Squeeze more power from virtualization.

Manage it smarter.
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Capitalizing on the power of virtualization

Few technologies in recent years have captured the attention of businesses and IT organizations like virtualization—and with good reason. By enabling IT to pool and share underutilized technology assets to meet business demand on the fly, virtualization has helped reduce IT costs and increase business agility. As the challenging economic environment continues to put companies under extreme pressure to do more with less, virtualization technologies are particularly suited to the times.

To understand the benefits and challenges of virtualization better, it is instructive to review its evolution. Like many emerging technologies, virtualization first demonstrated its effectiveness in lab environments focused primarily on testing and development. Here, virtualization helped improve server utilization and gave teams greater speed and agility when it came to setting up lab environments. Based on these benefits, enterprises are now extending virtualization into mission-critical production environments that support customer-facing business services and other core business processes.

But like most promising new technologies, virtualization has its dark side. Production environments are far more complex—and herein lies the challenge for IT organizations traveling down the virtualization road. The typical IT infrastructure for a production environment involves a staggering amount of relationships and dependencies among IT elements that often extend across distributed networks. To support critical business services in this context, production environments must meet a series of requirements, including high availability, redundancy protection, data persistence, integration across a wide range of applications, and links to other business processes.

With the introduction of virtualization technology into production environments, IT is finding it increasingly difficult to meet these requirements. One of the benefits of the technology, of course, is the ease and speed with which new virtual machines can be provisioned to meet rising demand. But as IT is now finding out, this advantage comes at the cost of increasing infrastructure complexity. Enterprises need to manage this increasing complexity in order to realize the full potential of virtualization in the production world. Otherwise, they run the risk of trading capital expenditure savings for operational costs.

Executive summary

Mixed results: virtualization in real-world environments

Given this reality, the results regarding the business experience with virtualization have been mixed. According to a study conducted by Enterprise Management Associates (EMA) in 2009, only 30 percent of companies are completely satisfied with their deployments of virtualization technology. Part of the problem has to do with diversity and difficulties in maintaining IT control in the face of increasing infrastructure complexity. Consider the following findings from the same study:

- Seventy-nine percent of organizations deploy virtualization technology in heterogeneous environments—with each organization using an average of 11 different platforms, technologies, and vendors for management purposes.
- Fifty percent of enterprises use only the management tools provided by the vendor for each virtualization tool in their environment.
- Sixty-seven percent of organizations maintain multiple departments for delivery and support functions.
- Thirty-four percent of enterprises report a lack of internal skills required to manage virtualization adequately.
- Forty percent of organizations say they do not have the resources to implement virtualization or expand existing implementations.

Pressing as these problems are, they are almost overshadowed by another phenomenon—new technologies tend to be deployed and managed in silos. Like client/server, enterprise resource planning (ERP), Web services, and other innovations before it, virtualization in many companies isn't even managed as part of the whole IT framework.

- Forty percent of today's mission-critical applications are virtualized.
- Forty-nine percent of IT executives name virtualization as their number one priority and a total of 92 percent put it in their top five.
- Sixty-seven percent of respondents believe that virtualization has increased complexity in their data centers, up from 47 percent in 2008.
- Forty-six percent of respondents believe that virtualization has put the performance and availability of their business applications at risk.

Source: CIO/IDG global survey, 2009

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Each virtualization project (and most companies have more than one) is often managed in a silo by the group in charge of implementing it. Even though its effects span all tiers and vendor systems. Instead, IT operations should manage each virtualization project in conjunction with the physical infrastructure. Otherwise, the result could be too many element managers, fragmented tools, and not enough highly skilled virtualization experts to go around.

In addition to general fragmentation, this siloed phenomenon has another serious negative consequence. The real experts are tied up performing routine tasks, and cannot apply their skills and knowledge to the strategic initiatives that need them.

A simple analogy with medical response teams shows how this works. Consider what happens when an automobile accident occurs and a driver is injured. The medical response is distributed over three levels.

Paramedics who arrive on the scene are the first-level responders, assessing the extent of the injury and collecting crucial data on the patient’s vital signs.

A triage nurse at the emergency room is the second level, re-evaluating the patient’s conditions and updating the vital statistics. The doctor provides the third level of response, evaluating the data collected by the paramedics and the nurse, examining the patient, and—if the patient immediately requires a procedure that only the doctor can perform—administering treatment.

If the injury requires treatment that can be administered by level-two nurses or technicians, the doctor delegates the task and goes on to apply top-tier skills to examining other patients. This structure frees up the doctor to see additional patients and reduces the need to hire additional headcount.

IT has evolved a similar response pattern, with different levels of support and with processes that enable top subject-matter experts to devote their efforts to the most difficult problems, while level-one and level-two support staff handle more routine fixes. In most companies, these processes are extremely effective to manage physical environments, but when it comes to virtualization, they are often not applied today.

It is to be expected that systems break down in virtualized environments as virtualization is a relatively new technology and highly trained specialists are in short supply. Virtualization is often managed apart from the standard processes that support IT in the physical environment. A virtualization administrator often ends up delivering all three levels of support—gathering and correlating information, making the diagnosis, and executing the correction. And as a result, the time and skill of the top-tier expert may be unavailable for planning and managing the strategic rollout of new virtual servers.

This is a serious problem because virtualization specialist teams are reaching a breaking point as executive management asks them to quickly adopt virtualization. In order to scale up the process, administrator teams must offload tactical tasks in favor of strategic deployments.
The case for converged management

Siloed virtualization management—with its multiple consoles, manual and labor-intensive processes, and lack of standard and repeatable processes—results in inadequate reporting, excessive labor requirements and operating costs, and poor application service levels.

Let’s take an example of a simple outage in today’s virtual environment. As mentioned earlier, an average IT organization uses 11 different virtualization platforms. If each domain uses the monitoring tool from its platform provider, that means 11 different tools are deployed to monitor a single virtual service. Each tool only “knows” about the component it was designed to manage. And when the outage occurs, 11 different administrators might be alerted simultaneously.

Only one component caused the outage, but since each tool is blind to what occurs in other domains, the only way to isolate the cause is to launch 11 different triage processes. HP internal and customer surveys conducted in 2009 indicate that it costs approximately US$75 to manage a single event manually, so the cost of 11 triages is US$825.

Converged management is the solution. By centralizing and standardizing operations across heterogeneous hardware and software systems, management technology can achieve a comprehensive service view that includes service levels, capacity, and power. IT can automate provisioning, change, and compliance management, and implement Information Technology Infrastructure Library (ITIL)-based processes and disciplines—bringing the triage, analysis, and correction of faults in a virtual environment under control. This frees the administrator to focus on strategic initiatives to reduce capital expenses.

If the data that the element managers collected in our outage example was processed centrally using a manager-of-managers approach, then that cost would be reduced to US$75. This kind of math applies to other processes such as security and compliance audits as well, adding up to significant savings. And equally important, as the converged approach frees the virtualization experts to focus on further rollout, the business can increase the benefits it gains from virtualization.

From virtual machines to virtual services

Fortunately, the adoption patterns of earlier technologies provide precedent on how to best move forward. As with virtualization, past technologies—such as client/server, Web, or ERP—started with specialized teams dedicated to monitoring performance and responding to issues as they emerged. Over time, however, management responsibility for these technologies moved to IT operations, which was better equipped to standardize management processes and drive down costs. For virtualization, organizations need to move along a similar maturity path—focusing on ways to make the technology more business-centric.

This requires a shift in focus—one that moves companies from the management of virtual machines (hypervisors) to the management of virtual services. Virtualization, in other words, needs to be approached in the context of the role it plays in supporting critical business services. In production environments, virtualization technology does not exist in a vacuum. To the contrary, it is almost always used in conjunction with physical assets and technologies (applications, servers, networks) to deliver the services that organizations depend on to conduct day-to-day business.

What does this mean for IT? It means that IT operations teams need to incorporate virtualization into a common service management approach—based on proven best practices—capable of accounting for both physical and virtual assets alike. IT operations must be able to orchestrate the provisioning of virtual machines across heterogeneous infrastructure tiers—in a way that accounts for software configuration changes in the real-world environment and coordinates with the simultaneous provisioning of applications, virtual machines, physical servers, network, and storage elements.
IT operations must also have the ability to monitor the health of the virtual and physical infrastructure with a full understanding of how system updates and patches impact the health of the business service before the updates are rolled out. And once virtualized applications are in production, IT operations must be able to monitor the infrastructure in context of the applications that it depends on along with the network in which it resides. To achieve this, organizations need a single system to manage hybrid, virtual, and physical business services.

**Virtualized service management**

Virtualized service management is the idea of unifying management across platforms and infrastructure tiers regardless of whether or not the assets involved are physical or virtual. When a company needs to monitor the health of its server environment, it does so from a common tool—spanning VMware, Citrix, and Microsoft virtual machines as well as “unvirtualized” physical servers. Patches can be rolled out across heterogeneous environments, and the interdependencies of all physical and virtual elements are understood and controlled. Network devices can be provisioned and reconfigured, and storage space can be automatically assigned or reallocated. By enabling technology to manage and automate all aspects of service delivery across all infrastructure tiers and diverse vendor systems, virtualized service management provides error-free and efficient operations management.

The following sections of this paper examine some of the strategies required for successful virtualized service management, followed by a description of how HP Software and Solutions can help you quickly realize the benefits of virtualization in real-time production environments.

**Converged monitoring**

It is difficult to realize the benefits of virtualization when your IT operations team lacks visibility into the role virtual assets play in supporting critical business services. Unfortunately, the specialized point products that individual teams within IT use to manage virtualization tend to promote splintered views of the infrastructure and lack support for enterprise-level service monitoring. Isolating an event quickly across virtualization silos and the physical devices that support it is virtually impossible.

What is needed is a way to instrument the entire technology stack (network, server, hypervisor, operating system, application components, and applications). This can enable IT operations to detect, isolate, and prevent service problems across heterogeneous environments—for physical and virtual servers, networks, applications, and storage devices.

How do you monitor the virtualized technology stack to maintain consistent performance and availability in hybrid environments? Start by having your IT operations team establish a centralized operations bridge by consolidating virtual monitoring tools so that all monitoring responsibilities are encapsulated in a single console. Next, employ end-user monitoring tools that capture the user experience so that IT operations can spot problems and respond before customers feel the impact. Third, move in the direction of service dependency mapping so that you can visually represent your IT infrastructure hierarchy to better understand how elements relate to one another for a given service.

As a practical matter, service dependency mapping for complex environments also requires automated discovery capabilities—in which unobtrusive probes are used to constantly monitor the evolution of the physical and virtual IT infrastructure and map the relationship between elements as changes occur. Together, these approaches to monitoring can help remove silos in hybrid environments while empowering your IT operations team to facilitate business service availability with improved visibility at a lower cost.
Converged compliance

Regulations such as SOX and HIPAA demand that IT organizations develop and follow compliance policies in applying operating system and security patches, configuring systems, and “locking” business services for year-end. Effective compliance management requires constant review, and virtualization makes it more difficult and time-consuming.

Virtualization introduces more layers of technical complexity that make it harder to understand how changes affect compliance. Components that need compliance monitoring become “hidden.” Changes, because they can be made more easily, are often made without checking compliance policies. And the licensing of products fluctuates as software moves from physical to virtual servers. The result can be inadvertent violation of compliance policies, and the way to prevent it is continual, automated discovery, monitoring, and remediation.

HP helps improve ongoing compliance through automation to validate that your network and server devices comply with the latest operating system and security patches recommended by HIPAA and other governing bodies. Our automation tools can monitor and automatically remediate compliance violation for virtual as well as physical servers and network elements, including “hidden” components.

And our service dependency mapping tools can freeze a portion of service hierarchy and then generate alerts if anything in that portion changes. In addition, these tools can generate on-demand compliance reports for auditors.

Additionally, our software asset management tool can discover the current state of software licenses and check for compliance violations. In the best of worlds, software license management is tough. Virtualization complicates the process by enabling companies to quickly spin up new servers and applications that require additional software licenses, making it harder to stay in compliance with license agreements.

To avoid penalties and costly one-off audits, companies need a comprehensive approach to asset management—one that enables technology to track the virtual asset lifecycle with the same rigor applied to physical assets.

Software license asset management implies deep and active discovery capabilities—supported by automation—so that organizations can identify and report hardware and software assets throughout the usage lifecycle—from procurement and acquisition all the way to reuse, recycle, or disposition. Based on this, technology can monitor entitlements, track usage, and manage chargeback to maintain compliance against all license terms while also confirming that the business does not overpay for unauthorized usage. Beyond daily monitoring, comprehensive asset management should also provide critical insights to aid the decision-making process. For example, it could help technology better understand the financial and compliance impact of software upgrades or pinpoint over-licensed software so that it can be removed to keep costs down.
Converged backup and recovery

Whenever a new virtual machine is instantiated on a host server, it runs a backup and recovery process to guard against data losses due to a potential crash. In most instances, this backup process is executed by a script-running agent in the virtual machine. Because of the amount of data these agents transfer, the network impact can be enormous. To complicate matters, the common “crash-consistent” backup technique used by many organizations provides little assurance that recoveries will work quickly without errors or loss of data. What’s needed is a more reliable recovery technique that enables business continuity and orchestrates virtual machine agents to stagger processing demand so that networks are not overwhelmed.

This can be achieved by offloading backup processing to the storage array—allowing you to increase the number of virtual machines on a given host server without impacting performance. The result is a consistent production replica of your virtualized application data. This, in turn, allows point-in-time recovery that maintains data integrity. What does this mean for the business and IT? It means error-free recoveries that are measured in seconds and minutes rather than hours and days.

Converged application testing

As virtualization technology introduces new levels of complexity to the IT infrastructure, predicting the performance of business services dependent on virtualization is often a shot in the dark. This is no small problem. At a time when customers are increasingly difficult to obtain, companies need to focus their energies on enabling a positive end-user experience.

To meet this challenge, IT needs end-to-end capabilities for stress testing business services in hybrid physical and virtual environments. Security, as always, is a major concern—and IT can benefit from more powerful risk assessment tools to proactively detect and correct security vulnerabilities and defects associated with virtual assets. Requirements include common security policy definitions, automated security tests, centralized permissions control, and Web access to security information. Equally important is the ability to load-test business services in distributed environments.

IT needs the ability to test performance from the perspective of the end user—so that it can understand how hybrid business services perform in real-world environments under peak load conditions. With these capabilities, technology can better serve the business by leveraging virtualization to both lower IT costs and achieve high levels of performance.
How HP can help: virtualization support for real business benefits

HP offers a wide range of specific solutions that help you manage virtualization technology in a holistic fashion. These solutions enable you to incorporate virtualization into the core processes of your IT operations groups, empowering support staff to do their jobs more effectively with automation and end-to-end infrastructure monitoring that supports faster problem detection and remediation. And with solutions that help you improve compliance, protect data, and facilitate high levels of performance, you may find it easier to reduce the risks associated with deploying virtualization technology in live production environments. The end result is an ability to move beyond the mere potential of virtualization and into the world of fully realized business benefits. These include dramatically reduced IT costs, increased business agility, and the power to increase IT efficiency by doing more with less.

The following table provides a quick overview of how HP solutions can help across all the five key areas discussed in this paper.
## Requirements for enterprise-level virtualization

| Converged provisioning | HP Operations Orchestration software helps:  
|• Orchestrate workflows across physical and virtual server environments  
|• Improve efficiency and reduce costs through automation of routine maintenance tasks  
|• Automate incident resolution and change management  
|• Enforce ITIL and maintain audit trails  
|HP Server Automation software helps:  
|• Automate physical and virtual server lifecycle management and common IT tasks to cut costs and productivity  
|• Manage regulatory compliance proactively  
|• Control virtual sprawl and accelerate application release management  
|HP Network Automation software helps:  
|• Reduce costs by automating configuration tasks and compliance checks for all physical and virtual network devices  
|• Improve network security by detecting and fixing vulnerabilities before they affect the network  
|HP Client Automation software helps:  
|• Automate physical and virtual server lifecycle management and common IT tasks to cut costs and productivity  
|• Manage regulatory compliance proactively  
|• Control virtual sprawl and accelerate application release management  
|HP Network Automation software helps:  
|• Reduce costs by automating configuration tasks and compliance checks for all physical and virtual network devices  
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|HP Network Automation software helps:  
|• Reduce costs by automating configuration tasks and compliance checks for all physical and virtual network devices  
|• Improve network security by detecting and fixing vulnerabilities before they affect the network  
|

| Converged compliance | HP Asset Manager software with DDMI helps:  
|• Discover, identify, and report hardware and software assets automatically on all physical servers and virtual machines  
|• Monitor entitlements, usage trends, and unauthorized virtual machines  
|• Set and enforce corporate standards with a standardized approach to software distribution  
|• Measure total cost of operations for business services and manage department chargeback  
|HP Business Service Automation Essentials software helps:  
|• Collaborate and engage with the broader Business Service Automation community, including customers and HP subject matter experts  
|• Access a Web portal that provides tools, product-specific content, and downloads  
|• Receive ongoing security vulnerability detection and remediation policies delivered to key BSA tools  
|• Stay current with regulatory and industry standards by getting the latest compliance policy updates  
|

| Converged monitoring | HP Operations Manager software helps:  
|• Consolidate event and performance management for both virtual and physical ecosystems (servers, network, and application components)  
|HP Business Availability Center software helps:  
|• Manage application performance for virtualized applications  
|• Monitor end-user experience proactively and isolate application performance issues quickly when they occur  
|HP Network Node Manager software helps:  
|• Reduce operating expenses with broad multi-vendor device coverage  
|• Perform dynamic root-cause analysis and advanced diagnostics  
|• Correlate events and create integrated performance thresholding and reporting  
|HP Discovery and Dependency Mapping helps:  
|• Discover and maintain dependencies automatically for physical and virtual infrastructure—with direct integration to VMware Virtual Center  
|• Determine virtual hypervisors and their environments  
|• Discover and map a wide range of applications, databases, servers, Web servers, network elements, and mainframes  
|• Leverage a robust architecture and rich reporting and analysis capabilities  
|• Integrate with an extensive suite of industry-leading IT management solutions from HP as well as third-party products based on partnerships with VMware, Citrix, Microsoft, and other virtualization software vendors  
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## Requirements for enterprise-level virtualization (continued)

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<th>HP Data Protector software helps:</th>
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<td>• Enable data protection, using a single interface to manage physical and virtual environments</td>
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<td>• Perform array-based snapshots to decrease backup-related performance degradation with the Zero Downtime Backup extension</td>
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<td>• Recover database and application data in seconds or minutes with point-in-time recovery capabilities supported by the Instant Recovery extension</td>
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<th>Converged application testing</th>
<th>HP Performance Center software helps:</th>
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<td></td>
<td>• Stress-test business services from end to end, taking into account both physical and virtual assets</td>
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<td>• Reduce the cost of distributed load testing</td>
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<td>• Pinpoint the root cause of business service performance problems quickly</td>
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|                               | HP Quality Center software helps: |
|                               | • Address the wide-ranging challenges that your quality assurance professionals face |
|                               | • Leverage consistent, repeatable, and standardized software quality processes |
|                               | • Your quality assurance teams turn quality into a competitive advantage |

|                               | HP Security Center software helps: |
|                               | • Developers, quality assurance (QA) teams and security professionals quickly and cost effectively perform a security risk assessment to detect and correct security vulnerabilities and defects throughout the application lifecycle |
|                               | • Provide common security policy definitions, automated security tests, centralized permissions control, and web access to security information |
Learn more.

To learn more about how HP Software and Solutions can help you realize the potential of virtualization, contact your HP representative today or visit us online at hp.com/go/btovirtualization.

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