
  - Utility pricing

Consolidates and virtualizes server resources for optimum utilization – supply automatically meets demand

Servers Storage Network Software

Challenge: Enterprises have unused server capacity yet still can't meet demand

Utilization at an actual HP customer



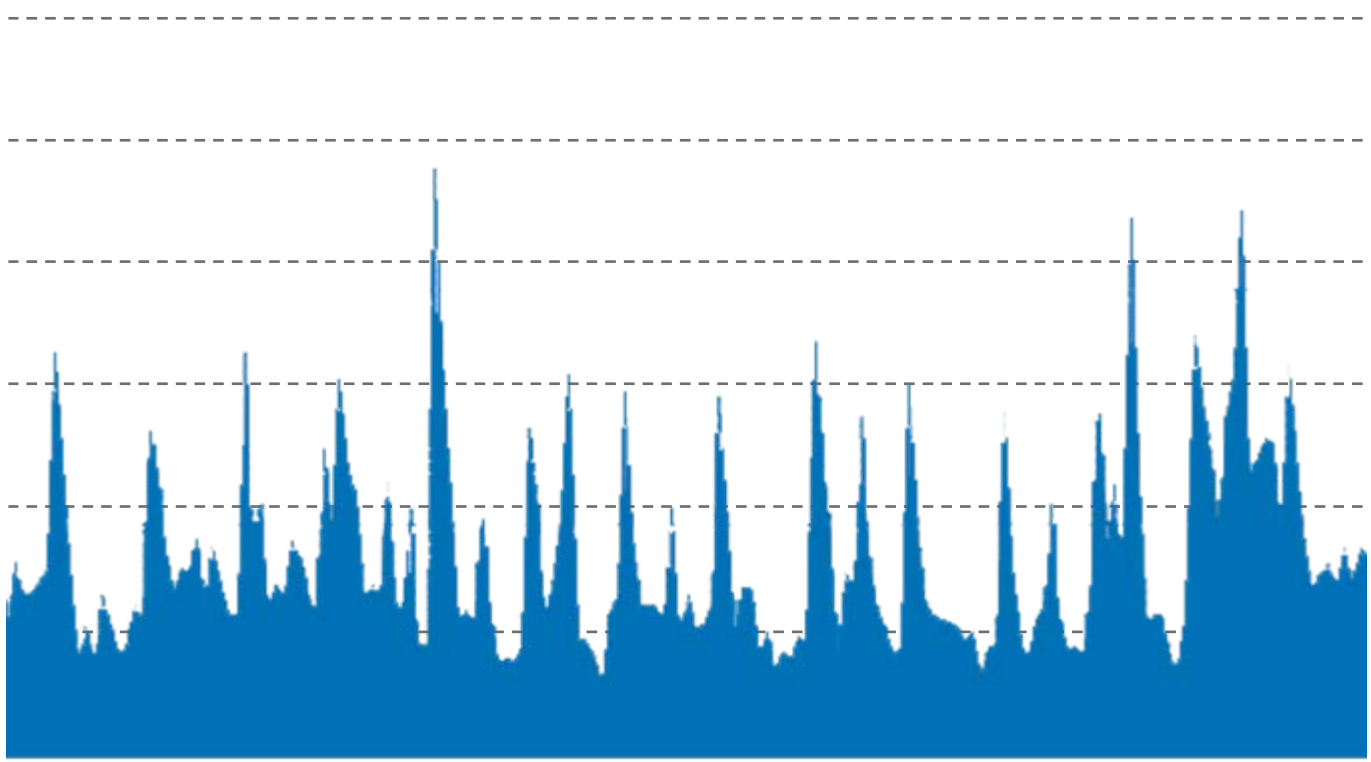
Tremendous amount of unutilized capacity

Yet these systems are unable to handle the load

Most reports put average utilization at less than 30%

Utilisation is so low because…

- Each system is an isolated island of resources
- Systems have load peaks that need to be met



What Real World Problems can *Virtualization* Solve?

Do you experience:

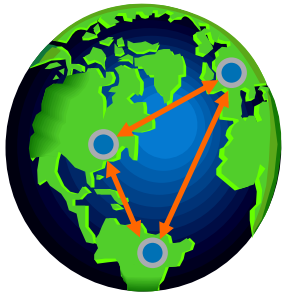
- Lack of **floor space** in computer rooms?
- Potential or actual overloading of **air conditioning**?
- Ever increasing **electricity** bills?
- Daily **problems** with **managing** a plethora of diverse systems, storage products and networks?
- Desire for systems to be much more **flexible** and easily re-configurable?
- **Escalating** system management and administration **costs**?
- **Escalating costs** of 3rd Party application software based on CPU count?
- Rapid **obsolescence** of computer equipment?
- Escalating hardware service and support **costs**?
- The desire to deploy **warm stand-by systems** if they were affordable?

HP OpenVMS Virtual Server Environment
Meeting Real-World Customer Challenges

A

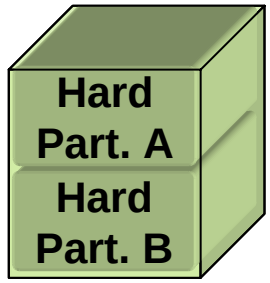
Optimizing cluster utilization within a data center

B



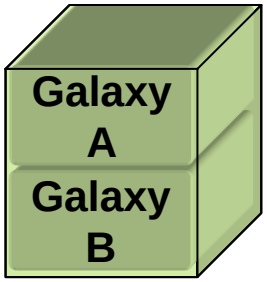
Optimize utilization across data centers for disaster tolerance

C



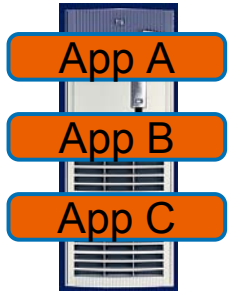
Consolidating multiple production environments on the same server

D



Consolidating of test/ dev and production on the same server

E

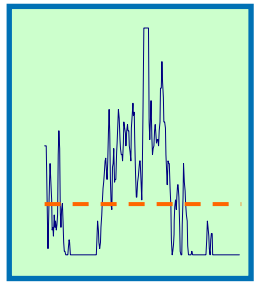


60%
30%
10%

node 1

Consolidation through application stacking within the same OS image

F



Activate and deactivate capacity as business needs change while aligning payments with actual usage

OpenVMS Virtual Server Environment (VSE)

HP OpenVMS Virtualization
HP VSE for OpenVMS

HP Virtual Server Environment (VSE)

Control
- ✓ Class Scheduler
- ✓ gWLM/CMS &
- ✓ Systems Insight Manager delivered in Mar '06

Availability
- ✓ OpenVMS Clusters (all nodes active)
- ✓ Disaster Tolerant Clusters, extends to 800 Km
- ✓ Volume Shadowing
- ✓ Availability Manager

Partitioning
- ✓ nPars (Hard Partitioning)
- ✓ vPars/Galaxy (Soft Partitioning)
- ✓ Partition Management SW

Utility Pricing
- ✓ AlphaServer Instant Capacity
- ✓ Pay Per Forecast

Future Directions

- ✓ VSE Mgr, Capacity Advisor, Visualization Manager
- ✓ Mixed Alpha and Integrity Clusters delivered in Jan '05
- ✓ 96 nodes Sep '05
- ✓ HP Integrity Virtual Machines (HPVM)

Future Directions

- ✓ PPU – Active CPU and Percent CPU for Integrity with OpenVMS 8.3
- ✓ iCAP and TiCAP for Integrity with

Global Workload Manager

(gWLM)

Benefits of Global Workload Manager (gWLM) for OpenVMS

- **gWLM benefits:**
  - Lower cost solution than purchasing additional CPUs to satisfy increasing work load demands
  - As workloads grow, gWLM restricts the escalation of hardware maintenance, service, operating system, floor space, electricity and air conditioning costs
  - Limits 3rd Party software costs as CPU count is kept to a minimum
- **gWLM for OpenVMS enables the following**:
  - Potential for much improved utilization of Integrity and/or Alpha CPUs across disparate work streams, managing multiple systems and clusters from a single console
  - Automatic CPU resource allocation to satisfy Service Level Agreements of multiple Business Units, based on Systems Management defined policies
  - Advisory Mode – Try different policies and assess results without affecting the live system
  - Intuitive management from GUI and comprehensive reporting tools

Why it works

Most servers are sized to handle peak loads

- Peaks are often short in duration and don't all coincide.
- On a shared pool, each workload has access to much more power for the peaks – *jobs finish faster*

Eliminates over provisioning for uncertainties in forecasts

- Size the virtual server for *actual* demand; tap into the shared pool for 'overdraft protection'
- Start small and grow as needed

Eliminates over provisioning for small workloads

- Lots of workloads need less than a CPU. Stack them

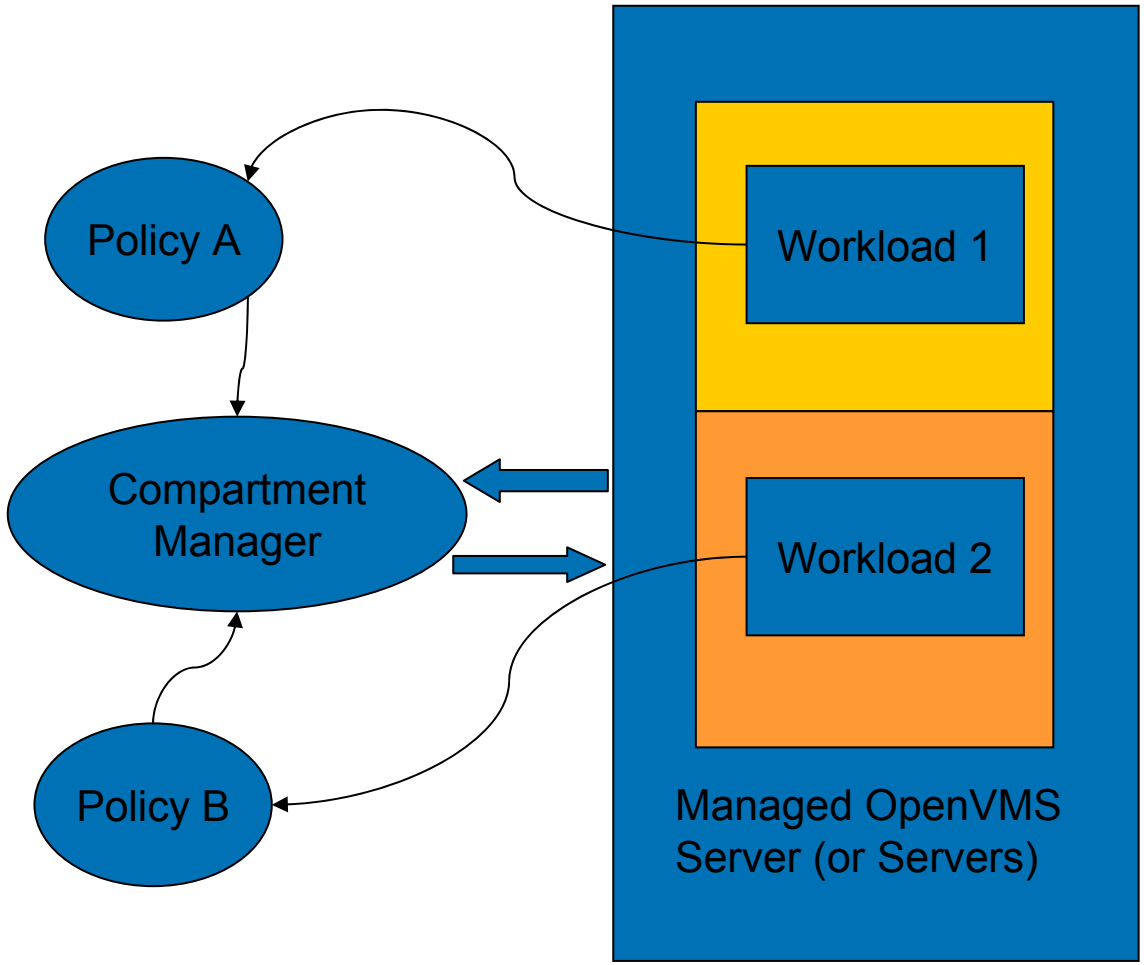
Hot standby's don't have to be idle

- Let lower priority workloads and those less sensitive to brief (and mild) slowdowns 'borrow' hot standby CPUs when not in use

gWLM Out of the Box Reports

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

Virtualization by Management of Compartments



Global Workload Manager on OpenVMS - 2

- Separately orderable part for all the Operating Environments on Integrity Systems and priced per CPU (Per Processor Licensing – PPL)
  - $2,500 Per Processor License

- Available as Workgroup, Departmental or Enterprise Capacity licenses on AlphaServer
  - DS25, DS20, DS15, DS10 $7,500
  - ES47, ES80, ES45, GS80, ES40 $15,000
  - GS1280, GS320, GS160, GS140 $30,000

- Ships independent of major OpenVMS release on Layered Product CD

- Management functions – gWLM Central Management Server - ported to Windows and also available on HP-UX and Linux

Actual CPU Utilization at a Major International Finance Customer (late 2005)

Actual CPU Utilization at a major international bank based on average of 24x365 scale			
Node	**% CPU**	**Model**	**A/V**
A	9.5	7620	V
B	8.3	7620	V
C	31.2	7620	V
D	6.7	7620	V
E	4.3	4500A	V
F	36	DS20E 68/833-2	A
G	11.7	AS4100 5/600-2	A
H	18.5	ES45 68/1000-2	A
I	21.8	DS25 68/1000-2	A
J	0.7	DS20E 68/833-2	A
K	1.9	AS4000 5/600-2	A
L	2.7	ES45 68/1000-2	A
M	2.3	DS25 68/1000-2	A
N	12.9	DS25 68/1000-2	A
O	11.9	DS25 68/1000-2	A
P	1.3	DS25 68/1000-2	A
Q	0.6	4705A	V
R	0.3	4705A	V
S	0.9	4705A	V
T	13.7	DS20 6/500-2	A
U	5.5	DS10 466	A
V	21.1	DS20E 6/500	A
W	6.7	DS20E 6/500	A
X	21.2	7630	V
Y	21.9	7620	V
Z	28.5	4705A	V
A1	9.7	DS25 68/1000-2	A
B1	3.9	DS25 68/1000-2	A
C1	2.5	AS1200 5/533-2	A
D1	1.7	AS1200 5/533-2	A
E1	1.8	DS10 466	A
F1	6.1	3180	V
G1	5.7	3180	V
Totals	**10.1**		
	Average		

gWLM Cost Comparison on Alpha

Today

CPU costs

ES80 system with 8 CPUs

Average Utilisation ~ **30%**

Each CPU cost ~ $12.5K

Total CPU cost ~ $100K

Database

Oracle RDBMS cost 8 * ~30K = $240K

Total costs excluding op/sys= ~ $340K

With gWLM from January 2006

CPU costs

ES80 with 4 CPUs

Average Utilisation ~ **60%**

Each CPU cost ~ $12.5K

Total CPU cost ~ $50K

Database

Oracle RDBMS cost 4 * ~30K = $120K

gWLM cost = $15K

Total costs excluding op/sys = ~ $185K

Capital Expenditure Saving of $155K (46%)

gWLM Cost Comparison on Integrity

Scenario: Need to add 2 CPUs to a 4 CPU rx7620 to cope with increasing workloads.

Today	**With gWLM from January 2006**
CPU costs Adding 2 more CPUs Average Utilisation ~ **30**% 1.5GHz Itanium 2 @ 14.5K Total CPU cost $29K	*CPU costs* No additional CPUs required Average Utilisation ~ **45%**
Operating System Enterprise OE cost $7,940 per CPU Total EOE cost $15.9K	*Operating System* No additional EOE licenses required
Database Oracle RDBMS cost 2 * ~30K = $60K	*No additonal Database licenses needed* gWLM cost = 4 * $2.5K PPL = $10K
Total additional costs including op/sys = $104.9K	**Total additional costs including op/sys = $10K**

Capital Expenditure Saving of $94.9K

Getting Started with gWLM for free

Licenses

- Obtain gWLM Loaner License (PAKs) from HP f.o.c.
  - http://h71000.www7.hp.com/openvms/integrity/integrity_gwm.html
    - BA447L3 — 30 day Integrity Loan PPL
    - BA447L6 — 60 day Integrity Loan PPL
    - BA447LS — 180 day Integrity Loan PPL

Management

- Obtain Systems Insight Manager (SIM) and Central Management Server (CMS) for HP-UX or Linux from *HP Software Depot*. **Both are free**.
  - http://h20293.www2.hp.com/portal/swdepot/displayProductsList.do?category=ISS

- OR -

- Obtain SMS and CMS for Windows XP from the OpenVMS web site f.o.c.
  - http://h71000.www7.hp.com/openvms/integrity/integrity_gwm.html

Utility Pricing

Pay Only For What You Use

Instant Capacity (iCAP) & Temporary Instant Capacity (TiCAP)

What is Instant Capacity iCAP?

Definition:

- Instant Capacity provides reserve capacity the customer can put into production quickly - without disrupting operations

Key features:

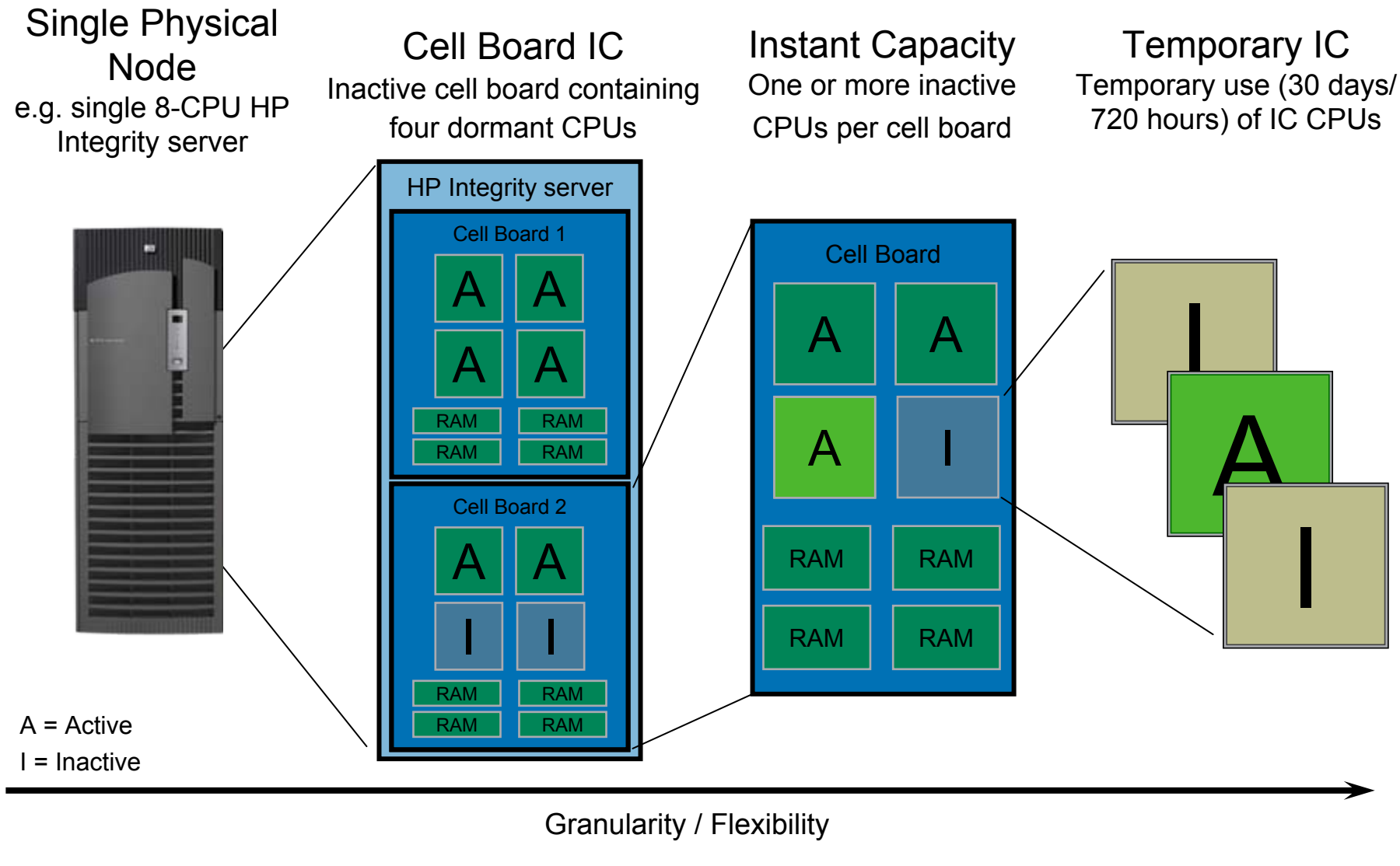
- Activate reserve capacity when needed
- Defer/avoid purchase until used
- Appropriate for purchase/capital expenditure only, not leasing
- Integrated with gWLM V1.1 that can automatically re-allocate active CPUs within hard partitions in response to workload demands
- Full corporate implementation ensures OpenVMS can share iCAP CPUs across hard partitions with HP-UX on a common Integrity system

Value proposition:

- Reduces costs and simplifies the infrastructure
- Provides a highly available pre-configured “ready-to-run” solution
- Recognizes that speed to market is critical

HP Instant Capacity for OpenVMS

All iCAP systems are configured at the factory before delivery to the customer



iCAP for OpenVMS
How does it work?

- Customer pays a one-time Component Without Usage Rights (CWUR) fee per iCAP (inactive) processor (25% of list price)
- No activation commitment
- Once extra processing capacity is required, customer simply activates the processor with the Right To Use (RTU) license and pays the enablement discounted list price for that processor: 75% of list price at the time of activation

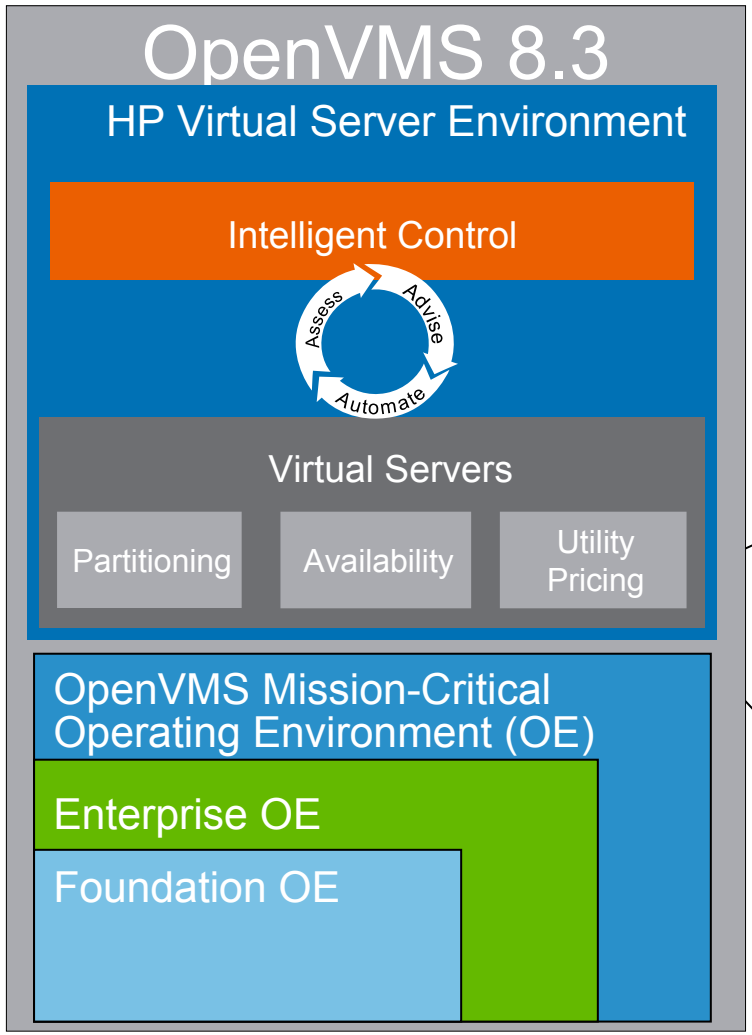
Value

- No premium pricing
- Instant processing power with a single command
- Capability to load balance partitions at no additional cost
- Dynamically move iCAP processors within a server
- Oracle now does recognize iCAP CPUs

- Supported Integrity platforms:
  - HP Integrity Superdome rx8620, rx7620
- Supported release:
  - OpenVMS V8.3

Easier access to HP Instant Capacity

New utility pricing features in OpenVMS 8.3



New

- 5 CPU-days of Instant Access Capacity provided *at no charge* with every HP Instant Capacity (iCAP) CPU so customers can
  - Get instant access to iCAP CPUs
  - Temporarily activate iCAP CPUs for performance evaluation
  - Test iCAP functionality
- No Email Requirement
  - Eliminates security issues associated with connecting mission critical systems to an external network

Operational Advantages of iCAP

- **CPU Failure –** total failure or intermittent problems
  - Turn the failing CPU off
  - This reduces the count of active CPUs by one, which is registered by the iCAP software
  - Instantly activate a healthy iCAP CPU thereby restoring the number of active CPUs to the original count

Benefits:

  - No additional costs incurred
  - Instant activation/no downtime

- Replace the failed CPU (at your leisure)

Temporary instant Capacity (TiCAP)

Temporary Instant Capacity TiCAP
How does it work?

- Works with processors, does not include cell boards or memory
- Customer orders standard iCAP processors and pays Component Without Usage Rights (CWUR) access fee
- Customer then purchases a 30-CPU day right to temporarily activate 1 or more iCAP CPU's

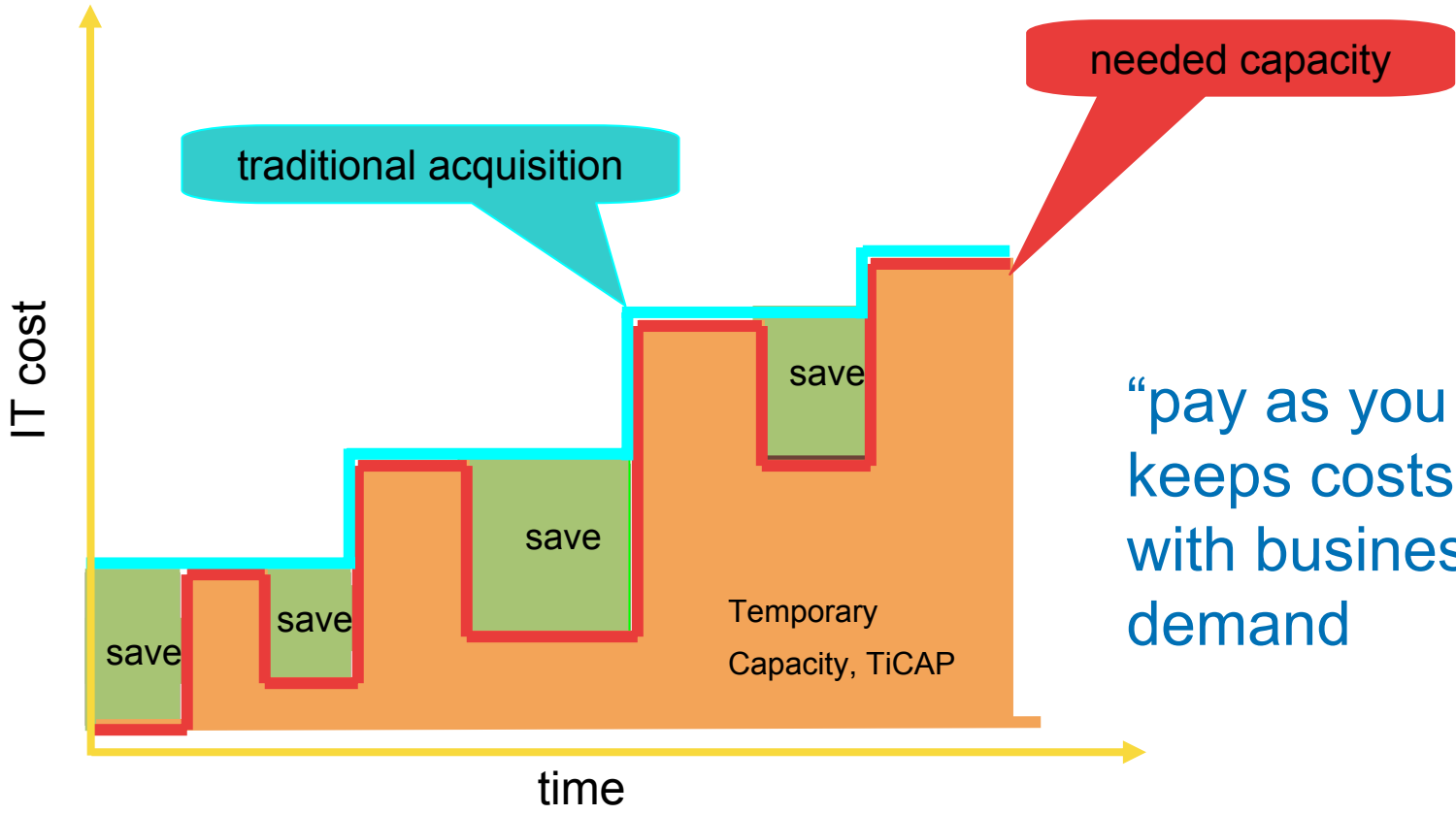
Value

- Enables the customer to temporarily activate a processor(s) for a set period of time
- No permanent activation fee is required – utilize an existing CPU at very low cost
- Accommodates those customers with unpredictable or planned processor demands

- Supported Integrity platforms:
  - HP Integrity Superdome
  - HP Integrity rx8620
  - HP Integrity rx7620
- Supported release:
  - OpenVMS V8.3

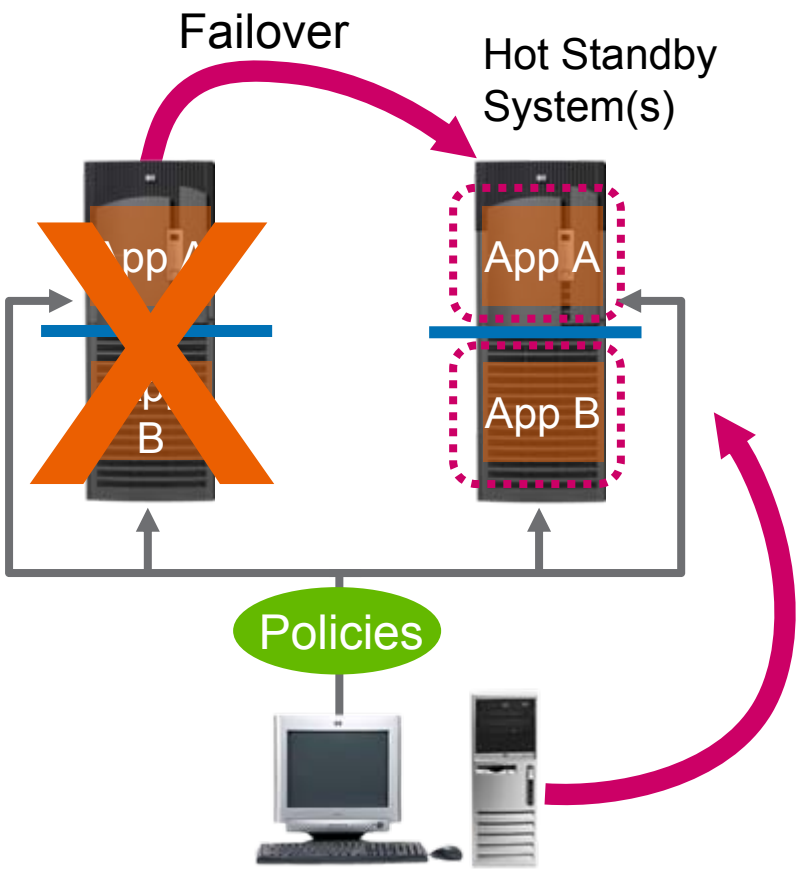
Temporary Instant Capacity TiCAP Benefits

Actively under development on OpenVMS Integrity for rx7620 and above



"pay as you go" keeps costs in line with business demand

HP Virtual Server Environment in action…



- Maintain continuous service levels…
  - Tight integration of workload management with clustering solutions (within a data center and across data centers)

…turn on iCAP CPUs only if and when needed

Re-allocate resources based on business goals and priorities

TiCAP Disaster Tolerant Cost Comparison

Scenario: Hot standby system

Today on Integrity	**With OpenVMS 8.3 Integrity**
Hot Standby system with 8 Active CPUs	Hot Standby system with one Active CPU and 7 iCAP CPUs
1.5GHz Itanium 2 @ 14.5K	1.5GHz Itanium 2 @ 14.5K
CPU costs rx7620 system with 8 CPUs	*CPU costs* One Active plus 7 iCAP
Total CPU cost $116K	$14.5K + (7 * 14.5K * 0.25) = $40K
Operating System Enterprise OE cost $7,940 per CPU Total EOE cost $63.5K	*Operating System* Enterprise OE cost $7,940 per CPU Total EOE cost $7,940K 30 CPU-day TiCAP license cost^ = $2K (includes cost of EOE on each iCAP CPU)
Total CPU and operating system costs **$179.5K**	Total CPU and operating system costs **$50K**

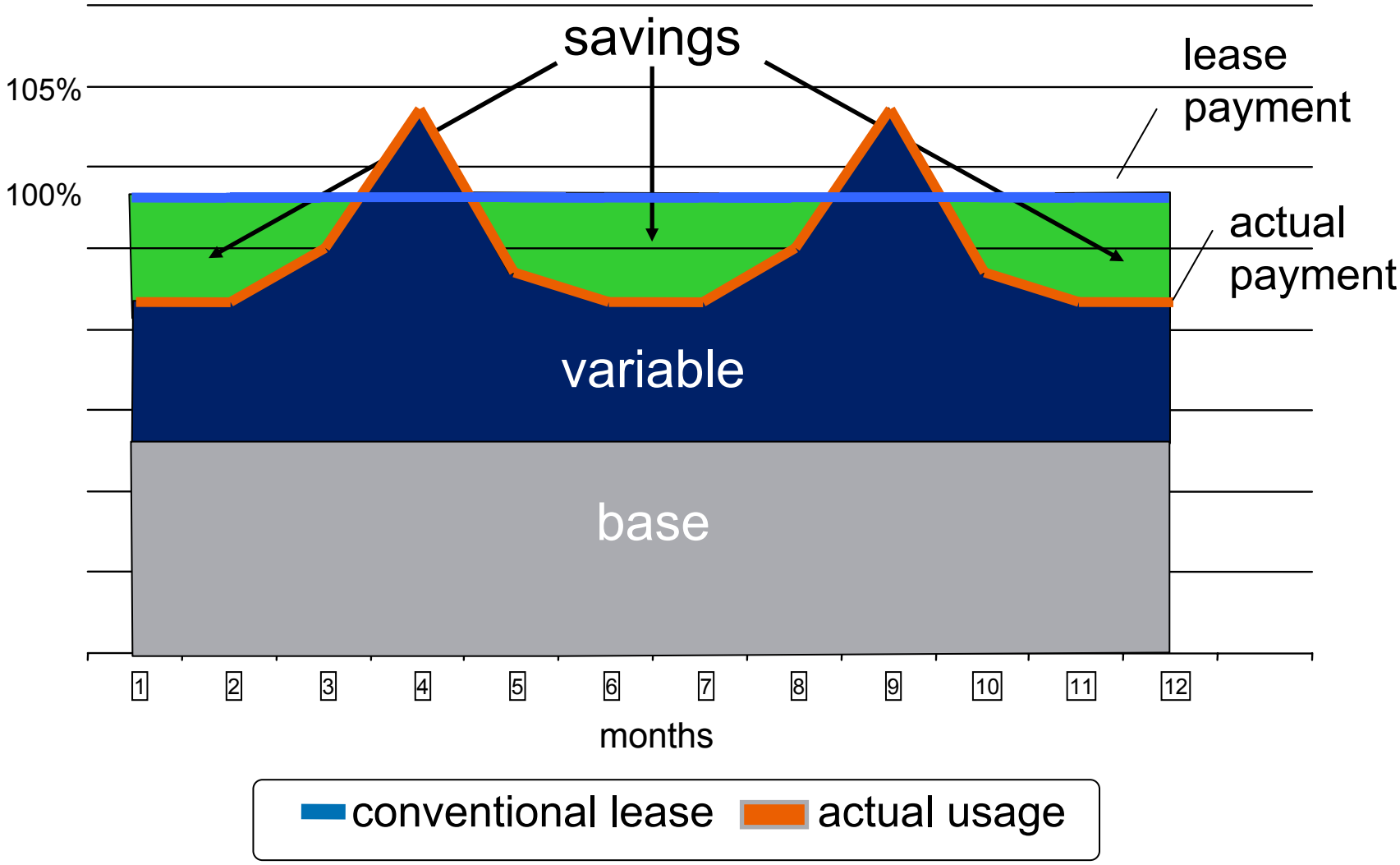
Capital Expenditure Savings of $129.5K (72%)

^More than one will be needed if greater than 4 days usage of all 7 iCAP CPUs

Pay Per Use (PPU)

Pay Per Use

Capitalizing on fluctuating demand



Utility Pricing Solutions
Pay Per Use - PPU

- PPU is relevant only for leasing
- The full corporate implementation has been ported, taking advantage of the capabilities of the separate Utility Meter for both *Active CPU* and *Percent CPU*
  - This means OpenVMS can share PPU CPUs with HP-UX and Windows64 on a common partitioned Integrity system
- Development work is complete. Planned to ship with OpenVMS 8.3

PPU on OpenVMS
Billing Methods

Active CPU

- PPU metering software on HP server
- "Active" CPUs are available for tasks by each OS
- Customers "light up" or "shut down" capacity
  - Reduces heat generation and electricity consumption (with Intel *Foxton* technology)
- Billing based on the monthly average of daily average utilization of Active CPU's
- **Lease only**

Preferred by ISVs and the method supported in the future by Oracle

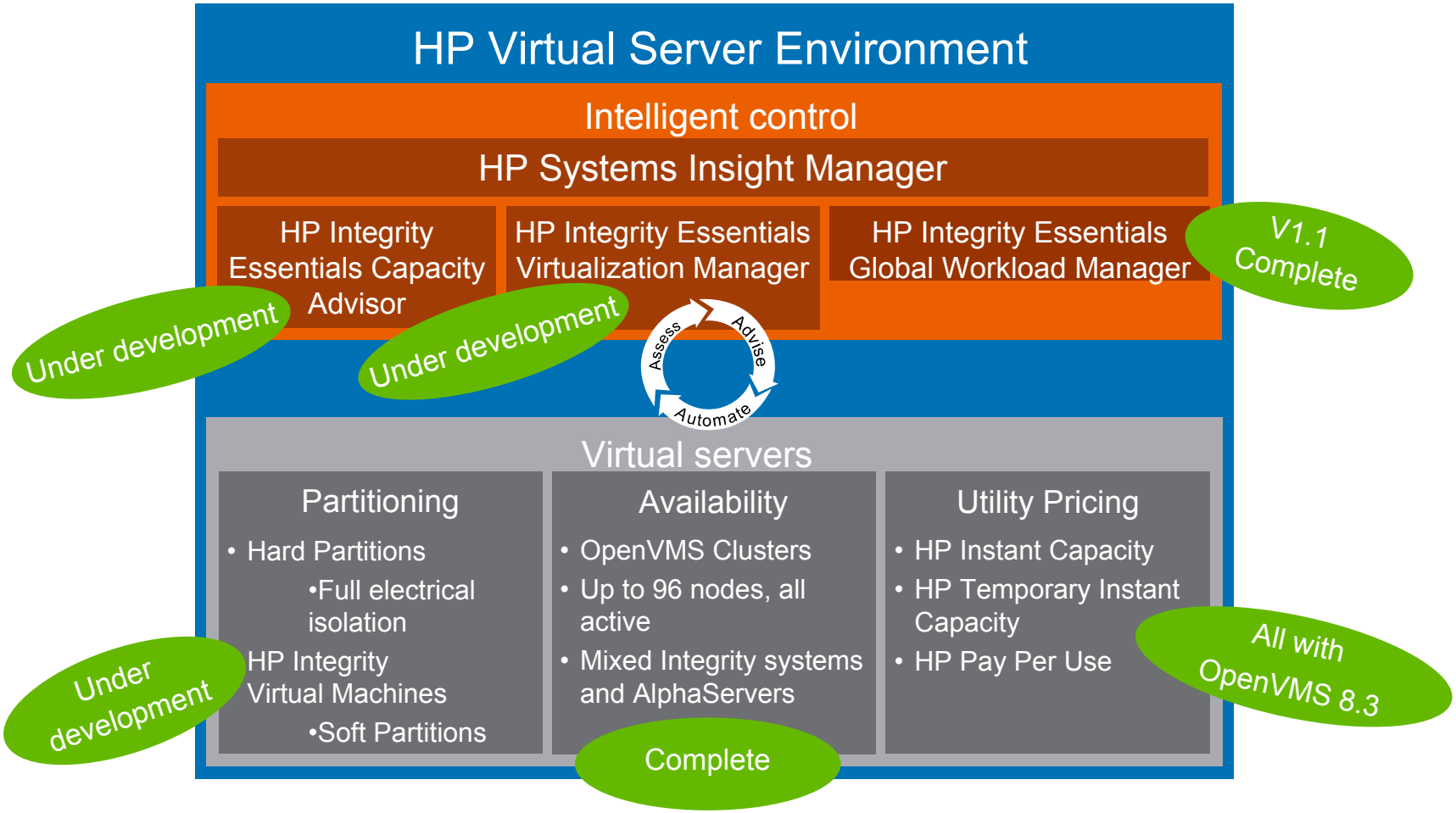
Percent CPU

- PPU metering software on HP server
- All CPUs running at all times
- Measures the % of each CPU used within a system
- Supports Soft Partitioning
- Billing based on monthly average of daily average % CPU utilization
- **Lease only**

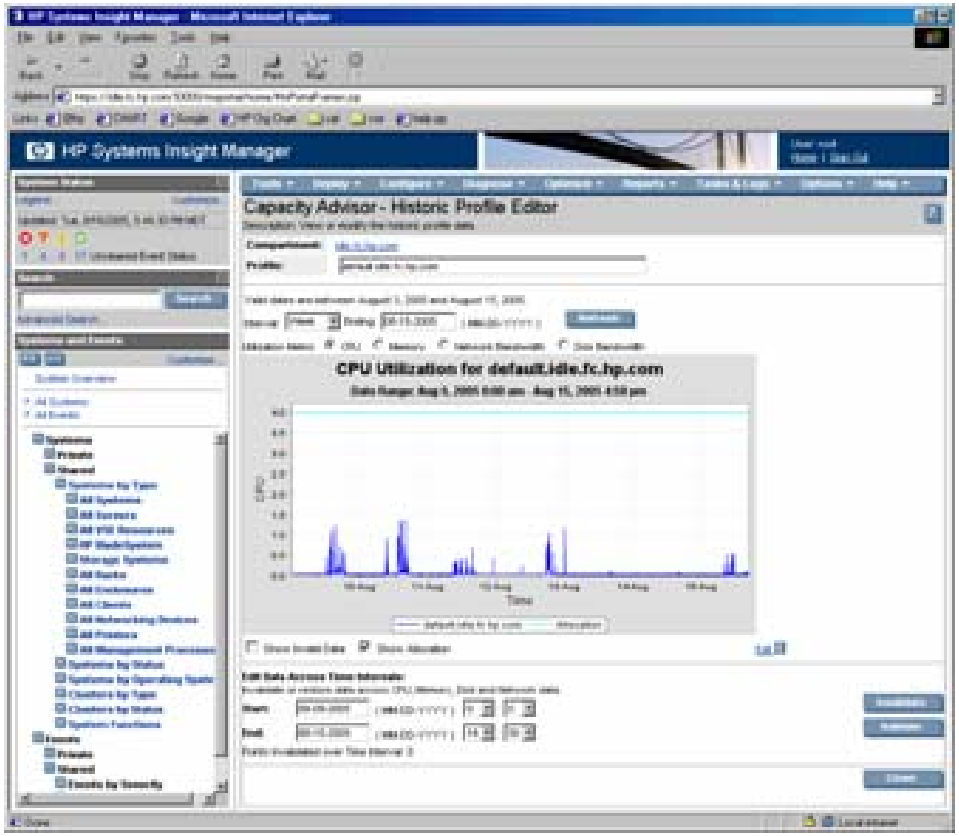
Preferred by customers as workloads are spread across all CPUs for good response

Other Corporate VSE Technologies in Development

HP Virtual Server Environment for HP OpenVMS Integrity systems

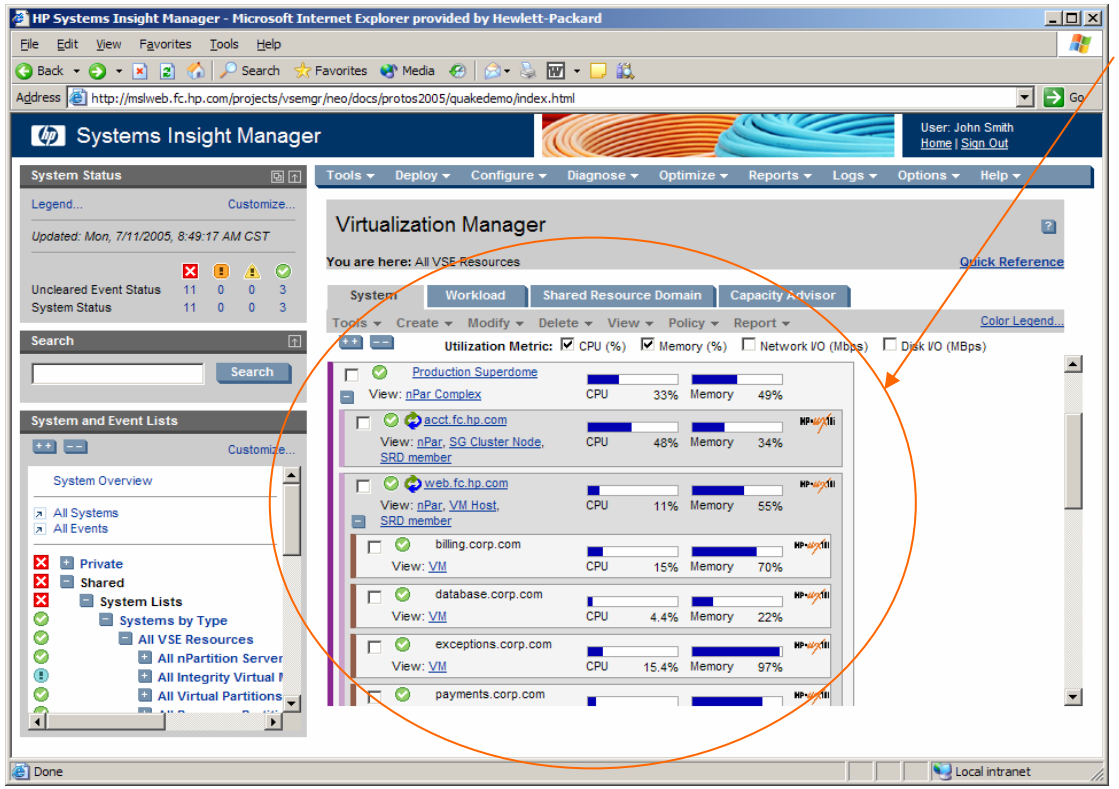


New VSE functionality:
HP Integrity Essentials **Capacity Advisor** - 2007



- **Experiment with different scenarios**
  - Fully integrated with VSE technologies to simulate major configuration changes before implementation
- **Easier to use and more accurate**
  - Designed for on-going use by general server administrators
  - Uses historic data of actual usage
    - **Determines ideal amount of resources needed for:**
      - Existing workloads
      - Planned migrations
      - New workloads
    - **Recommends placement of workloads such that**
      - Each workload has sufficient resources
      - Over-capacity is minimized

New VSE functionality:
HP Integrity Essentials **Virtualization Manager**
Visualization of OpenVMS VSE technologies - 2007



Discovery, visualization and **configuration of virtual resources / workloads** and their **utilization**

- OpenVMS Clusters
- Hard Partitions (and standalone servers)
- gWLM groups
- gWLM managed workloads: iCAP, psets and Class Scheduler
- Integrity Virtual Machines
- Utility Pricing
- Memory, Disk and Network Utilization in real-time

- Single click drill down capability

Management Server supported by Systems Insight Manager on Windows (planned 2007), HP-UX and Linux

Integrity Virtual Machines Manager: VM Host *web.fc.hp.com*

All VSE Resources >> **You are here:** web.fc.hp.com

OpenVMS[4]

General | Virtual Machines | Network | Storage

Tools | Create | Modify | Delete | View | Policy

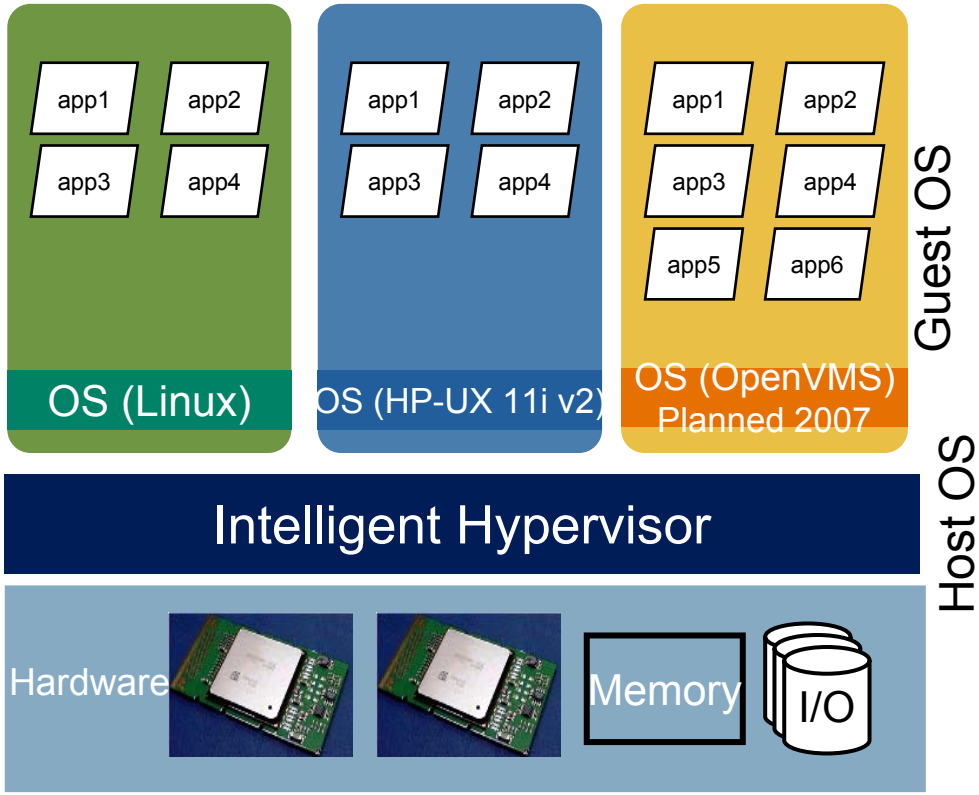
	VM Name (Hostname)	Virtual Hardware Status	OS Status	Operating System	VM CPU Utilization	Memory Utilization	Disk I/O	Network I/O	Virtual CPU Count	gWLM Policy	VM Host CPU Utilization
○	database (database.corp.com)	✓	✓	HP-UX B.11.23	46%	70% of 2GB	70.0 MBps	130.3 Mbps	4	tbd	5%
○	portal (portal.corp.com)	✓	✓	Windows XP SP2	9%	20% of 8GB	51.2 MBps	173.8 Mbps	4	tbd	2%
○	portal2 (portal2.corp.com)	✓	✓	Windows XP SP2	114%	98% of 2GB	67.1 MBps	836.5 Mbps	2	tbd	6%
○	billing (billing .corp.com)	✓	✓	HP-UX B.11.23	28%	77% of 2GB	45.6 MBps	105.1 Mbps	4	tbd	3%
○	payments (payments.corp.com)	✓	✓	HP-UX B.11.23	72%	43% of 4GB	200.2 MBps	182.1 Mbps	4	tbd	15%
○	exceptions (exceptions.corp.com)	✓	✓	HP-UX B.11.23	16%	85% of 2GB	64.9 MBps	140.2 Mbps	4	tbd	1%
○	support (support.corp.com)	▨	▨	Linux	0%	0% of 2GB	0.0 MBps	0.0 Mbps	2	none	0%

Virtualization

through

Partitioning

HP Integrity Essentials **Virtual Machines** … optimum utilization across multi-OS



Customer value – improved asset utilization - across multiple op/sys & reduced TCO

Partitioning into multiple virtual machines – more partitions than CPUs, fully virtualized CPU, I/O and memory

Fine grained partitioning & sharing - sub-CPU granularity (down to 5%), I/O device sharing and memory sharing

Dynamic resource allocation – CPU oversubscription, resource limits, dynamic CPU and I/O movement

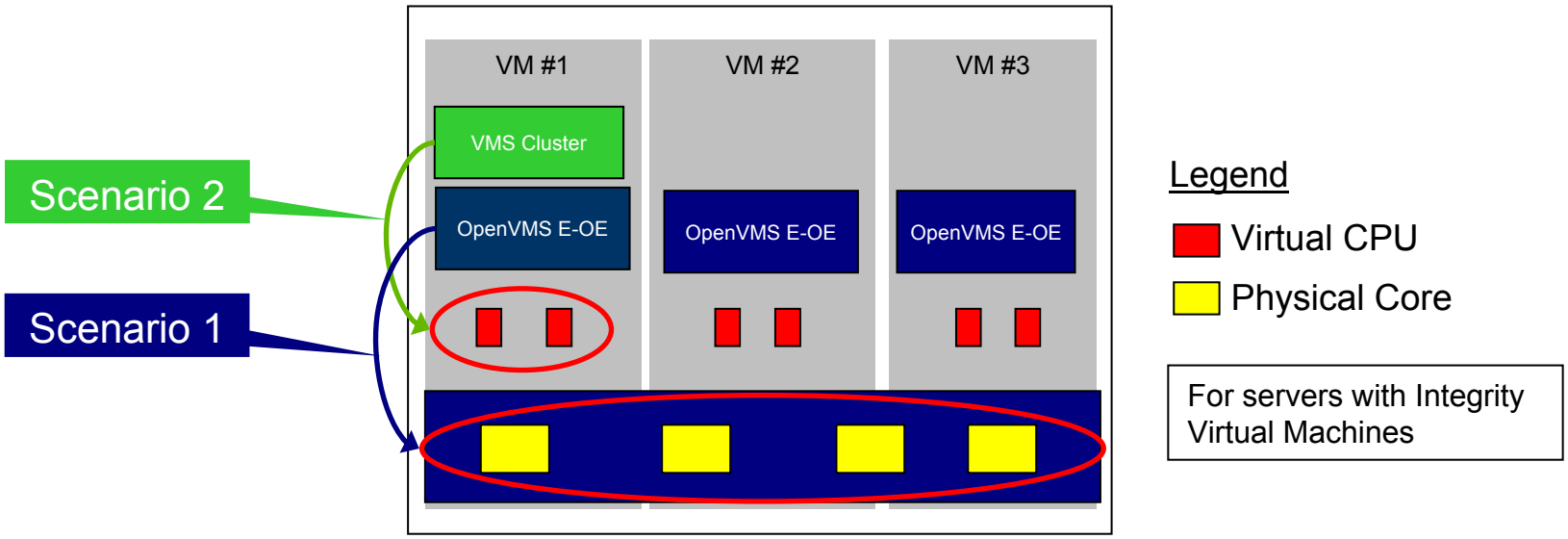
Isolation - provides OS fault and security isolation

Hardware independence – supports all - current and future - HP Integrity servers

Multi-OS support – runs un-modified HP-UX and Linux; **OpenVMS HPVM is running in the lab on Montecito prototype systems**

Virtualization Licensing Program

Reduce costs with future flexible licensing for OpenVMS software (available with Integrity VM support)



Scenario 1: as many as you want

- Run as many instances of OpenVMS Enterprise Operating Environment as you want.
- Never pay more than the physical cores in the server.
- In this scenario, pay for 4 Enterprise OE licenses.

Scenario 2: as few as you want

- Run VMS Cluster on only a portion of the server.
- Pay only for the licenses you need.
- In this scenario, pay for 2 VMS Cluster licenses.

Other Technologies under development

Further OpenVMS VSE Developments

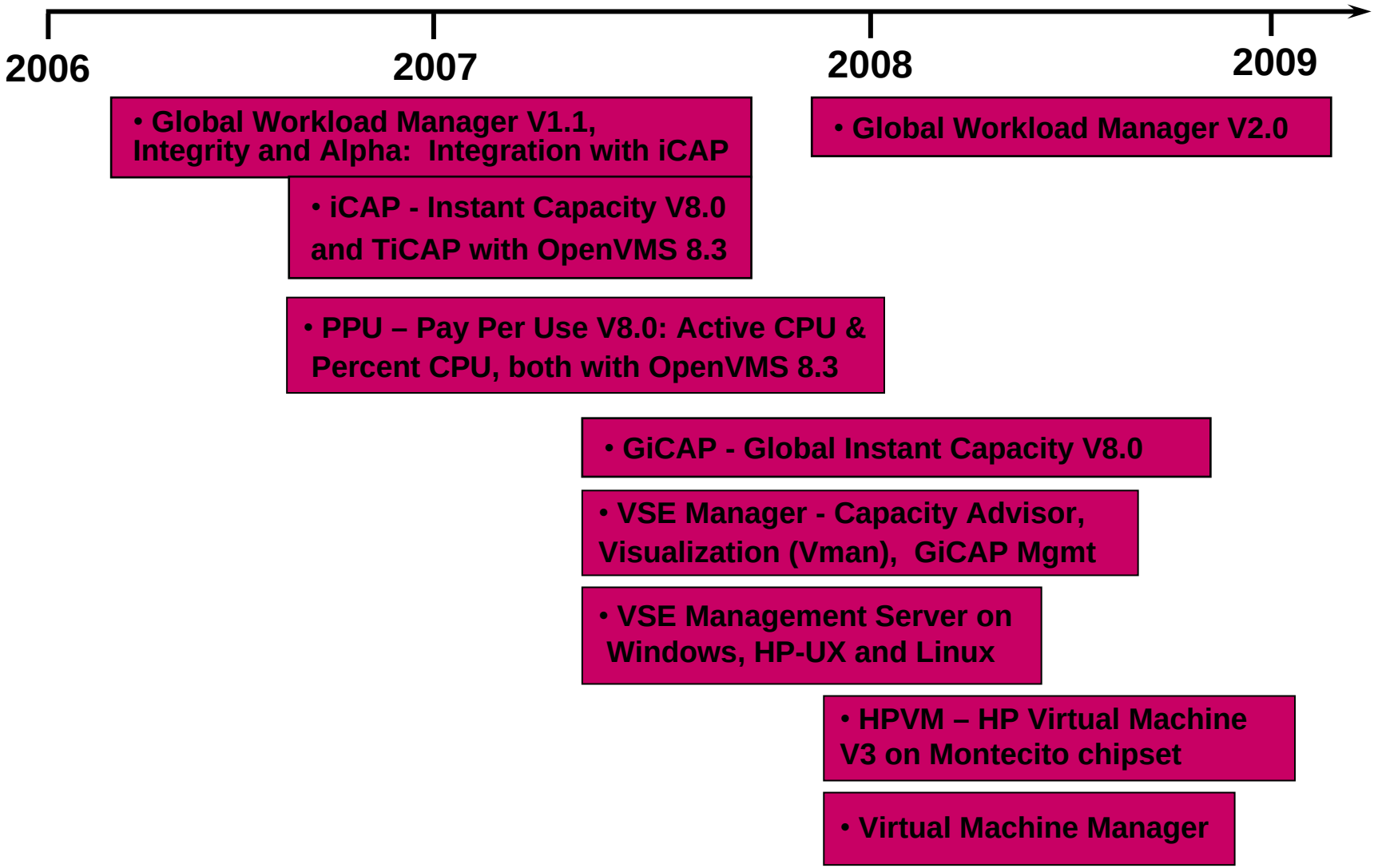
- Global iCAP (GiCAP)
  - Central management of iCAP resources enabling manual reallocation of iCAP CPUs on systems across the network to satisfy work streams of many business units
  - Latent GiCAP functionality included with OpenVMS Integrity 8.3

Future VSE Developments being studied for likely inclusion with OpenVMS in 2007

gWLM V2.0

- Integration with iCAP and VSE Manager
  - Within a system, gWLM V2 automatically reassigns idle CPUs within hard partitions if workloads demand more resources
  - gWLM V2 is cognizant of HP Integrity Virtual Machines and will manipulate workloads accordingly
  - gWLM V2 can also apply available TiCAP license units to activate iCAP CPUs to satisfy SLAs
  - gWLM V2 Management interface is integrated with VSE Manager

OpenVMS *Virtual Server Environment* Virtualization Roadmap



All implementations Integrity only unless otherwise specified

Footnote: Management of Virtualization

- Extensive and ease of management are crucial elements of all the OpenVMS Virtualization deliverables
- SIM and CMS are free downloads from the Web
- HP OpenView is not required for any of the aforementioned products
  - However OpenView can now manage significant elements of OpenVMS if required

Corporate *VLaunch* Announcements

Enhancing the HP Virtual Server Environment

"HP continues to demonstrate its leadership in delivering virtualization solutions. With this announcement, HP is delivering breakthrough integration that simplifies the management of virtualized environments and is propelling the mainstream adoption of virtualization technologies."

— Vernon Turner, Group Vice President, IDC,
September 2005

Questions?

Suggestions?

Requests?

End

Thank you