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Avoiding the Stall: Riding the Momentum of the Next Levels of Datacenter Virtualization — A Business Value Perspective

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March 2013

EXECUTIVE SUMMARY

IT executives at organizations large and small have successfully virtualized a large portion of their server infrastructure over the past five years. Today, over 50% of all applications run as virtual machines (VMs) on a virtualized server, and in many large organizations, levels of virtualization often exceed 80%.

These efforts reduced datacenter capital costs, heightened asset utilization, and enhanced IT staff productivity; however, IDC finds that many datacenters tend to hit a barrier and stop short of successive stages of datacenter resource virtualization. They anticipate diminishing returns as they evaluate continued virtualization of performance-sensitive, mission-critical applications — fearing overloaded storage and network facilities, demands for overprovisioning of storage capacity, and disruptions in administration workloads.

Their other major concern is about the never-ending demand for more agile IT service delivery. While server virtualization allowed IT organizations to deliver applications in days, rather than weeks or months, new applications in areas such as cloud, mobile, and analytics require delivery of IT resources in hours or even minutes. This pace of service creation requires elimination of bottlenecks in storage and network resource provisioning.

It is very clear that datacenter managers need, in addition to server virtualization, the virtualization, pooling, and management of all the other resources that interoperate with their VMs. They require virtualized network interconnects and storage. They also need the tools to manage and automate these converged IT assets as an integrated datacenter system.

This more agile system is the key to enabling the shift to a cloud-based infrastructure IT delivery model.

Solution providers like HP are now addressing the need for more optimized and agile IT solutions. They are delivering virtualized storage, virtual application network (VAN) infrastructure, and the orchestration software to manage and automate all these ingredients as a single system.

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Our research with over 45 companies at different levels of virtualization experience indicates that increased datacenter virtualization and improved asset sharing deliver substantial business benefits. Continuing results show that progress toward more centralized datacenter resource pooling and management, in fact, reduced datacenter costs per unit of workload, accelerated resource deployment, and reduced downtime.

Organizations that had progressed to higher levels of datacenter virtualization deployed new infrastructure in 40% less time than those at basic levels. Likewise, organizations at more advanced stages of datacenter virtualization processed workloads (sustained throughput to the core) at less than 10% of the costs (total datacenter costs) of those at the beginning stages of datacenter virtualization. The benefits increase the further the organization journeys into datacenter standardization and virtualization.

This document discusses the results that more comprehensive datacenter virtualization delivers, and it lays out both the promises and the potential pitfalls of the journey through successive stages of datacenter virtualization.

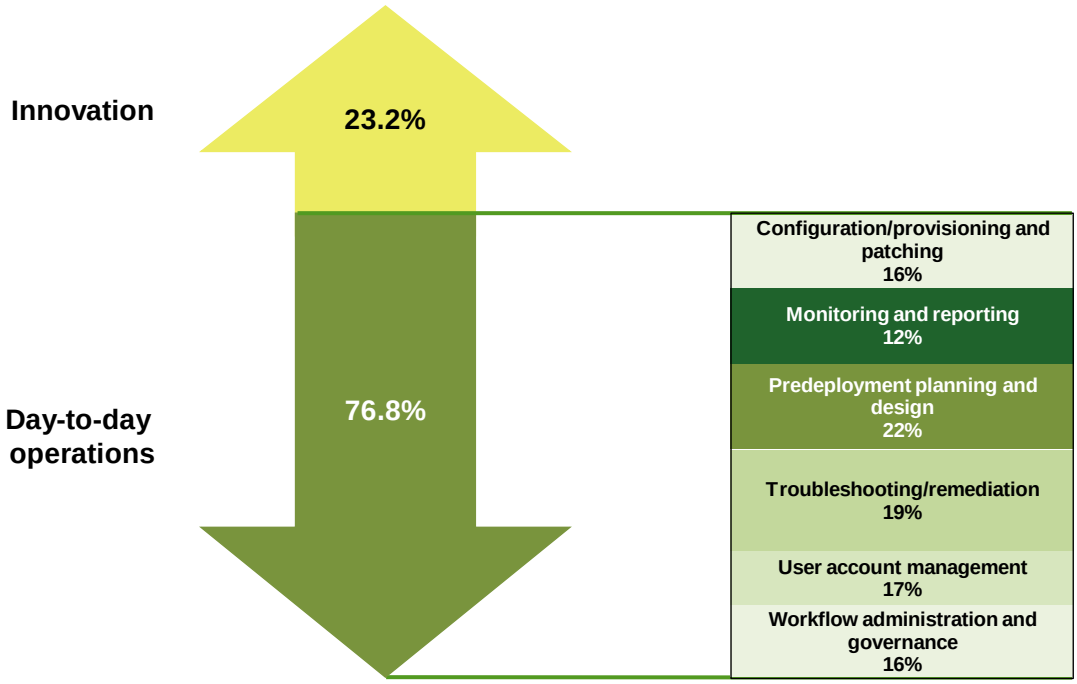
SITUATION OVERVIEW

Server virtualization has taken hold. IT organizations now run multiple applications per physical server, improving the utilization rates of server hardware and further lowering spending requirements for new server hardware. In a recent survey of datacenters, 75% of the IT managers interviewed indicated that they consider "virtualization first" for most applications. But because of server virtualization, the number of virtual machines has exploded, imposing a management challenge. Legacy networks that offer relatively rigid, multitier architectures and require manual processes for configuration and provisioning can slow down and increase management overhead for virtualized application workloads. Our recent research, depicted in Figure 1, shows that IT departments now spend three-quarters (76.8%) of their time and resources maintaining the environment and less than a quarter (23.2%) on value-added activities.

FIGURE 1

Allocation of IT Administration and Operations Staff Time

Q. Over a given week, how do IT admin and operations staff spend their time?



Source: IDC's *Converged Systems Survey,* July 2011 and 2012

This workload distribution has hampered the efforts of senior IT executives to "operationally" transform IT so that it can react quickly to major positive or negative changes in the business environment and integrate new technologies and services (e.g., mobile applications, use of cloud services, big data analytics).

Why the stall? Initial levels of server virtualization tend to ease the process of rolling out new software or widening the user bases for applications. However, that very ease of deployment has exposed and sharpened the need for virtualizing the rest of the datacenter resources that enable that deployment — namely virtualizing not only the server but also the network infrastructure and storage capacity to enable these rapid deployments. One IT manager who decided to break through the stall and expand virtualization to all aspects of the datacenter said, "We were building new lines of business and onboarding customers at an incredible rate … we were constantly gated as an organization by the speed at which we could then assemble the IT infrastructure behind that." To keep up with this demand without overwhelming IT staff, some organizations have moved to higher levels of datacenter virtualization and effectively dealt with:

- Virtual server sprawl's effects on server/storage/network administrative burdens that threatened application performance

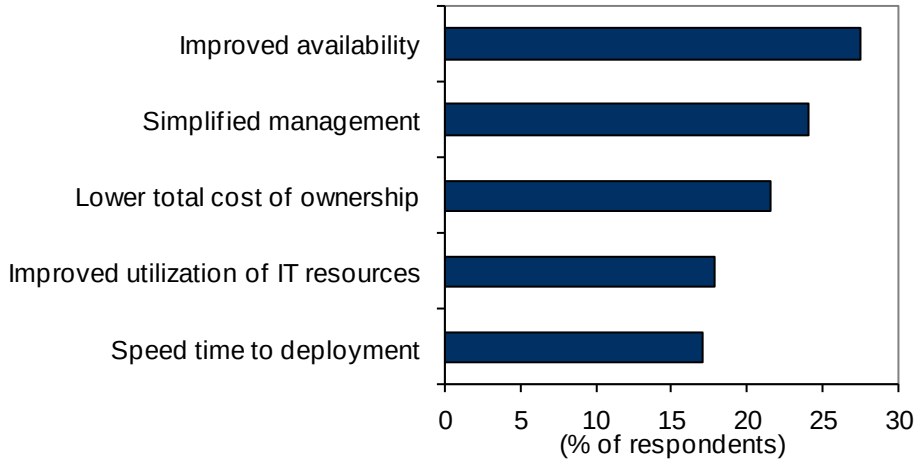
- Overloading/overprovisioning of storage and data network facilities, which forces time-consuming, costly, and often unnecessary upgrades
- Unpredictable application performance and recovery behaviors, which stall plans to migrate more business-critical applications to virtual environments

In our conversations with IT teams, we consistently heard that these problems could escalate as the scope of virtual server use expands beyond a few hundred virtual machines. Some organizations held back at that level, while others invested to move to the next level. These organizations looked to more complete datacenter virtualization to reach the top benefits recognized by customers (see Figure 2). Note that for purposes of this paper, IDC defines datacenter virtualization in parallel with converged infrastructure as an infrastructure based on a set of standard elements placed into virtual resource pools of IT capacity.

FIGURE 2

Major Benefits of Advanced Stages of Datacenter Virtualization

Q. What do you see as the top 2 major benefits to converged computing?



n = 206

Notes:

Multiple responses were allowed.

Total may exceed 100%.

Source: IDC's *Server Team Survey*, July 2012

Datacenters at more advanced stages of virtualization can deliver on these goals, but we are not there yet. A majority of datacenters continue to deal with multiple "silos" — support resources dedicated to a specific domain (e.g., a technology island or a separate application or organizational domain [test and development versus financial systems versus departmental, etc.]).

Moving Beyond Level 1

But as evidenced by some pioneering datacenters, today's advances in server, network, and storage virtualization enable today's IT managers to more completely virtualize the datacenter and manage resources centrally. These advanced datacenters are moving a larger and larger portion of their datacenter resources (e.g., storage, memory, server nodes, network I/O, virtual OS images) into pooled collections that enable administrators to deploy resources centrally. The following technologies enable these higher levels of datacenter virtualization:

- **Continued standardization.** The consolidation of multiple hardware architectures to x86 servers and the deployment of increasingly consistent (standardized) operating system images and other software layers signal a movement toward standard platforms. Likewise, standards for software-defined networks (SDN, OpenFlow) enable the IT manager to control network traffic without physically accessing the network's hardware devices.
- **Virtualized compute.** Server hypervisors have allowed the pooling of server instance images, enabling the hosting of multiple applications per physical server and allowing IT to respond to spiking application demand with more efficient utilization of physical server infrastructure.
- **Virtualized storage.** Networked storage that uses thin provisioning on virtual volumes allocates storage requested by the node as virtual storage. It preserves actual physical disk capacity and adds more only as needed. The system manages physical disks as a single disk pool and allocates physical disk capacity according to the amount of data written to the virtual volumes, avoiding overprovisioning.
- **Virtualized network.** Software-defined networking technologies such as HP's Virtual Application Networks provide a centralized pool of virtual I/O ports that integrate core I/O for storage (SAN) and server interconnectivity (LAN, VLAN), eliminating the need for separate physical networks for each. With these technologies, IT managers can separate network provisioning from device management to simplify management and reduce time to deploy applications.
- **Automation.** Pooling of these resources enables dynamic partitioning and automatic load balancing for different business applications with different service-level demands. IT teams can allocate IT resources for critical services-oriented applications (e.g., virtual desktops, data analytics warehouses, or large content repositories) and handle disaster recovery within a datacenter or across geographically dispersed datacenters.

Organizations that have leveraged all of these technologies report very positive results. Our continuing research with over 45 companies whose levels of datacenter virtualization and IT asset unification ranged widely indicated substantial business benefits associated with higher datacenter virtualization.

How Can We Measure the Effect of Higher Datacenter Virtualization?

To specifically identify and assess the business value of a converged datacenter infrastructure, IDC opted for in-depth interviews to allow extensive profiling of convergence, throughput, and costs. The team screened many prospective respondents to identify and interview managers of enterprise datacenters that satisfied criteria for size, datacenter ownership, and management. In the final survey, 22 managers of datacenters spanning a range of infrastructure convergence levels were interviewed to quantify the financial benefits of attaining more advanced levels of convergence and to identify a set of key best practices that corresponded to these levels.

For this study, IDC assessed levels of datacenter virtualization according to the percentage of datacenter resources (e.g., storage, memory, server nodes, network I/O, virtual OS images) that administrators can deploy from a pooled collection versus the percentage of resources dedicated to a specific domain (e.g., a technology island or a separate application or organizational silo).

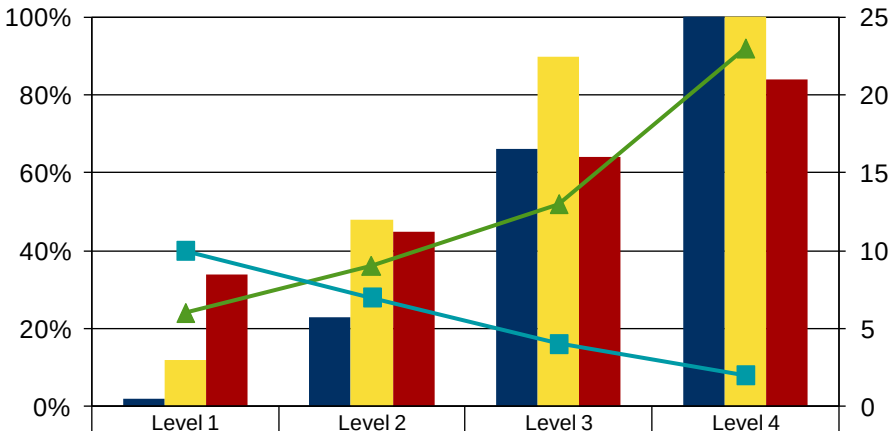
IDC interviewed these companies to assess their levels of:

- **Standardization.** Reduction in the number of technology platforms (separate consoles) to learn and master
- **Virtualization.** The percentage of datacenter resources (e.g., storage, memory, server nodes, networking, virtual OS images) that administrators can deploy from a pooled collection versus the percentage of resources dedicated to a specific domain (e.g., a technology island or a separate application or organizational silo)

Figure 3 portrays some key characteristics discriminating companies fitting into these increasing levels of datacenter virtualization from level 1, which includes the vast majority of datacenters, to level 4.

FIGURE 3

Virtualization and Standardization Characteristics of Datacenters at Increasing Levels of Virtualization



	Level 1	Level 2	Level 3	Level 4
Percentage of server nodes with virtualized IO	2%	23%	66%	100%
Percentage of domain under automated provisioning	12%	48%	90%	100%
Percentage of servers (Unix and x86) running hypervisor	34%	45%	64%	84%
Virtual OS images per server	6	9	13	23
Number of consoles used to manage datacenter	10	7	4	2

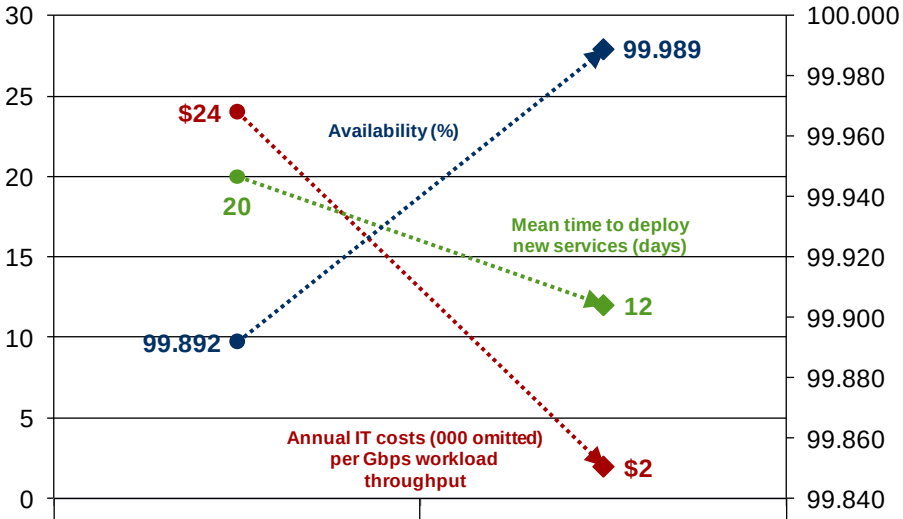
Source: IDC, 2013

To measure the effect of these levels of virtualization, IDC analyzed the relationship between the level of convergence (e.g., consolidation, standardization, virtualization, automation) of an enterprise's IT infrastructure components and processes and the cost to deliver IT infrastructure capability (e.g., work/throughput/capacity). To model this, we needed to measure at least three key real-world values for a sample of datacenters.

We measured each organization's cost per datacenter workload — sustained throughput to the core, speed of deployment, and availability. That cost served as one of the key inputs for our ranking, which ranged from level 1 (low) to level 4 (high). The results of the ranking's effect on business value are depicted in Figure 4, which shows the difference between datacenters at level 1 and those at level 3. Organizations that achieved higher levels of virtualization by standardization and convergence realized reduced IT costs per unit of workload, faster deployment, and reduced downtime as depicted in Figure 4.

FIGURE 4

Effect of Fuller Datacenter Virtualization — Standardization and Convergence — on Datacenter Costs per Workload, Availability, and Deployment Speed



Standard Metrics	Level 1	Level 3
Standardization level	No centralized asset config. DB, 50% with SLAs in place; >14 consoles	70% with centralized asset config. DB, 100% with SLAs in place; <8 consoles
Percentage of server nodes running hypervisor	20%	50%
Percentage of nodes with virtualized network I/O	<10%	>20%; converged FCoE installed

Source: IDC, 2013

Why Do More Advanced Stages of Datacenter Virtualization Deliver Such Business Value?

Our research indicates that more standardization (i.e., fewer consoles and technologies) and more pooling of resources (i.e., virtualization and central management) allow datacenters to achieve higher levels of automated provisioning and higher utilization of networking, compute, and storage resources. This means that organizations moving to higher levels of datacenter virtualization achieve more datacenter throughput per unit of infrastructure capital cost, power, and facilities footprint. It also means that these organizations experience lower datacenter administrative costs. The centralization drives the consolidation of technology support teams and the establishment of network operations centers to manage consolidated systems — network, compute, memory, and storage — support for critical applications. Availability increases as automation programs and datacenter administrators remediate system-critical events with "elastic" pools of available resources such as additional memory, I/O, or scale-out compute power.

HP'S DATACENTER VIRTUALIZATION SOLUTIONS

HP is a global supplier of network, storage, and server hardware as well as data management software products for large and medium-sized businesses. It also provides a broad range of IT implementation and support services for its customers through its partners and its own global services organization. HP, through its ExpertOne program, also provides customers with the opportunity to enhance IT staff expertise with the capability to design, implement, and manage a virtualized, converged datacenter. By leveraging all of these assets, HP is striving to be an early champion/advocate for more completely virtualized datacenter environments.

HP provides Converged Systems that it pre-integrates, tests, and supports. HP has optimized these product solutions for cloud, virtualization, and next-generation applications to meet the design goal of reducing the resources and the time (by months or even years) required for planning, procurement, and deployment so that customers can accelerate their time to application value. HP provides customers with several options:

- HP Converged Systems for virtualization simplify and extend converged infrastructure into optimized, turnkey solutions for server and desktop virtualization. The HP Converged Systems for virtualization are targeted for use cases, whether they are running a single application or multiple applications — including mission-critical applications. They are also the foundation for the next level of system, the HP CloudSystem.

- HP CloudSystem is an integrated system for building and managing services across public, private, and hybrid clouds. It combines converged infrastructure with HP Cloud Service Automation software to boost agility for enterprises and drive revenue growth for service providers.

- HP AppSystems is a portfolio of integrated systems optimized for dedicated workloads such as data management, business reporting/analytics, and collaboration. HP's design goals for these specific applications include achieving fast time to value, high application performance, and service-level requirements.

HP's Converged Systems leverage the latest generation of ProLiant servers, storage, networking, and management and orchestration technologies.

Servers and Management

Blade platforms, such as the HP BladeSystem c-Class, which utilizes HP Insight Management software, help IT organizations reduce their overall server management complexity and respond more efficiently to higher levels of virtualization. HP's newest generation of servers, HP ProLiant Gen8, are powered by HP ProActive Insight architecture. The HP ProLiant Gen8 servers include built-in intelligence that can simplify setup and maintenance, which in turn reduces operation and deployment costs. Specific features include:

- **HP Intelligent Provisioning.** The configuration and provisioning tools are embedded in the server, thereby speeding deployment and reducing setup hassles and errors and ensuring systems are online faster.

- **HP Active Health.** Servers can automatically analyze their own health across 1,600 data points via internal sensors. HP claims this automated monitoring, self-diagnosis, and alerting information enables customers to provide 24 x 7 mission control for delivering maximum uptime.

- **HP Smart Update.** Firmware and software updates are now automated. The automation lowers IT maintenance windows and reduces potential human error through simplified systematic updates of servers and blade infrastructures.

- **Dynamic workload management.** Smart data protection and solid state optimization with built-in analytics help balance performance, capacity, data protection, and uptime goals.

HP Integrity systems with HP Insight Management software and the Matrix Operating Environment automate key management tasks to enable simpler and more reliable provisioning, monitoring, and control of the HP systems and storage deployed in a converged infrastructure (CI). HP Virtual Connect technology simplifies networking complexity and I/O storage challenges, enabling organizations to wire just once and still accommodate workload migrations between servers. HP claims that Virtual Connect enables the CI administrator to make server additions and subtractions in minutes to meet server change requests in a timely fashion. HP Virtual Connect FlexFabric modules consolidate Ethernet and storage I/O onto a single fiber network, avoiding the cost of running two sets of wires and simplifying the communication and storage infrastructure.

Storage

HP Converged Storage offers two primary storage platforms that deliver networked storage with efficiency by leveraging clustered, scale-out architectures that are purpose-built for virtualization, cloud, and IT as a service (ITaaS). Designed to deliver high performance levels under unpredictable, mixed, and heavy virtual machine workloads, HP 3PAR StoreServ Storage enables the increase of virtual machine density on physical servers for equipment and operational savings. HP StoreVirtual Storage uses virtualization to turn a set of heterogeneous disks and disconnected physical disk drives into a pool of logical storage capacity.

Both HP 3PAR StoreServ Storage and HP StoreVirtual Storage enable new VMs to be deployed more quickly.

Network

HP's Virtual Application Networks enable the virtualization of the entire network by providing a single control plane across the end-to-end network, from the datacenter to the campus and branch. The abstraction layer created through a single control plane across the entire network enables IT to orchestrate the network using policies instead of managing device by device as required on legacy networks. The control plane

across the network operates similarly to a server hypervisor controlling server resources in server virtualization. By leveraging OpenFlow, an open standards–based programmable network interface, IT can use orchestration tools to characterize the delivery requirements of an application and provision a virtual network that meets the service levels and experience expected by the user. HP's VAN solution enables IT to provision the network connectivity/server rapidly.

Moving to Successively Higher Levels of Datacenter Virtualization Involves More Than Products

HP recognizes that its customers need a systematic approach to full datacenter convergence — with accelerating time to value — by having more pervasive virtualization that brings together server, storage, and networking resources in a common pool. This approach also requires management tools, policies, and processes so that datacenter resources and applications are managed in a holistic, integrated manner. In addition, it brings together security and power and cooling management capabilities so that systems and facilities work together to extend the life of the datacenter.

A virtualized datacenter solution can also become the ideal foundation for private clouds. HP customers can deploy at their own pace through a transformational or project-based approach that matches the organization's preferred delivery model: on-premises, outsourced, or via the cloud — or a hybrid of all three.

As customers move to a more fully virtualized datacenter, HP Technology Services can help them balance IT efficiency, innovation, and modernization priorities and identify the best convergence approach. The HP Strategic IT Advisory Services (SITAS) portfolio of capabilities strives to help CIOs achieve several vital goals, such as delivering a better ROI by reducing costs and improving processes, producing faster response to changing business needs, and enabling business innovation.

HP's IT Consolidation and Virtualization services include baselining the current infrastructure, what is deployed, its performance, and the dependencies between applications; undertaking detailed infrastructure designs and migration road maps; and executing the infrastructure builds and workload migrations, ensuring that organizations transition quickly while mitigating the inherent risks in any consolidation and virtualization engagement. HP utilizes a hybrid delivery model, deploying onshore and offshore resources in such a way as to minimize costs while ensuring that all the customer-facing work is done with local resources.

Challenges and Opportunities for HP

As discussed previously, most organizations are dealing with the beginning of the journey toward fully virtualized datacenters. The journey will take several years to complete. Today, rethinking the datacenter and how it's run is a top priority, which is driving current discussions about converged infrastructure systems and/or private clouds.

HP, as a leading provider of many of the core elements in current datacenters (e.g., servers, storage, networking, facilities, power, and cooling), must play a role in helping companies make the transition as painless and flexible as possible. Part of achieving this goal requires HP to stay focused on rolling out some key technical enhancements to existing product lines. These enhancements include:

- Extending support for 10GbE across all of its storage products (including support for both block and file access options)
- Continuing to enhance the automated data movement services on its disk storage systems and extend those services to remote datacenters
- Expanding the portfolio of application-specific converged systems while ensuring consistent data management and connectivity options across general and application-optimized systems

HP must also continue to extend the scope of unified orchestration services across multiple converged systems and across multiple datacenters. Extending enterprisewide support further in other elements (e.g., server provisioning, performance monitoring, and resource management) will also be critical.

A virtualized datacenter approach presents technology challenges, but more important, it poses a significant number of challenges for IT organizations in terms of product evaluation, budgeting, and IT operations management. These organizations will ask HP what it is doing in terms of services, application development, and financing to help them navigate the transition in the areas of technology standards, facilities design, and IT staff retraining. HP and its business partners must educate HP customers about the broad set of professional services offerings available to help them navigate the change.

LEVERAGING THE POTENTIAL: THE NEXT ESSENTIAL STEPS TO DATACENTER VIRTUALIZATION

The transition to a virtualized datacenter will play a vital role in helping IT teams meet the fast-evolving business needs of their organizations. It will help executives reduce both the capital costs and the operational costs of running datacenters and improve the resilience of the applications/information residing in them. Leading solution providers like HP are now advancing solutions that abstract and virtualize the hardware elements, provide an open operating environment, and support full orchestration of pooled resources across the entire datacenter.

IT executives must adjust existing product and service selection and management practices to fully take advantage of the advancing converged IT infrastructures and the exceptional cost, speed, and resilience business benefits they deliver. Working closely with a provider that understands this journey and offers the full range of solutions, services, and education will prove critical for the transition to the virtualized datacenter. In this context, IDC recommends that IT executives consider the following in their next steps toward full datacenter virtualization:

- Embrace standardization of servers, storage, networking, and software components as much as possible because it can simplify management and interoperability challenges (however, be sure that the approach also provides an interoperability and transition path for mission-critical applications on installed systems and SANs)
- Implement a mature, centralized, and automated approach to management operations with added investment in performance monitoring and analytics
- Revamp the IT organization structure to move away from device-specific (e.g., server, storage, and network) administration and move toward an IT resource–oriented (e.g., database, collaboration, and archiving) structure
- Consider holistic training and certification programs that cross technological boundaries and affirm the IT staff skill set necessary to lead datacenter transformation

Embarking on these initiatives will help organizations realize the significant efficiency and effectiveness improvements that our research has uncovered, even as the path toward the software-defined datacenter evolves, changes, and improves.