

Closing critical IT gaps and driving towards converged infrastructure with storage virtualization

White paper

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Today's IT challenges are driving the adoption of infrastructure virtualization

IT organizations today are still reeling from a once-in-a-century economic storm and yet at the same time, businesses are being given a once-in-a-century opportunity—a short pause before the return to growth. HP is aware that this economic cycle is unique as it is being matched by an inflection point in IT, where the convergence of new and existing technologies creates new opportunities.

In the midst of all of this change IT is being asked to contend with explosive data growth. Networked storage growth is over 80% in many companies and industries, and despite the economic downturn, will increase by 51% across all organizations in 2010 according to the leading industry researcher, IDC.* The continued data growth as well as increased deployment of virtual servers is resulting in IT sprawl which is causing storage infrastructure to be inflexible, unmanageable, and inefficient.

As an outcome of previously unrestrained proliferation of servers and storage that produced unwieldy IT sprawl and the explosive growth of data that demands increasingly more storage, IT organizations finds itself caught between the proverbial rock and a hard place. It must confront four critical infrastructure gaps—even as it experiences intense pressure from organizations to reign in both capital expenses (CAPEX) and operational expenses (OPEX)—to play a part in addressing these challenges.

IT must help the organization move from high cost IT islands and resource silos to low cost pooled assets that can deliver more predictable service levels at lower costs.

This paper is intended for IT and business managers who are concerned about controlling budget while closing the infrastructure gaps and extending the benefits of IT virtualization. It intends to:

- Identify storage virtualization key strategy going forward
- Identify four critical IT infrastructure gaps that hinder businesses today
- Introduce the HP approach to storage virtualization to close the gaps
- Quantify the benefits of end-to-end storage virtualization

Appendices will summarize the following related HP products: HP StorageWorks SAN Virtualization Services Platform (SVSP) for SAN virtualization, HP StorageWorks EVA and HP LeftHand P4000 SAN Solutions for array-based virtualization, and HP StorageWorks X9000 Network Storage Systems, for file virtualization.

The case for storage virtualization solution

In recent years, companies jumped on server virtualization to halt server sprawl and boost utilization, and the results have been impressive. They have been able to increase server utilization, increase management efficiency, and reduce costs while continuing to meet service level agreements (SLAs).

But the success of server virtualization isn't enough. Business needs to virtualize the entire technology infrastructure; not only servers but storage and network too. To get the full benefits of IT virtualization, every change made in the virtual server environment needs to be reflected similarly in virtualized storage and network environments.

At the same time, IT managers must understand how the virtualized infrastructure is being utilized so they can better optimize service delivery and performance. For example, they must understand storage capacity utilization and performance by application, which may allow them to provision resources efficiently as needed and not before. This, in turn, reduces the storage cost effectively without constraining application performance or reducing IT service levels.

The benefits of virtualization already are widely recognized—cost savings, management efficiency, improved application availability, increased IT and business agility, and responsiveness. In addition, IDC notes specific benefits of extending virtualization to storage.** Virtualization can:

- Boost utilization levels for installed storage assets from under 20% to 70% (when used in conjunction with server virtualization).
- Simplify storage provisioning, capacity expansion, and data protection across heterogeneous storage systems (tripling the amount of storage managed per FTE).
- Enable seamless cross-system data movement, so IT managers can migrate or replicate data to less expensive storage tiers easily and intelligently (cutting the cost of future storage system acquisition by over 50%).

Given these benefits, it is no surprise that businesses are now looking to extend their initial server virtualization efforts to storage and network. There remain, however, significant gaps when it comes to storage. For example, organizations continue to manually provision individual arrays while capacity remains trapped or stranded, unable to be shared. Storage also suffers from silos of management and silos of data services where each device, storage pool, and storage service must be handled individually. This leads to particularly ineffective storage management, which drives up the cost. Finally, organizations continue to experience performance and scalability limitations.

These gaps result in an unnecessarily costly and inefficient storage infrastructure, while piecemeal management hinders the optimization of services. The solution is to extend virtualization to storage.

Four IT infrastructure gaps, which must be addressed

IT must address the following four critical gaps as they pertain to storage if organizations are to achieve the kind of benefits they already are experiencing with servers through virtualization. These gaps result from conditions that have persisted from years.

Explosive data growth constrained by storage silos and stranded disk capacity

Organizations have been experiencing explosive data growth for years. At times, storage capacity demands data grew over 80% in a given year. According to IDC reports, 2009 annual networked storage growth rates of 41%, reduced from previous highs mainly because of the slowing economy.*

As and when the economy rebounds, however, IT must prepare itself for higher rates of data growth and as various compliance mandates require organizations to store more data for longer periods. In addition, new applications and the growing adoption of digital media by enterprises dramatically increase the amount of data to be stored and managed.

In the past, IT responded to the explosion of data by simply adding more storage devices. This, however, led to storage silos and stranded disk capacity that made it difficult to share storage capacity, shift storage capacity to other applications as needed, or otherwise repurpose under-utilized storage capacity. The result was historically low rates of storage utilization, which resulted in higher than necessary costs.

Today, it has become clear that trying to solve such problems while undertaking new initiatives using the same old storage and outmoded storage practices is a recipe for failure. These challenges call for storage virtualization, storage tiering, consolidation, and effective data migration.

Costly physical IT infrastructure unable to pool storage or scale

An IT infrastructure consisting of silos of storage and stranded disk increases storage costs in several ways.

- Acquiring, deploying, and managing separate, unconnected pools of storage
- Low utilization wastes the storage investment
- Managing separate pools of storage is inefficient and costly
- Inability to redirect or repurpose storage capacity hinders flexibility while forcing the unnecessary purchase of yet more storage

Storage virtualization reduces stranded capacity while enabling the logical pooling of resources. This provides smooth storage scalability, as easily as attaching more disk capacity.

Piecemeal management inhibits optimization and automation

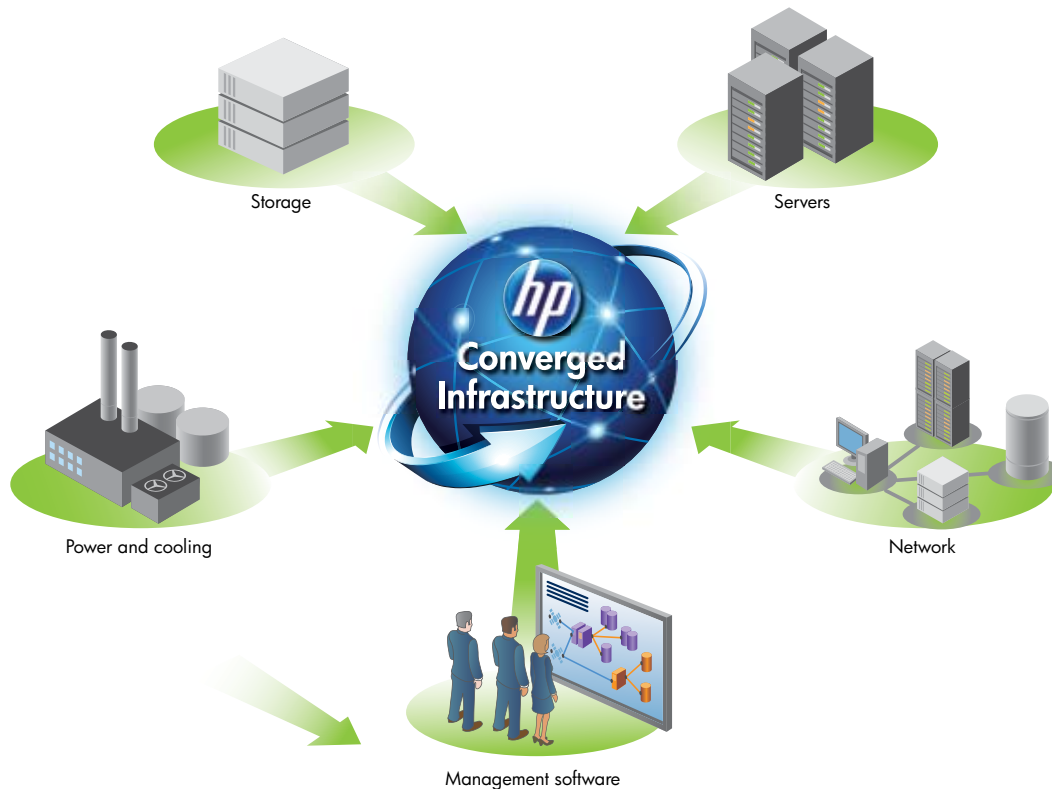
Effective storage optimization and automation requires IT to manage the storage as a single, logical storage pool. Otherwise, each storage silo must be optimized and automated as its own island of storage, which frustrates any effort at load balancing, performance tuning, or dynamic capacity management. Optimization and automation can be best deployed when administrators work at a logical level of abstraction across the wide range of physical storage pools and storage devices.

Such piecemeal management also is inherently inefficient and increases costs in numerous ways. To begin, it is slow, requiring administrators to handle each storage silo or device separately. It also forces administrators to work at the device level, which requires more specialized skills. As a result, organizations need more administrators with more and different skills. In the end, piecemeal management results in administrators handling fewer TBs/administrator.

Separate IT domains hinder unified IT data services

Data services address the placement, provisioning, and protection of data. Unified data services allow administrators to work at higher levels of abstraction where they can move and manage storage logically across different arrays, vendors, and storage domains.

Figure 1: Tomorrow's business will be built on a converged infrastructure



Unified data services include:

- Intelligent automated tiering: It uses policy-based tools to automatically store data on the appropriate storage based on the required level of service and protection, frequency of use, age, and other attributes
- Replication: An ability to move data to other storage capacity synchronously or asynchronously, using data mirroring
- Snapshots: A fast, partial backup of a larger data set, often for interim data protection
- Cloning: A fast, partial copy of a larger data set, similar to snapshots, used for load balancing as well as interim data protection
- Mirroring: An exact block by block copy of a data set made when the data is initially written (synchronous mirroring) to disk or at a later time (asynchronous)
- Thin provisioning: A form of storage provisioning in which less physical disk capacity is reserved for an application than what has been logically provisioned with the expectation that more physical capacity can be added later if required

A consistent set of unified storage data services enables IT to lower costs and deliver such capabilities as cross-array consolidation, migration, and tiering and do so faster, more effectively, and efficiently.

The result is more effective storage deployment, faster and more efficient storage provisioning, and better data protection.

How does storage virtualization help enable the HP Converged Infrastructure?

The vision for the future of infrastructure, the next-generation data center is the HP Converged Infrastructure. Customers are moving here because they need to improve the flexibility and efficiency of IT to enable business agility and transformation. To deliver on this vision, HP is converging the industry's leading infrastructure portfolio, partners and expertise across systems, application, and infrastructure management and facilities, defined by a common architecture. A core element of this architecture is an adaptive pool of compute, memory, storage, and I/O that is called the HP Virtual Resource Pool.

This Virtual Resource Pool must:

- Increase total utilization by freeing and repurposing trapped capacity to support applications.
- Provide resiliency and flexibility to support any application on any resource.
- Accelerate standardization to enable higher levels of automation and increase productivity.

“In today’s difficult economic environment, companies must extend the value of their existing IT assets and maximize the benefits of any new investments. Companies that are deploying networked storage and server virtualization can quickly achieve both of these goals through deployment of storage virtualization solutions.”

Richard Villars, IDC Vice President,
Storage Systems & Executive Strategies

The implementation of a virtualized networked storage environment ensures that the business can fully achieve the benefits of a virtualized server environment. For organizations interviewed by IDC,** the benefits of storage virtualization include:

- Increased storage utilization
- Increased storage management efficiency
- Improved storage responsiveness, performance
- Lower costs
- Unified, consistent data services
- Support for new server and storage initiatives faster and more easily
- Consolidation of storage and server assets (by 50% or more in many cases)
- Increased storage utilization to 40% or 50% thereby reducing the need to acquire new storage
- Leverage lower-cost/higher-capacity storage tiers to reduce the need for new storage assets by up to 80% in certain cases
- Improve application and information availability while shrinking backup times by over 80% and reducing IT staff resources devoted to backup and recovery activities

- Protect investments through simplified integration with existing systems, upgrades to new capabilities, and scalability to meet future demand.

Specific to storage, delivering a flexible pool of storage as part of a converged infrastructure requires a fundamental shift towards a **virtualized storage infrastructure** where solutions are built using standard components and platforms, information is virtualized across devices and protocols, data services are optimized to deal with large data sets, and application workloads can be dynamically moved closer to data sources.

HP StorageWorks is working across these design principals to lower acquisition costs, simplify management, reduce the impact of explosive data growth, and speed up the deployment of storage for critical business applications.

HP enables storage virtualization as the new enterprise storage strategy

According to IDC, “The implementation of a virtualized networked storage environment ensures that the business can fully achieve the benefits of a virtualized server environment.” See sidebar: Benefits of storage virtualization.**

Ultimately, storage virtualization is a key component to the HP Converged Infrastructure to enable an end-to-end virtual infrastructure, which will be critical for success in the future.

Virtualized storage pools, it turns out, are a key enabler for reducing overall IT complexity, especially when it is used as part of a converged IT infrastructure. Such a converged IT infrastructure provides the foundation for the widespread consolidation and policy-based automation that produce the savings and efficiencies enterprise seek through virtualization.

HP takes a comprehensive approach to virtualized storage infrastructure that encompasses array-based virtualization, SAN-based virtualization, and file virtualization [refer appendices A through D].

Recent studies suggest that such SAN-based virtualization can increase storage utilization by 300%, while each administrator handles 3x more storage and 2x more servers by working through a single management console (single pane of glass) for all services and storage. HP delivers SAN-based virtualization through its SAN Virtualization Services Platform (SVSP), which also provides separate paths for data management processes to allow for independent scaling of I/O performance and management tasks [refer to appendix A].

“HP is one of only a very few organizations today that could even attempt what is represented by the Virtualized Storage Infrastructure and its umbrella superstructure, the Converged Infrastructure. It is clearly an ambitious leap forward, but HP has historical proof points as a market leader and has the services, product portfolio, and financial wherewithal to prove that it is a horse worth betting on.”

Mark Peters, Senior Analyst
Enterprise Strategy Group

SAN-based virtualization raises storage virtualization to a higher level of abstraction, enabling support for heterogeneous storage pooling with centralized management. This increases storage utilization as it boosts administrator efficiency. For example, it allows a consistent set of storage data services that protect data, lower costs, and enable cross-array consolidation, migration, cloning, thin provisioning, mirroring, and storage tiering.

Array-based virtualization resolves the problem of stranded storage which as a result, shows when capacity must be managed by individual disk groups. This allows idle disk capacity to be put to use for other applications. Array-based virtualization similarly addresses key issues raised by server virtualization—utilization, management, performance, and availability. When combined with dynamic capacity management (DCM), array-based virtualization can reduce management costs by 50% and reduce business risk through automation. Overall storage performance improves due to the ability to increase disk use for all applications (no idle spindles). The EVA and LeftHand P4000 SAN Solutions provide the foundation for the HP array-based virtualization [refer to appendix B and C].

File virtualization addresses unstructured file data, one of the fastest growing contributors to the explosive demand for storage capacity. File virtualization takes advantage of clustered file systems and massive singular name spaces to deliver easily scalable, high performance file storage capacity, and streamline the management of unstructured content across the enterprise. The HP StorageWorks X9000 Network Storage System family is the foundation of the HP file virtualization [refer to appendix D].

The return of investment (ROI) from an end-to-end approach to virtualization

Enterprises are reporting substantial business payback from virtualization in the server environment. This mainly takes the form of reduced costs due to consolidation, greater utilization, and increased management efficiency. In short, companies are able to handle more workloads with fewer servers and administrators and require less energy without sacrificing performance or service. In addition, they report increased flexibility and responsiveness.

By extending virtualization end-to-end and encompassing storage arrays, storage networks, servers, and network fabric, enterprises should be able to achieve even better results. For example, enterprises report cost reductions of as much as 300%** through increased asset utilization and the corresponding ability to delay additional IT acquisitions.

Enterprises also report substantial savings in management costs. As previously noted, enterprises report administrators handling 3x** more storage and 2x** more servers. This reduces the number of administrators required to support the workload or, as is often the case, it frees administrators to take on other tasks.

Virtualization also reduces storage complexity, which similarly streamlines management. Here enterprises report savings of 50%**.

Ultimately, virtualization enables better focus on data and the business rather than on IT devices. As IDC concludes: Leveraging server and storage virtualization together makes it possible for companies to get the most business value from their IT assets.**

Conclusion: Virtualization enables data center transformation

Storage virtualization allows enterprises to close the gaps that have long hindered efficient storage deployment and management. IT is able to accommodate the explosive growth of data without disrupting applications, often without even the need to acquire more physical capacity due to increased utilization of the existing storage.

In the same way, virtualization enables enterprises to pool storage resources, even heterogeneous resources, quickly and easily. This increases flexibility while simplifying management as administrators operate at a higher level of abstraction. A logical storage pool also enables optimization and automation of storage processes. Finally, it allows IT to deliver unified services for data protection.

The result: An IT organization is able to fully focus on the data and business, and is also ready for data center transformation.

Appendix A: HP StorageWorks SAN Virtualization Services Platform (SVSP), SAN virtualization

Targeted at enterprise and midsize firms that are experiencing significant storage growth, the HP StorageWorks SVSP provides a cost-effective and change-ready storage virtualization solution that addresses the storage management, utilization, and mobility challenges of virtual environments.

The SVSP aggregates capacity of multiple SAN attached arrays and creates efficient pools of virtual storage that can be easily provisioned to virtual and physical machines on demand. Trapped capacity becomes available in the virtual pools that when combined with thin provisioning, produce significantly higher utilization rates and lower storage costs. The SVSP also comes with a comprehensive set of data services across all managed capacity that enables the SVSP platform to address a significant number of use cases that streamline operations, improve data protection and increase productivity. Services include volume management, thin provisioning, non-disruptive data migration, copy services (snapshots and clones), local synchronous mirroring and remote asynchronous mirroring.

With its innovative split-path architecture, the SVSP provides a flexible, modular storage infrastructure that is able to evolve with your needs to meet performance, scalability, and availability requirements. The architecture separates data flow from management processes. As a result, the SVSP delivers better performance and greater scalability than traditional appliance-based architectures.

Finally, the SVSP comes with a Command View Management framework that drives greater management efficiency and simplification for virtualized environments. It delivers centralized management of all capacity and data services for the day-to-day operations and also enables HP customers to enjoy shorter learning curves due to its consistency with EVA management.

For more information about SVSP, see www.hp.com/go/SVSP

Appendix B: HP StorageWorks Enterprise Virtual Array (EVA), array virtualization

The HP StorageWorks Enterprise Virtual Array (EVA) family of storage arrays offers an easily deployed enterprise-class virtual storage array for large and midsize enterprises at an affordable price. With built-in virtualization, it is designed to improve capacity utilization and be easy to manage that lowers the cost of ownership compared to traditional arrays. It has high performance, scales easily, and is highly reliable and available. The availability built on the EVA architecture delivers 99.999% availability and a dual redundant design. It provides broad operating system support with proven integration with major applications, such as Microsoft Exchange, Oracle, and SAP. The EVA family brings robust local and remote replication capabilities with HP Business Copy EVA and HP Continuous Access EVA Software. With HP Command View EVA Software and HP Dynamic Capacity Management Software, management and storage provisioning of the EVA is easy and saves time.

For more information about HP StorageWorks Enterprise Virtual Array (EVA) family, see www.hp.com/go/EVA

Appendix C: HP LeftHand P4000 SAN Solutions, array virtualization, and virtual SAN appliance

Your storage needs are growing. You need a SAN for virtualized servers, and you want your next investment to have a long term payoff.

The HP LeftHand P4000 SAN Solutions are optimized for database and email applications, as well as virtualized servers. With a pay-as-you-grow, all-inclusive pricing model and intuitive storage management software, the P4000 is perfect for the budget-minded users.

Do high availability and disaster recovery seem out of your reach? The P4000 eliminates single points of failure across the SAN with an innovative approach to data availability, reducing risk without driving up costs. Unsure that current storage can meet your future needs? Built on a storage clustering architecture, the HP P4000 SAN allows you to scale capacity and performance linearly without incurring downtime or performance bottlenecks, or forcing expensive upgrades. Need creative ways to stretch your IT budget? Reservationless thin provisioning substantially increases your storage efficiency.

For more information about HP LeftHand P4000 SAN Solutions, see www.hp.com/go/P4000

Appendix D: HP StorageWorks X9000 Network Storage Systems, file virtualization

HP StorageWorks X9000 Network Storage Systems customers span from data intensive financial institutions to advancing researchers in life sciences to the high-tech operations of communications, media, and entertainment.

The HP StorageWorks X9000 Network Storage Systems scale-out beyond traditional network attached storage (NAS) in both capacity and performance. Designed to be extremely scalable, flexible, and cost-efficient, HP X9000 Network Storage Systems deliver excellent performance and a modular storage infrastructure to accommodate unprecedented storage growth and performance. Central management allows the administrator to manage not just terabytes but multi-petabyte environments at the highest density possible from HP. The pay-as-you-grow architecture and an all-inclusive feature set reduces storage over-provisioning or expensive add-ons. HP X9000 is the platform for customers designing the next-generation data center.

The HP X9000 has a unique file system architecture that can scale to tens of petabytes of capacity in a single namespace and support thousands of physical storage elements.

The HP X9000 family includes three models:

- X9320 Network Storage System: Highly available, scale-out storage solution that allows customers to add a performance-based system quickly and easily into their environment for file data workloads.
- X9720 Network Storage System: A turn-key, highly dense scale-out NAS appliance designed for those customers with extreme capacity needs looking for an affordable architecture that offers low \$/GB and scales from sub-hundred terabytes to multi-petabytes.
- X9300 Network Storage Gateway: A flexible, scale-out solution that brings feature rich gateway file services to HP MSA, EVA, P4000 or third-party arrays, or SANs for those customers experiencing considerable unstructured data growth.

For more information about HP StorageWorks X9000 Network Storage Systems family, see www.hp.com/go/X9000

* IDC Worldwide Enterprise Storage Systems 2009–2013 Forecast: Economic Crisis Driving Quest for Storage Efficiency and Emerging Architectures: May 2009—Doc # 218252

** IDC White Paper sponsored by HP, The Business Value of Storage Virtualization: Scaling the Storage Solution; Leveraging the Storage Investment, #216719, February 2009

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