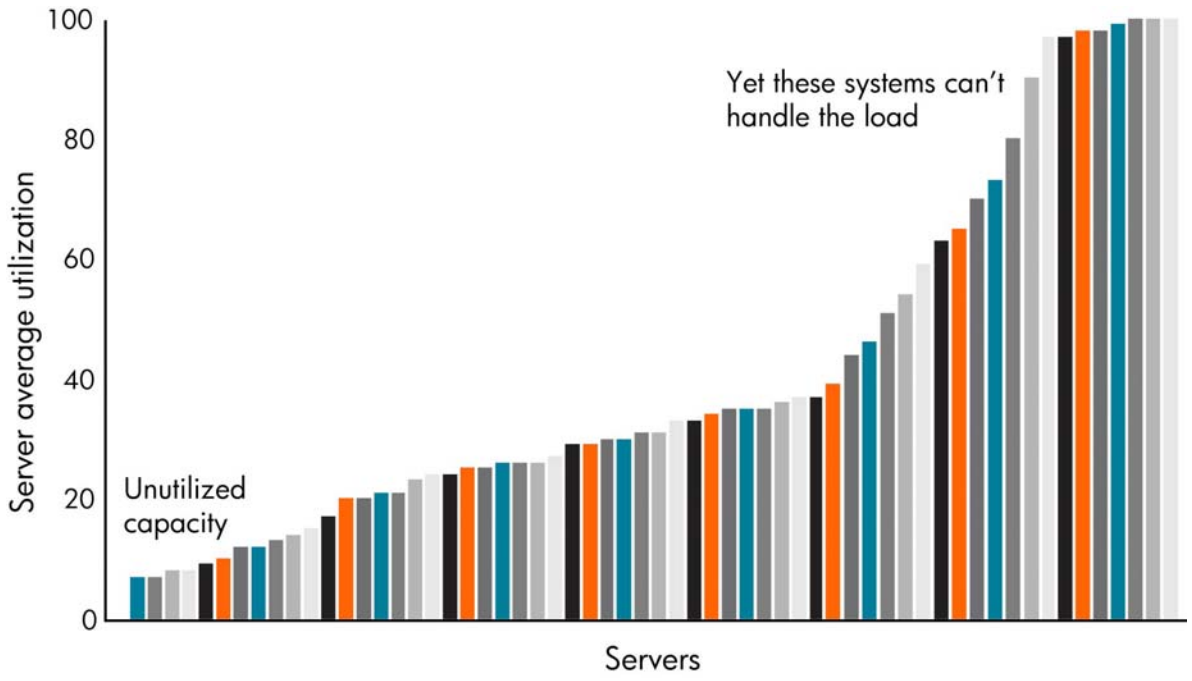
Building the next generation of IT with virtualization

Introduction

In an effort to stay ahead of the competition, companies have poured capital resources into information technology. In many cases, this has been done on a group-by-group basis, with each line of business creating its own infrastructure silo. Each silo had its own systems, servers, storage, licenses, and support teams—and each shouldered the total cost of owning and operating a standalone infrastructure.

And in most cases, that infrastructure far exceeded their routine needs. Over-provisioning to handle peak loads of three to five times average daily needs has been a standard and accepted strategy. With plenty of reserve resources in place, companies were equipped to deal with business fluctuations. Unfortunately, over-provisioning often results in a large percentage of available resources sitting unused most of the time. In fact, average utilization of non-virtualized data center resources is often cited in the 10 to 30 percent range (see figure 1).

Figure 1. Typical utilization scenario



The virtualization solution

Virtualization can help companies address the pains of over-provisioning. Virtualization has emerged as a pivotal step on the roadmap toward a "next-generation" data center architecture that enables 24x7 lights-out computing. Virtualization is an approach to IT that "pools" and shares resources so utilization is optimized and supply can flex to automatically meet demand.

In some instances, virtualization refers to pools of servers, storage, and other resources that are presented as a single, unified set of resources available for allocation and consumption. Resources from the pool are transparently accessed by users and applications, and users can trust that resources *will be* dynamically made available when needed. At the other end of the virtualization spectrum are single systems that are divided so that they can be viewed as multiple individual server instances or storage devices, without visibility to the underlying infrastructure on which they are running. Each device can support different workloads and applications. By consolidating systems in this way,

companies increase utilization of available resources and reduce the physical footprint of IT while retaining—or even improving—service levels and availability. Typical IT-wide virtualization employs both the pooling of resources and the sharing of systems.

The agility advantage

As resources are amassed, abstracted, and transformed from vertical silos into shared pools, resource utilization can be optimized, and capacity can be dynamically shifted to support resource demand. In a virtualized infrastructure, IT services are more closely connected to business demands, and internal customers can pay for what they use rather than what they might need. The long-term benefits of virtualization are clear and compelling:

- **Reduce IT costs:** By virtualizing servers, storage, networking, and other resources, businesses can reduce IT costs by consolidating and improving asset utilization. Hardware cost savings is one obvious benefit, but virtualization solutions can also lower other costs, from power and cooling to floor space. HP has found that businesses can often consolidate 6 or 10 servers onto one server. For example, the University of Utah Health Sciences Center achieved a 10:1 consolidation ratio and expects to save $2.5M over 3 years. Some enterprises have achieved 30:1 consolidation ratios. For more mission-critical environments, we've seen server utilization triple.
- **Increase IT agility:** Virtualization makes the IT environment more flexible, letting businesses speed up deployment of infrastructure and applications, keep them up and running more efficiently, and adjust their infrastructure more quickly when business demands change. For example, virtualization helped Polaris Industries streamline the process of deploying new servers from 4–6 hours down to minutes.
- **Improve the quality of IT service delivery:** By decoupling applications from infrastructure, virtualization lets enterprises more closely align IT with the needs of the business. HP has helped customers such as Hubert Burda Media use virtualization to deliver IT as a service, increasing the service levels experienced by end users by allocating more IT capacity during peak times.

With virtualization in place, IT is well-positioned to be ready for change, to achieve an adaptive infrastructure goal, and to take advantage of technologies that can *automatically* balance workloads and resource allocation based on service agreements. Virtualization coupled with automation helps increase agility and predictability, and it also cuts down on unnecessary manual, labor-intensive, and error-prone tasks.

HP solutions making the virtual real

As a means of abstracting physical resources, virtualization techniques are not new. However, rather than applying virtualization technologies in discrete areas like memory or disk storage, today's virtualization technologies can be applied to IT systems and groups of systems. This shift in focus and scale is changing the way companies think about their IT assets. Indeed, virtualization has become a fervent industry buzzword as companies race to transform IT into a flexible, service-oriented entity that is able to drive business change.

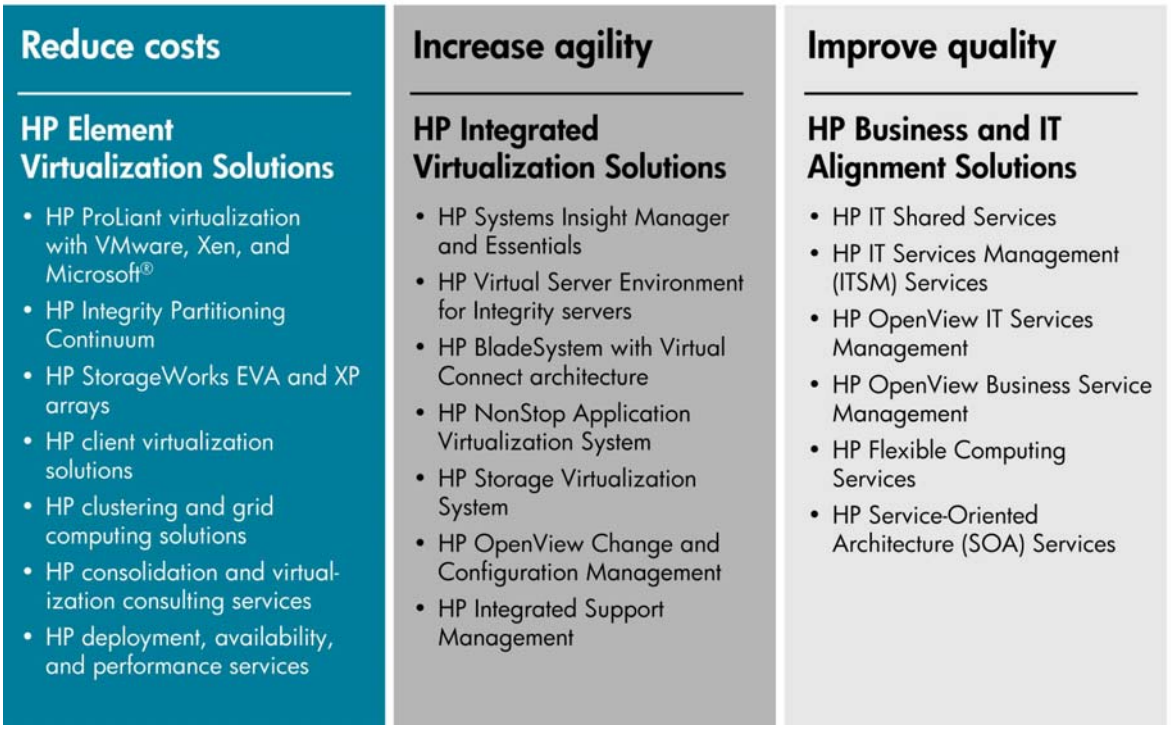
The path to a virtualized infrastructure doesn't follow the same course for every IT organization. For some, it begins with the virtualization of a single type of server or a single application. Other companies initially use virtualization to create shared resource pools of one type of resource, like storage. There are different types of technologies and solutions that companies employ as they start to embrace virtualization.

- **Element virtualization solutions** optimize the utilization of server, storage, and networking resources and enable sharing of resources from the desktop to the data center. Improving resource utilization helps reduce costs ranging from hardware to power and cooling.

- **Integrated virtualization solutions** simplify the management and automation of the virtual infrastructure. These solutions help speed up deployment and offer increased agility and the ability to quickly make changes to the infrastructure as business needs change.
- **Business and IT alignment solutions** improve the quality of IT service delivery by aligning IT supply with business demand.

HP offers a range of technologies, services, and solutions to address each phase of virtualization (see figure 2). Whether you begin with the addition of isolated assets, approach virtualization during a period of infrastructure upgrade, or have made a company-wide decision to migrate to a shared application environment, HP tools and solutions are available to help you on the journey from over-provisioned silos to pools of virtual resources.

Figure 2. HP Virtualization Solutions portfolio: making the virtual real



Virtualization considerations

One reason there is so much industry attention on virtualization is that it is relatively easy to get tangible benefits very quickly. There are obvious cost savings when a company is able to consolidate from 10 servers onto one. While virtualization brings clear benefits, sharing IT resources also requires new processes, tools, and strategies to manage this virtual infrastructure in order to reap its benefits. With intelligent, integrated, virtualization-aware tools and assets in place—and a company-wide understanding of the ways a virtual infrastructure changes business—the road to an adaptive, virtualized environment can be a smooth one.

Capacity planning

By pooling resources, virtualization reduces the need for over-capacity. Within a virtual resource pool, IT can shift resources to workloads that need them or move workloads to available resources. IT is able to think about provisioning for peak use at the level of the whole pool rather than discrete systems. Groups that were over-provisioning and over-spending for an "in-case" scenario may pay for less in a virtualized environment while still maintaining peace of mind that resources will be available in the event of a usage spike.

In a virtualized environment, capacity planning becomes more of an ongoing task rather than something that is done once at application deployment. Capacity planning experts need to estimate how much "total" compute and storage power they need to have on hand to supply *multiple groups*, where before they were able to focus on the provisioning of *individual* applications. They now also have to sort through the list of applications, processes, and service-level objectives and determine the best configuration of virtual assets. *How can we best consolidate and virtualize without hurting service levels? Which applications can coexist on the same server in virtual machines? Are policies and service-level agreements in place that establish a hierarchy of resource allocation? When the resources are pooled, is there enough to handle all applications at forecasted times of peak usage? How can IT assure the business that there will be sufficient capacity to meet critical needs? What happens if we run out?*

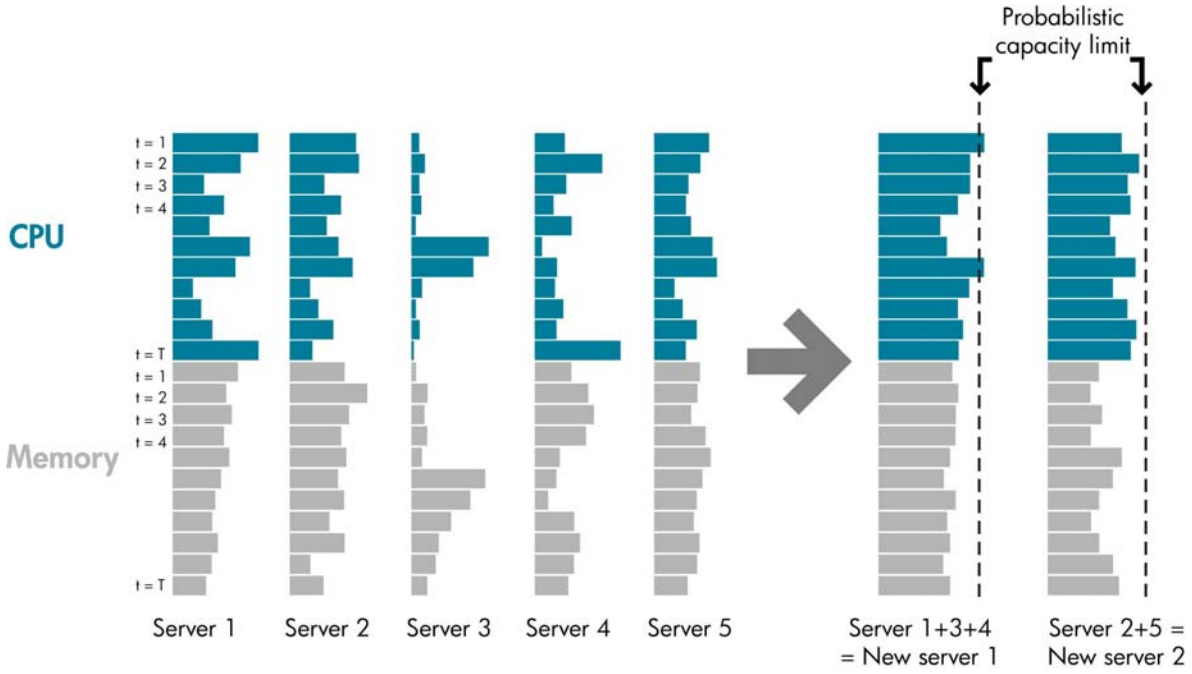
With pooled virtual resources available, everyone should feel confident that their routine resource needs are covered, potentially with clear cost savings. They also need to be assured that they can access more computing power during critical periods of peak usage. The move away from physical, dedicated assets with clear ownership to shared resource pools may require some adjustment in business and IT planning. It also necessitates solid capacity planning and a contingency plan in case additional supply is required as business demands change. This planning can help build confidence among business lines that are adapting to the idea of virtual resources.

How much do I need?

The first step with capacity planning is to understand asset utilization. Enterprises need more than just average-utilization data; they need to understand historical usage patterns. This information helps them see how they can consolidate and virtualize assets to increase utilization while ensuring that critical applications get appropriate resources during peak demand. One way HP helps customers in this phase is with HP Virtualization Assessment Services.

In a typical scenario, utilization data for servers, storage, and desktops is collected over a three-to-four-week period. There are several tools which can be used during this phase, including HP Asset and Consolidation Analysis Tools (see figure 3) and VMware Capacity Planner. This analysis phase provides a clear representation of historical use patterns that are easy to understand. HP Services professionals then make recommendations on how to best consolidate and virtualize the customer's environment, and they also provide a cost justification and sound business rationale for these projects.

Figure 3. Using analysis tools helps identify what can be consolidated and virtualized.



After initial virtualization, enterprises may want to implement an ongoing capacity-planning process to model "what if" scenarios. For example, this process can help them understand where is the best place to deploy a new workload in a server pool. One tool to assist with that is HP Integrity Essentials Capacity Advisor for HP Integrity servers. Capacity Advisor uses historical workload data to play out "what if" scenarios with projected workloads, looking at CPU and memory utilization. For example, pre-planning using Capacity Advisor can help determine which applications and workloads can be combined together on a virtual server or an instance of a virtual OS—*and which ones can't,* before virtual servers and OS images are put into motion.

Provisioning with flexible server capacity

With a virtual system of resources and assets in place, the question of "what happens if" becomes paramount. There may be times when more capacity is needed because changing market conditions, business processes, or customer demands have created an unexpected surge in demand for resources. The need for extra capacity may be temporary, or it may signal the need to permanently add resources and expand the infrastructure.

Virtualization can be made even more cost-effective when it is combined with solutions that let businesses pay for spare capacity as needed—provided that this capacity can be accessed quickly. HP Instant Capacity (iCAP) solutions place installed but inactive processors and/or servers onsite that can be activated if an overflow occurs. With versions available on many HP server lines—including HP Integrity and HP 9000 servers, HP Integrity NonStop servers, and HP BladeSystem[1]—HP Instant Capacity solutions cushion the task of capacity planning by providing resources that can be quickly activated "just in case" and paid for only when used. For HP Integrity servers, two additional solutions let you cost-effectively manage spare capacity:

- HP Temporary Instant Capacity (TiCAP) allows IT to take temporary advantage of installed iCAP processors, paying for overflow capacity in 30-day blocks of processing power. TiCAP resources can be activated and deactivated as needed.

[1] Available in U.S. only.

- HP Global Instant Capacity (GiCAP) allows hardware usage rights to be shared among servers. With GiCAP, resources can be deactivated in one system and activated in another to help cost-effectively meet changing system demands in mission-critical environments.

Flexible storage capacity

IDC believes that the worldwide disk storage systems market segment will continue to experience revenue expansion as terabyte shipments continue to increase 50%+ annually.[2] Storage environments require tools and solutions to ensure adequate capacity planning and rapid response. Storage virtualization can simplify the deployment of new storage resources as business needs grow. The HP StorageWorks family of storage products and tools works to provide an integrated platform for a virtual environment.

The HP Storage Essentials resource management software gives IT a visual look at storage usage and availability, making it easy to see when utilization and capacity thresholds are being approached and additional storage is required. To simplify storage growth when new capacity is added, the HP Enterprise Virtual Array (EVA) enables transparent, dynamic expansion of the disk pool. As disks are added, the EVA controller automatically incorporates them into the pool and into the RAID configuration and resource availability presented to the host. Taking this automated facilitation of new storage a step farther, as capacity is added, workloads are automatically balanced and redistributed across the entire pool of disks within the EVA. On a larger scale, the HP StorageWorks XP array family can aggregate multiple disk arrays into a single pool—and can even be partitioned to present multiple virtual arrays to hosts.

Similar to HP Instant Capacity for servers, HP StorageWorks Utility Ready Storage offers a safeguard against data loss and business delay. This utility-based storage solution involves additional storage that is installed but only paid for when the additional resources are put into service. In the event that capacity limits are reached and overflow capacity is needed, the additional storage can be rapidly put into service and integrated into the virtualized storage pool.

Server and storage virtualization give IT new control of, and visibility into, resource needs and utilization. As asset utilization is increased and the need to over-provision is removed, IT is in a position to realize cost savings. With HP temporary and instant capacity solutions, and the ease of adding new storage, businesses can respond rapidly to rising demand without incurring the risk of large up-front, "in-case" investment.

Management

On the one hand, virtualization streamlines and minimizes IT management tasks by reducing the number of physical machines and cables and by reducing the need to have a *person* on location actually *touching* static machines to make upgrades, deploy patches, or install new applications.

The virtual environment shifts the focus of IT from the management of many separate machines to the management of a larger, aggregated pool of virtual resources. While the number of physical servers may be fewer, the number of operating systems may proliferate, each with its own application stack and service-level agreements to manage. In addition, IT must ensure that everything works together; that resources are deployed and shifted as needed to workloads that vary throughout the days, weeks, and months; and that the entire data center is being safeguarded appropriately.

Intuitive, intelligent, integrated, tools for effective management, control, and monitoring of the virtualized environment are critical. To effectively administer and maintain the virtual environment, IT needs robust management tools that offer both total-pool and granular visibility into resource availability and utilization. They must also clearly show how the virtual resources map to the physical infrastructure.

[2] IDC, "Worldwide Disk Storage Systems 2006–2010 Forecast and Analysis: Expansion, Efficiency, and Economics Driving Growth," Doc #201596, May 2006.

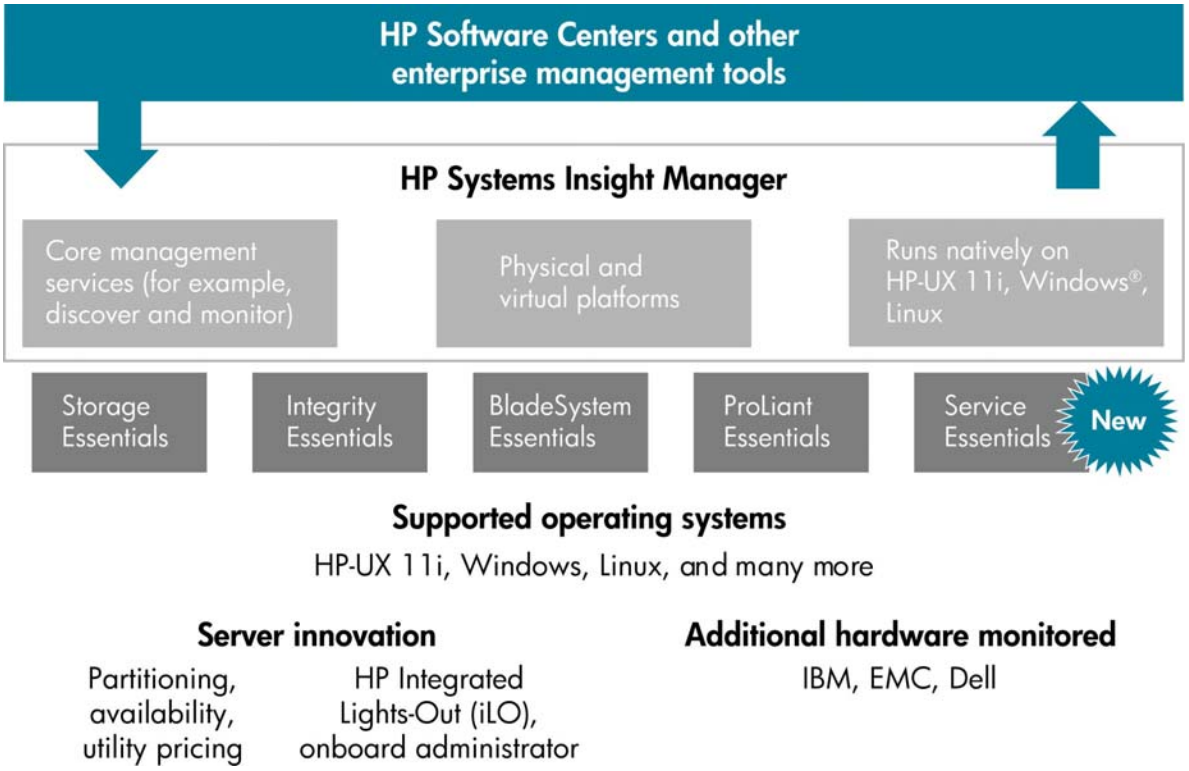
What resources are in use? Which virtual resources depend on which physical resources? How are workloads being balanced? Historically, how well have workloads and applications run when they are together on a virtual server? How are storage pools being utilized? Are service-level agreements being met? What capacity is available for peak demand? How can I easily fine-tune allocation and deployment within the virtual pool?

HP offers a powerful set of management tools designed to give IT total control of virtualized server and storage environments. With HP virtualization management tools in place, IT both manages and makes full use of the virtual infrastructure.

Simplifying management of a virtual environment

The cornerstone of HP's infrastructure management portfolio is HP Systems Insight Manager (SIM), a single, unified management console with platform-specific plug-ins to simplify the management of a virtual environment. SIM acts as a single point of control, a top-level vantage point from which the entire environment can be viewed, managed, and adjusted. SIM is easily extensible. In addition to basic management features like device discovery and identification as well as data collection and reporting, SIM supports the integration of other HP management tools that extend the functionality and offer additional virtualization-specific capabilities (see figure 4).

Figure4 . Unified infrastructure management—providing the software intelligence to build and run an adaptive infrastructure

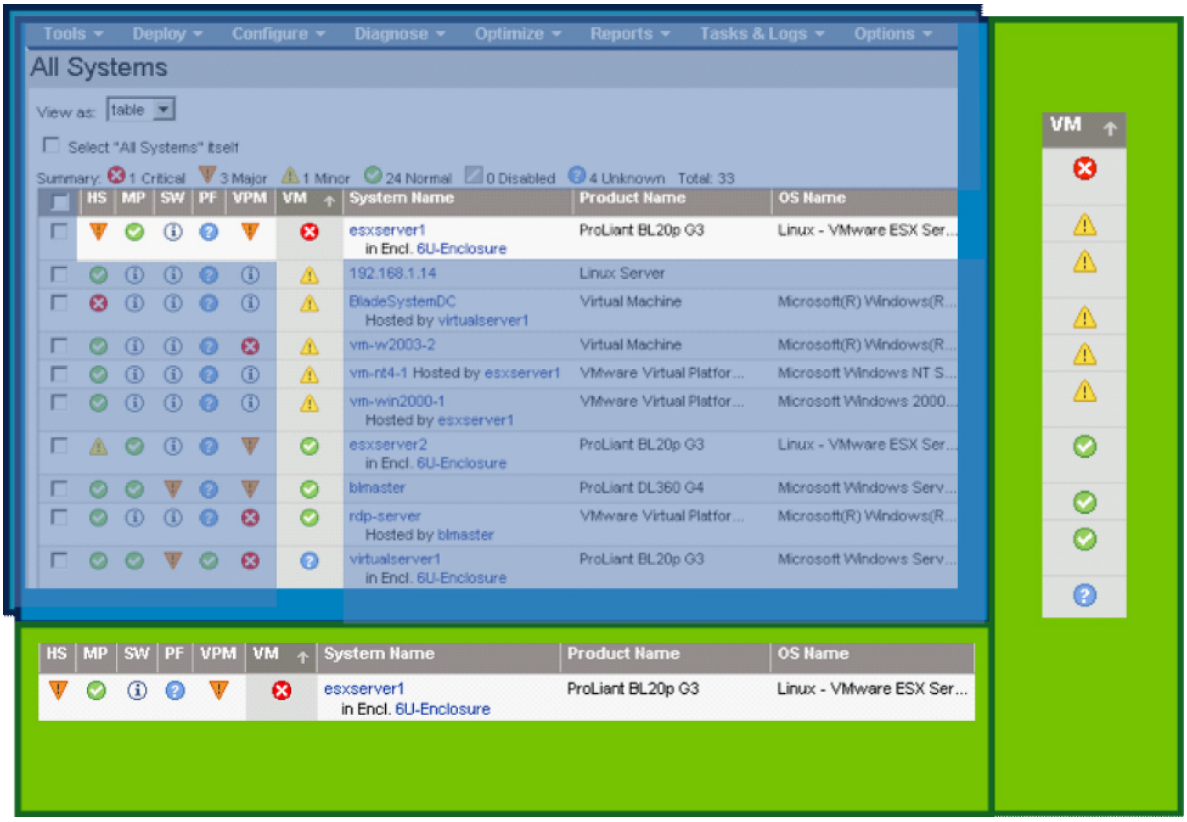


Managing virtual servers

Two plug-ins to SIM enable the visualization, configuration, and management of virtual servers. They enable systems administrators to see available virtual resources, how they are being used, and how they relate to the physical infrastructure. These plug-ins also allow seamless configuration of virtual resources in real time. As a result, you can spend less time managing your virtualized IT infrastructure—and still make data-center optimization a reality.

For HP ProLiant servers, HP offers ProLiant Essentials Virtual Machine Management Pack and ProLiant Essentials Server Migration Pack to manage and migrate data on and among heterogeneous virtual machines such as VMware and Microsoft (see figure 5). In addition, the HP ProLiant Essentials Workload Management Pack is a collection of tools that assist with resource allocation, partitioning, and the creation of policies.

Figure 5. Unified physical and virtual machine management



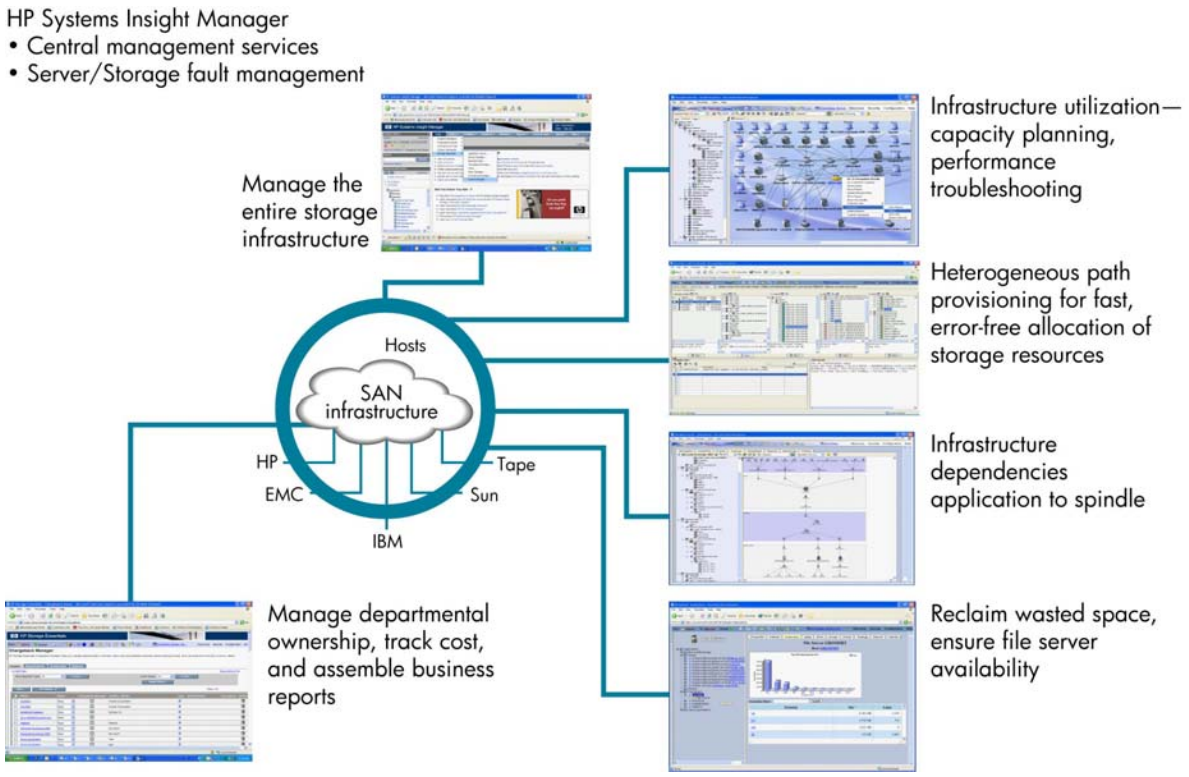
For HP Integrity and HP 9000 servers, management and visualization of all servers aggregated in the virtual pool are facilitated by the HP Integrity Essentials Virtualization Manager. Virtualization Manager reduces complexity by offering a central, unified point of control for managing *all* resources in the HP Virtual Server Environment for Integrity and HP 9000 servers. It enables the visual configuration of both physical and virtual servers.

Managing storage virtualization

For storage, too, virtualization involves the encapsulation of disparate and potentially heterogeneous storage components into a single pool that can be maintained, administered, and accessed as a single virtual entity. A storage pool may contain various storage arrays—even from different vendors—each with its own management tools. A management solution that enables top-level administration of the entire virtualized storage infrastructure is critical.

Offering a single point of contact for provisioning and monitoring storage resources, HP Storage Essentials provides resource management for all network storage in the virtualized pool and includes tools to monitor, configure, and manage aspects of the unified storage pool, including provisioning, chargeback, visibility into availability and performance, and reporting—including custom reports (see figure 6).

Figure 6. HP Storage Essentials—integrated heterogeneous storage resource and SAN management



The approach to virtualization employed by the StorageWorks family further eases management of virtualized storage assets. For example, HP StorageWorks XP arrays and SVS200 systems pool the total available capacity, simplifying the management of the resources to a single interface through which an administrator can manage the arrays. This enables storage systems to be viewed and managed as a single entity regardless of how many physically distinct RAIDs or disk drives are connected—even if some attached systems are from different vendors.

Simplifying infrastructure change

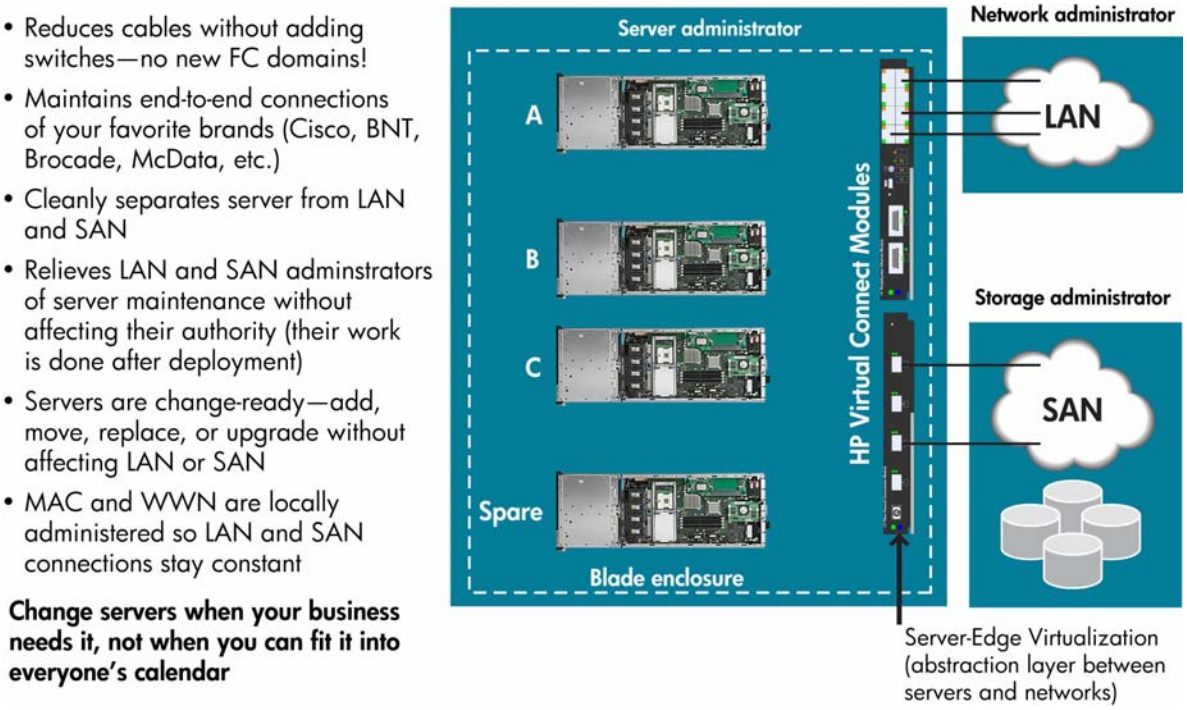
Part of the promise of virtualization technologies is a reduction in the need for an onsite person to physically perform certain routine IT tasks. Ideally, in a virtualized environment, IT is approaching a state where the system is infrastructure-aware and can process and facilitate certain routine tasks, including deployment and configuration. Indeed, tools and technologies that offer IT the ability to easily and rapidly—and remotely—change the configuration of the infrastructure, either at the level of a single virtual server or an entire cluster, are critical to enabling IT to effectively control and adjust the virtualized environment.

HP offers several capabilities that assist IT departments as they strive to simplify their ability to make changes in their IT infrastructure:

- **HP Virtual Connect** for HP BladeSystem c-Class environments virtualizes the connections between server blades and storage and network resources, simplifying administration. It can define a server connection profile for each server bay before a server is installed. This profile establishes the Media Access Control (MAC) addresses for all Network Interface Controllers (NICs), the World Wide Names (WWNs) for all Host Bus Adapters (HBAs), and the SAN boot parameters; and then it holds them constant so that even if the server is changed, the configuration and connection profile stay constant. Virtual Connect decouples servers and the network so that changes in the server

infrastructure and in the LAN and SAN environments don't require coordination among multiple data-center teams for every task (see figure 7).

Figure 7. Virtual Connect makes IT change-ready.



- The **Integrated Lights-Out (iLO)** management processor for HP ProLiant, Integrity, and HP 9000 servers is an autonomous management subsystem embedded directly on the server. iLO provides system administrators which secure remote management capabilities regardless of server status or location.

Enabling automation

Creating an infrastructure that facilitates more and more automatic response to changing workloads and service-level objectives is part of the promise of virtualization. In a virtualized environment, automation technologies bring new levels of system-initiated and system-deployed management, offering both increased efficiency and reliability for 24x7 services. But trusting software-based toolsets to handle allocation, deployment, and even the configuration and assimilation of new assets added to the virtual pool requires strong, intelligent tools that can sit atop the infrastructure and manage the virtualized resources based on defined business policies and objectives.

The need to use automation to preserve service levels is most important in mission-critical environments, where the ability of IT infrastructure to handle its workload can have a direct impact on business results—for example, the ability to take orders, manage a global supply chain, or provide critical customer support information. For HP Integrity and HP 9000 servers, the HP Virtual Server Environment (VSE) is central to automating the virtualized infrastructure. The HP VSE provides a set of virtual servers that can automatically grow and shrink as business needs change. In particular, the VSE offers automated, goal-based policy engines such as HP Integrity Essentials Global Workload Manager (gWLM) that provide the intelligent control of virtual resources.

Automating VSE workloads: a more detailed look at gWLM

HP gWLM handles the allocation and optimization of virtualized resources based on service-level objectives. It can proactively move resources around, within, and across virtual servers in response to workload requirements and the hierarchy of business objectives. Based on the service-level objectives that IT can set, gWLM will allocate resources by dynamically adjusting the "knobs" of the virtualized infrastructure to help facilitate the adherence to and successful meeting of defined targets. gWLM provides the following capabilities:

- Managing the real-time resource allocation of many soft partitions (HP Virtual Partitions—vPars, HP Integrity Virtual Machines, or Secure Resource Partitions)
- Shifting Instant Capacity licenses between HP Hard Partitions (nPars) or servers based on business priorities, or resizing servers based on demand by activating or deactivating Temporary Instant Capacity
- Synchronizing resource management policies to re-allocate server resources in case of a failover

HP gWLM is ideal for a large-scale deployment with multiple servers. A typical example is a shared IT deployment, where a single IT department manages servers for multiple business units and many applications run on a large number of servers—each with several partitions. HP gWLM's ease-of-use features include centralized policy administration and pre-defined policies and reporting features to enable IT to easily set up, manage, and track resource usage. These benefits also make gWLM a suitable solution for many common types of IT environments, where fine-tuned policies and specialized resource management are not applicable.

Data assurance and availability

Data assurance and protection of critical data against loss or system failure is of increased importance in a virtualized environment where physical systems may be running closer to capacity (due to optimized resource utilization) and where multiple business applications may be sharing physical systems (where previously they may have occupied single systems).

What about availability—do I put more of my business at risk in case of a failure in a virtualized environment? How do I manage this?

Because virtualization and consolidation strategies typically reduce the number of physical assets, safeguarding those assets becomes even more important. A failed system can bring down not just one project, but many. Ensuring that data is safeguarded, that resources will be available when needed, and that in the event of failure, measures are in place to automatically and transparently shift resources and re-deploy is a central consideration in the design and architecture of a virtualized IT environment. Virtualization also creates the opportunity to provide more cost-effective disaster recovery to classes of applications that might previously have gone unprotected.

Throughout its portfolio, HP virtualization technologies help provide contingency, backup, and failover planning—just in case. Some of these solution features include:

- HP supports VMware's VMotion, which speeds up data migration between servers, allowing the live migration of an entire running virtual machine from one server to another with zero downtime. VMotion allows hardware maintenance to be conducted without disruption of business processes, and virtual machines can be immediately relocated in the event of a failing server.
- With Virtual Connect modules, I/O connectivity for four enclosures can be grouped and managed as a whole, and a single server can become the backup for 63 other servers for streamlined failover protection and replacement on HP BladeSystem c-Class systems.
- The HP Virtual Server Environment (VSE) for Integrity servers helps safeguard mission-critical applications with HP Serviceguard, software that ensures application availability and provides automatic failover workloads, automatically moving virtual machines between servers in the event of a system or component failure. In the event of a failure, the VSE can reassign server resources to the highest priority applications.

- EVA RAID 5 (vRAID 5) can sustain up to two disk failures, offering added protection against data loss.
- The SVS200 and XP inter-array mirroring protect virtualized storage against loss from an entire subsystem failure.
- HP StorageWorks Continuous Access and HP StorageWorks Business Copy software for EVA and XP help prevent against loss and help assure data is available when needed.
- HP's Information Lifecycle Management (HP ILM) tools help manage the utilization of networked storage and help support defined business policies. An increased focus on policies helps refine storage utilization so that assets are provisioned, tracked, and retrieved appropriately regardless of physical location.

Security and compliance

Security issues in a virtualized data center are different from traditional security concerns. A virtualized data center may have fewer physical machines and assets to contend with. Moreover, robust workload, tracking, and reporting tools give IT a window through which to audit and evaluate processes and utilization in terms of compliance and governance. On the flip side, there may be more server instances, numerous system images, and a proliferation of entry points into the virtualized pool. In addition, concerns raised by the realities of pooled rather than siloed assets and data streams emerge as issues of *data sensitivity*.

Can Workload A and Workload B share a virtual server? Can they reside on the same server on separate partitions? Or, for security and compliance reasons, are there applications that need to be treated separated, quarantined off from other applications?

These are not strictly questions IT must consider in configuring and securing workloads and data within a virtual environment. They are also *business* issues that have to be addressed—and clearly defined with processes and policies—when evaluating matters of security and compliance as vertical silos are collapsed and replaced with horizontal pools of resources.

Several technologies exist to manage and protect the security of virtual servers. For example, hard partitioning such as HP nPartitions for HP Integrity and HP 9000 servers provides the electrical isolation of physical systems in a consolidated environment. Using virtual machines like VMware or Integrity Virtual Machines means that applications in those machines cannot communicate with other applications on the server without going through standard networking, which can be secured in the same way as in physical environments. Finally, to stack multiple applications within a single OS image, technologies like HP Secure Resource Partitions (SRP) for HP-UX 11i can ensure that processes running on one SRP have no contact with processes running on other partitions, so applications within a SRP are afforded extra containment and security.

Additional tools can add layers of security to virtual environments. For example, for HP ProLiant servers, HP Vulnerability and Patch Management can be used to apply security updates to virtual machines as well as physical servers.

Software licensing

Another potential area for consideration in a virtualized environment is software licensing. When single physical systems are provisioned and presented as multiple systems, and virtual systems usage is variable, historical licensing agreements and assumptions can change. Virtualization does not impact traditional user-based software licensing models. However, for applications which license based on infrastructure attributes like the number of CPUs, virtualization projects need to take software licensing into account. Depending on the specifics, this impact may be positive or negative, as the following examples illustrate.

- Software licensing costs can increase when an application that was hosted on a 1-processor server is moved to a virtual machine running on a 4-processor server.

- Software licensing costs can decrease if the same application is running on 10 1-processor servers and can be consolidated into 10 virtual machines running on one 4-processor server.

Careful analysis of the virtual environment is essential.

While some application providers have begun re-evaluating licensing arrangements and pricing to take into account virtualized infrastructures, change is happening slowly. HP is among the companies stepping forward with alternative licensing agreements and pricing and is spearheading change with virtualization-aware licensing programs for some of its products. For example, the HP-UX 11i Virtualization Licensing Program allows the licensing of software based either on the number of physical CPUs in a system or on the number of virtual CPUs running the software.

Putting it all together

Virtualization is a broad area, and enterprises often wonder if all of the components in a virtualization solution will work together—*and* work well with the applications that run on them. One way HP is addressing this concern is with the HP Virtual Server Environment Reference Architectures for HP-UX 11i. These are documented best practices for VSE and key applications such as Oracle® RAC, BEA, SAP and more. Filled with white papers, cookbooks, scripts, and configuration files, these reference architectures dramatically reduce the design and deployment complexity of virtualization projects with mission-critical applications (see figure 8).

Figure 8. VSE Reference Architectures for HP-UX 11i

Applications	Versions Application / Database / HP-UX / Server	White paper (WP), cookbook (CB) availability	Tested VSE offerings
bea ORACLE	• 7.0 / 9*i* / 11i v1 / rp7400	WP, CB	PRM, WLM, Serviceguard
	• 7.0 / 9*i* / 11i v1 / Superdome	WP, CB	nPars, PRM, WLM, Serviceguard
	• 8.1 / 9*i* RAC / 11i v1, v2 / Superdome, rx5670	WP, CB	nPars, vPars, PRM, WLM, SGeRAC
	• 8.1 / 10*g* RAC / 11i v2 / rx7620, rx8620	WP	vPars, WLM, SGeRAC, TiCAP
WebSphere. ORACLE	• 5.1 / 9*i* & 10*g* / 11i v2 / rp8420, rp8400	WP	nPars, Serviceguard
	• 6.0 / 10*g* R1 / 11i v2 / rx7620	WP	vPars, gWLM, Serviceguard
SAP ORACLE	• 4.7 / 9*i* / 11i v2 / rx8620	WP	vPars, WLM, Serviceguard, SGeSAP
sas ORACLE	• 9.1 / 9*i* / 11i v2 / rx8620 New	WP	vPars, WLM
ORACLE	• 10*g* RAC / 11i v2 / rx8620 New	WP	vPars, gWLM, Serviceguard CFS for RAC

Transforming the "whole" business

Virtualization is implemented in the data center, but it can impact many different facets of how IT teams interact with their business counterparts. It enables IT to move to a shared-services model and, ultimately, to a model where IT is offered and billed as a service. As companies take these steps, they need to evaluate and adjust company-wide practices, processes, and assumptions in order to reap the rewards of virtualization.

To take full advantage of the possibilities that virtualization brings, companies have to devote time to assessing how their standard IT processes need to be changed to operate in the new, virtualized, model. Business units need to come together and begin conversations regarding the development of service-level agreements and policies and to tackle questions about data cohabitation—can our applications run side by side or reside on the same slice of a virtual server? IT-centric processes like change and configuration management must be evaluated and adapted. Processes by which IT communicates and interacts with business partners to get service requirements and deliver services may require change.

As processes are standardized, streamlined, and simplified, and as virtualization sets the stage for the adoption of powerful automation technologies that bring new levels of intelligence and independence to routine operations, traditional manual tasks either change or disappear. And taking advantage of the more abstracted and powerful view of an infrastructure *as a whole* requires new training. On all fronts, virtualization and the transformation of businesses to the shared-services model brings change to the people of a company, and change of this sort is often met with resistance, skepticism, and mistrust.

In addition to a broad range of technologies, HP Services offers expertise that can help businesses prepare to meet the unique challenges posed by virtualization, providing support and training to make the transition a smooth one. HP Services can help companies design, implement, and administer virtualization solutions that help achieve specific business objectives with a goal of improving resource utilization and increasing business agility.

Conclusion

Virtualization is a catalyst on the road to a next-generation data center, and the promise of virtualization and the benefits a virtualized IT are many—from clear cost savings to improved business responsiveness.

Approaching virtualization begins with a move away from business-specific over-provisioned resource silos toward the creation of adaptive pools of resources that can support multiple groups and processes. Initial steps involve simplifying and unifying the underlying infrastructure through consolidation and the employment of virtualization technologies and by creating a flexible IT environment that will be highly utilized. Next steps involve managing virtual systems rather than physical systems. Finally, as IT becomes more adaptive, the link between supply and demand is automated, infrastructure is dynamically aligned with workloads, and IT can be managed and delivered as a service.

HP understands the need for tools and technologies that help companies effectively assess, manage, and safeguard virtualized environments. HP can also help you adapt your processes to the new possibilities virtualization presents. HP offers a strong portfolio of hardware, software, and services designed to keep you moving on the road to a more adaptive infrastructure.

With a virtualized infrastructure, IT can realize the promise of virtualization; do more with less—with greater agility—while delivering a higher level of service to the business.

For more information

- HP Virtualization
  http://h71028.www7.hp.com/enterprise/cache/454414-0-0-0-121.html?jumpid=/go/virtualization
- Virtualization brochure
  http://h71028.www7.hp.com/ERC/downloads/5983-0462EN.pdf
- Virtualization Business white paper
  http://h71028.www7.hp.com/ERC/downloads/4AA1-0040ENW.pdf
- "HP StorageWorks Virtualization White Paper"
  [http://h71028.www7.hp.com/ERC/downloads/4AA0-7358ENW.pdf]
- HP Virtual Server Environment
  http://h71028.www7.hp.com/enterprise/cache/258398-0-0-0-121.html
- HP and VMware
  www.hp.com/go/vmware
  http://h71019.www7.hp.com/ActiveAnswers/cache/71088-0-0-0-121.html
- HP Adaptive Infrastructure
  http://h71028.www7.hp.com/enterprise/cache/342611-0-0-0-121.html?jumpid=reg_R1002_USEN

4AA1-1335ENW, March 2007