

Lab White Paper

Brocade One and Hitachi Virtual Storage Platform

A Reference Architecture
for Next Generation Data Centers

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Introduction

If you ask business executives today what they need most from their organizations, the majority would cite the ability to respond quickly to changing conditions. Shifting markets, constant communications, and competitors approaching from all corners of the globe converge to make business move and change at the speed of light. Failure to respond quickly can lead to decreased market share, lost revenue, and competitive takeover. As a result, today's businesses want to become virtual enterprises that are agile enough to shift on a dime by leveraging "information centers" rather than legacy data centers. This has obvious implications for the IT departments that power business.

To make a business more agile, technology advancements must support today's environments. They must help deliver IT as a service that is consumed when needed; data and IT services must be cloud-ready and available at any time, from any location, by anyone. Virtualization of server processing power, data storage capacity, and network bandwidth are becoming ubiquitous. The result is end-user appreciation (and increasingly, expectation) of always-on business resources and non-disruptive operations.

Legacy infrastructures are clearly not up to this task. Siloed resources, application-dedicated hardware, data that cannot be shared, and platform-dependent infrastructures result in rigidity, complex management, low resource utilization, inefficient use of both equipment and human resources, and extra costs. You can't change your product strategy to fill a new need or fight a sudden competitive threat if your IT infrastructure is too rigid to accommodate change.

The New Requirements

Businesses need next-generation data centers that are virtualized resource pools built for flexibility, scalability, energy efficiency, and automated task management. In addition, they must be focused on quality of service to streamline costs while tailoring service levels to individual needs. Agile businesses can no longer afford to deliver the highest service levels to all applications, nor can they allow some to suffer with the lowest common denominator of services.

Forward-looking IT managers are considering new requirements with the goal of improving business agility. These requirements are focused on key attributes of the IT infrastructure, which include virtualization, flexibility, scalability, energy efficiency, automation, and quality of service.

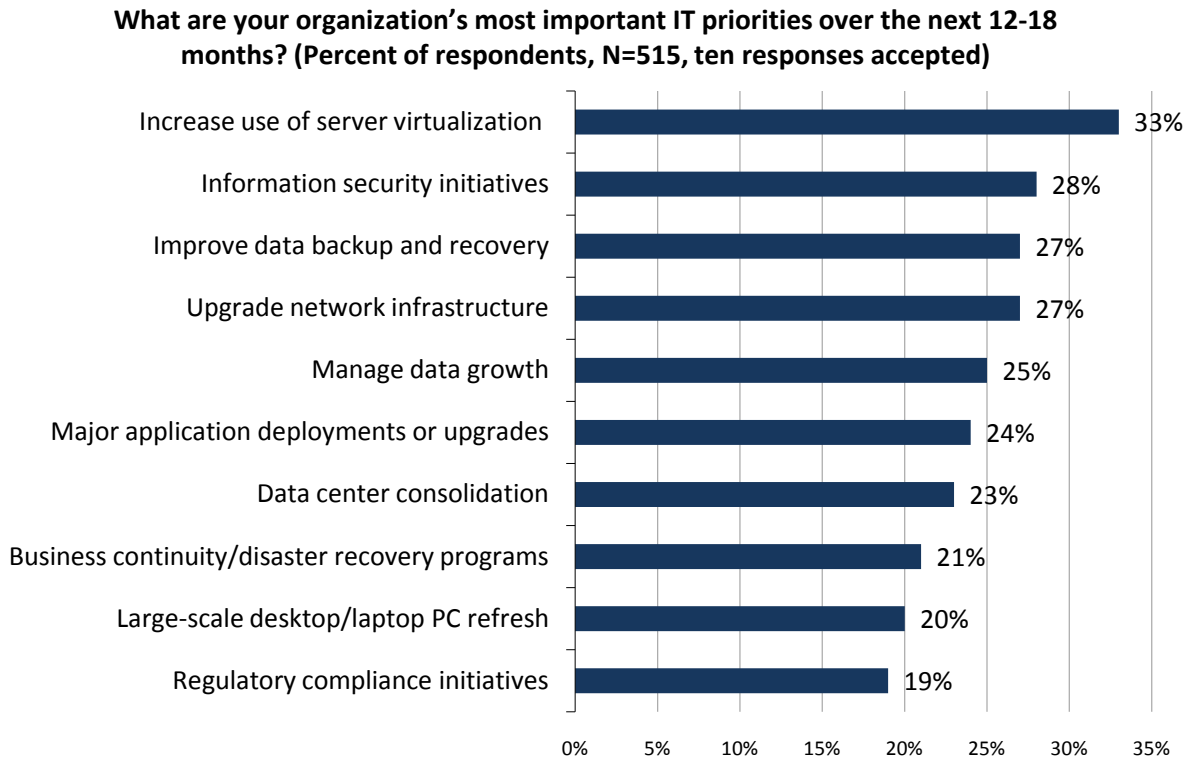
Highly Virtualized

Increasing server virtualization is at the top of the IT priority list for most organizations according to the ESG research shown in Figure 1.¹ Those that have not yet virtualized their server infrastructures want to and those that have done so want to expand that strategy because of its efficiency and ability to maintain "always on" services. Other top priorities involve information security and protection, upgrading network infrastructures, managing data growth, and data center consolidation.

The next step in data center transformation is end-to-end virtualization, including storage and networking. A fully virtualized infrastructure can improve the performance and availability of resources, reduce server and storage sprawl, enable consolidated management, and control escalating costs by increasing utilization. Virtualization also enables an organization to take advantage of resources that were previously wasted, such as application-specific servers with captive storage resources.

¹ Source: ESG Research Report, [2010 IT Spending Intentions Survey](#), January 2010. All ESG research statistics come from this report unless otherwise specified.

Figure 1. Top 10 IT Priorities for 2010



Source: Enterprise Strategy Group, 2010.

Flexible

Flexibility is a must if an organization is going to respond quickly to changing business requirements. Just because Server A is hosting an Exchange application today doesn’t mean that configuration will be convenient in the future. Businesses need to be able to move workloads to optimize resources and maximize availability, scale resources up and down as needs change, and offer pay-as-you-go services—all so business can “go with the flow.” Equally important, lack of flexibility often increases operational expenses. Taking systems down to move data to a more convenient location requires management time and renders applications unavailable.

Scalable

Growth that requires downtime and interrupts revenue-generating activities is problematic. An agile data center scales easily and without disruption. The ability to dynamically, non-disruptively scale storage capacity and performance is a must as structured and unstructured data volumes grow; key to agile scalability is keeping management from getting out of control as devices are added. In addition, the ability to scale up and scale down without pre-planning and moving data around is a much more accommodating delivery model for application managers.

Energy-Efficient

One of the most constrained resources in today’s data centers is energy for power and cooling. As data center power consumption doubles every few years to keep pace with storage growth, some data centers face the prospect of actually *running out of power*. Treating energy consumption responsibly not only helps sustain the planet, it can also represent huge cost savings. At the same time, energy efficiency must be accomplished without compromising system reliability or application availability. Consolidation, virtualization, and centralized data management are the first energy efficiency strategies to pursue.

Automated

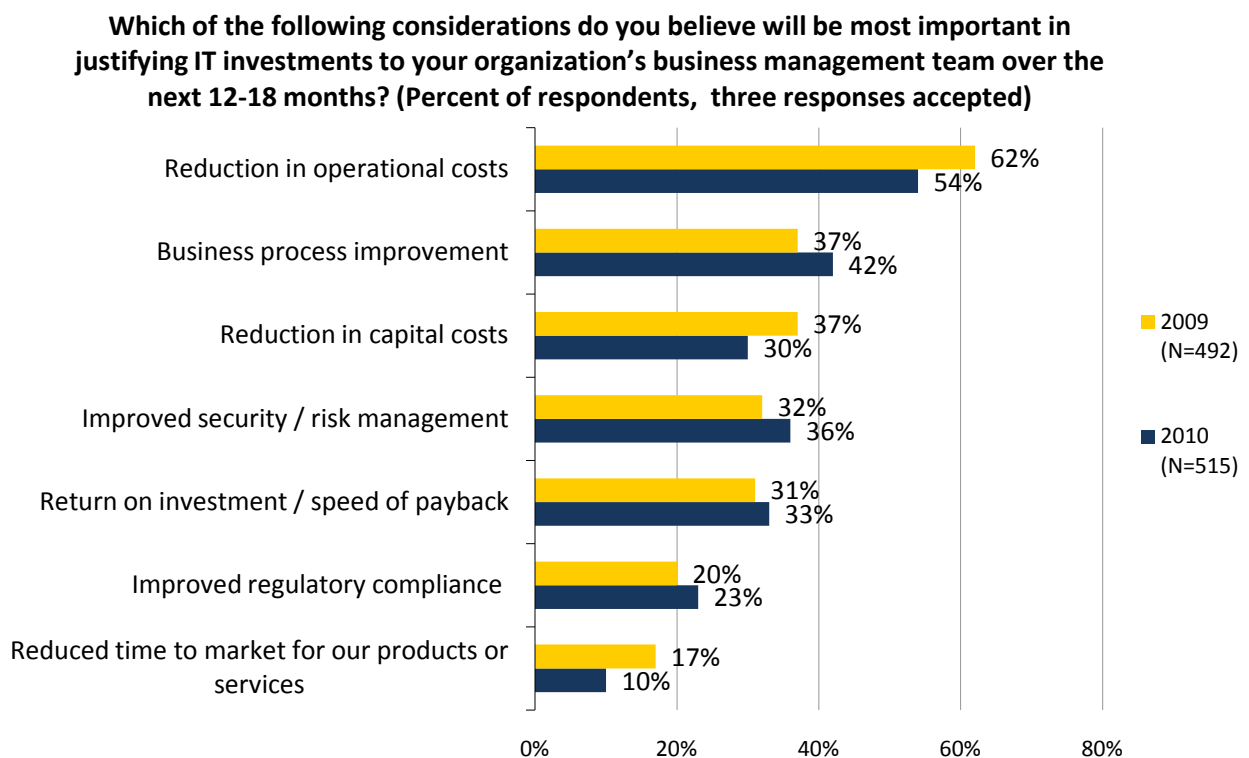
A good way to reduce cost and complexity is by automating manual tasks. Automation increases efficiency using software intelligence and frees up IT administrators to work on more value-added functions. Manual tasks are slow, disruptive, and prone to error, which increase operational expenses. Automation using integrated software tools can ensure reliable, repeatable, and scalable IT processes and can transform data centers by delivering computing and storage resources quickly while reducing costs.

Quality of Service (QoS)

An infrastructure focused on QoS ensures that high priority applications get the bandwidth they need, even if that means less bandwidth for others. Guaranteeing performance and reliability lets organizations improve business processes and appropriately manage risk and a continuum of services is cost efficient in terms of both capital and operational expenses and it minimizes waste. If two of 20 applications require more bandwidth, why supply extra bandwidth to all 20? Conversely, why deny those two applications the resources they need because supplying the entire infrastructure would be too costly? QoS is a networking term, but as a concept it can apply to any infrastructure resources. Combining Flash, SAS, and SATA drives with automatic storage tiering allows organizations to use high-performance storage only when applications need it. Dedicating internal cache resources for high priority applications running within an enterprise-class disk array shared by a number of lower priority application is another great example of QoS: it enables organizations to allocate resources according to the needs of the moment instead of treating all applications the same all the time. Flexibility, scalability, and automation go hand-in-hand with QoS to facilitate tailoring.

The importance of strategies focused on cost effectiveness, performance, and reliability is underscored by ESG research. Respondents to a recent survey clearly indicated that the highest priorities for funding are those projects that reduce operational costs, improve business processes, and manage risk better (see Figure 2). Capital cost reduction remains a high priority, but it slipped in importance from 2009 to 2010 while business process improvement and improving security/risk management increased.

Figure 2. *Justifying IT Investments*



Source: Enterprise Strategy Group, 2010.

Delivering a Complete Solution: Brocade and Hitachi Data Systems

For organizations working to create an agile business environment, [Brocade](#) and [Hitachi Data Systems](#) offer a combined solution designed for end-to-end virtualization. The Brocade One Architecture with Adaptive Networking Services and Hitachi's Virtual Storage Platform (VSP) is a complete solution for the delivery of a cloud-ready information utility. This section describes the capabilities and benefits of a cloud-ready reference architecture based on Brocade One and HDS VSP technology.

Brocade One Architecture

With the proliferation of intelligent devices, mobile users, and increasing virtualization, network capabilities have come to the forefront. While data centers have previously been thought of as walled rooms full of equipment and cabling on raised floor tiles, in many ways, today's extended network *is* the data center. Organizations are looking to create highly flexible networks focused on virtualized, on-demand services so that information and applications can be accessed from anywhere, at any time, by anyone.

As data centers become virtual, applications are dynamically provisioned and can be moved between physical machines and virtual storage applications can move data between storage tiers based on policies and service level requirements. This new mobility of workloads can cause unexpected network congestion in server-to-storage traffic, server-to-server clusters, and storage-to-storage replication. As traffic patterns shift more quickly, the dynamic behavior of the fabric is harder to understand and regulate. As a result, virtual environments often make network provisioning, configuration management, capacity planning, security, and fault isolation more complex.

The Brocade One Architecture is designed to help organizations create an environment in which information and applications can reside anywhere. Its hallmarks are simpler network deployment, configuration, and support; continuous operations; optimized application performance and reliability; and investment protection that let organizations build on their existing multivendor infrastructure while adding innovative technologies. These innovations include:

Adaptive Networking for Virtualized Environments

A key feature of the Brocade One Architecture is Adaptive Networking Services which monitor, anticipate, and detect congestion, and then adjust bandwidth and fabric resources dynamically to meet application-based service levels. The intelligent fabric monitors resource users at the *application level* rather than just at the port level. Adaptive Networking Services simplifies provisioning and management activities, reducing operating costs in an evolving, virtualized infrastructure.

Brocade's virtual channel technology is the foundation that allows Adaptive Networking to assign application workloads to specific service levels and to re-allocate resources as these workloads move throughout the server resource pool. These virtual channels divide up resources within physical network links into multiple logical data paths connecting virtual servers to storage, providing granular management and control of fabric resources. Fabric bandwidth and resources are assigned low, medium, or high QoS priorities that are applied to virtual channels.

The Adaptive Networking Services then enable the fabric to dynamically allocate shared resources as changes occur in the traffic flows. This increases the utilization of shared physical resources and enables smooth adjustments as traffic flows change between virtual servers and virtual storage LUNs. The fabric can adjust bandwidth and other network resources according to defined service levels, delivering a kind of "predictive intervention"—if monitoring predicts that congestion will occur, the fabric can intervene to prevent bottlenecks. Flows can be re-routed or throttled according to application service levels and traffic can be reduced to relieve network congestion.

Adaptive Networking introduces several new services:

- **Fabric QoS** allocates fabric resources based on the relative importance of the application receiving them. Most important, QoS priorities will follow applications as they move among physical servers and fabric connections. Virtual channel technology enables Adaptive Networking Services to monitor usage, detect or predict congestion in the data path, and dynamically adjust resources to avoid congestion while maintaining relative QoS priorities.
- **Traffic management services** manage network congestion to support application service levels. Automatic ingress rate limiting and advanced queuing algorithms can dedicate bandwidth to particular applications as well as eliminate network congestion.
- **Fabric dynamic profiling services** provide end-to-end analysis of application-based traffic flows and resource usage, which help to identify congestion points. These services monitor and report on physical resource utilization to assist in provisioning, capacity planning, and fault isolation.
- **Policy management services** prevent buffer credit exhaustion to optimize fabric flow control. These services can also detect when shared physical resources are under-utilized so that they can be reclaimed and reallocated.

Server Application Optimization (SAO)

Brocade SAO works with Brocade Fibre Channel host bus adapters (HBAs) to improve application performance and virtual machine (VM) scalability by extending fabric services like QoS from the fabric to physical and virtual servers. It enables organizations to prioritize traffic flows for end-to-end application-oriented QoS, allowing organizations to maximize the number of VMs per server, simplifying consolidation and increasing efficiency. As more and more virtual machines share individual network adapter ports, SAO can ensure deterministic SLAs for multiple, mixed workloads. Application-level performance monitoring and diagnostics simplify overall management.

High Density Brocade Backbone

Another part of the Brocade One Architecture is the Brocade DCX Backbone, which offers up to 512 Fibre Channel ports in up to eight vertical blade slots using 4 or 8 Gbps SFP connections. It is also capable of running converged networks with 10 Gbps FCoE and has blades for storage extension and encryption. The DCX Backbone offers the non-disruptive scalability and flexibility required for data center consolidation and virtualization, particularly as more and more virtual servers occupy fewer physical machines. Consolidating on high-density backbones reduces equipment and data center costs, including those associated with power and cooling. Management is delivered through Brocade's Data Center Fabric Manager (DCFM) which provides centralized, multi-site, multi-fabric, end-to-end management of enterprise scale data center networks. In virtualized environments, this end-to-end management will be critical as organizations leverage advanced mobility functions to seamlessly move applications throughout the data center fabric. DCFM also provides proactive monitoring and alert notification.

Hitachi Virtual Storage Platform

The Virtual Storage Platform (VSP) is the latest version of Hitachi's award winning enterprise-class storage platform. Hitachi based VSP on the belief that today's IT environments must be virtualized, automated, cloud-ready, and sustainable—and that the best vehicle to deliver those features is via simplified storage architecture. VSP is a central, virtualized platform for all of an organization's data—open systems and mainframe, block, file, and object-based content—supporting a virtualized, multivendor, multi-platform infrastructure. The VSP was designed to:

- Flexibly adapt for performance and capacity
- Support multivendor storage
- Use a 3-D scaling architecture to scale up, scale out, and scale deep
- Offer unique management capabilities

Hitachi achieved the creation of single platform for all data by integrating multiple products, including the Virtual Storage Platform, with 3-D scaling, Hitachi Command Suite 3D management capabilities, Hitachi Dynamic Tiering software, the Hitachi NAS platform powered by BlueArc, the Hitachi Content Platform for distributed object storage, and the Hitachi Data Discovery suite for content search and eDiscovery.

Scale Up, Scale Out, Scale Deep

3-D scalability is a unique and valuable capability of the VSP platform. *Scale up* enables the system to start in a small footprint (using standard 19-inch racks) and grow while retaining the ability to manage a common pool of resources. The system can scale dynamically to optimize workload performance by adding capacity and connectivity (including cache, processors, connections, and disks) without disruption. It is the only enterprise storage platform currently using the 2.5-inch disk drive form factor for high storage density to reduce power demands.

The ability to *scale out* means that the Virtual Stored Platform can combine multiple units into a single logical system, non-disruptively adding capacity, performance, and connectivity as needs grow. Servers can access resources from a common pool of storage and the VSP can also dynamically partition storage resources between servers for safe multi-tenancy and QoS.

Scale deep is a new dimension that extends the functions of the VSP to external, multivendor storage. VSP can currently virtualize 200+ models of storage and up to 255 petabytes of capacity. Dynamic virtualization of new and existing storage systems let those systems join the VSP pool, adding its “scale up” and “scale out” features. Once virtualized, all data can be migrated, tiered, and managed by the VSP—including backup services, replication, snapshots, and other advanced functions. This way, organizations can increase the ROI of older systems by extending their useful lives for uses such as disaster replication. The common management framework reduces OPEX while using lower-cost storage tiers where appropriate to reduce CAPEX.

Three-dimensional management is equally important. The VSP can “manage up” to unify and scale large deployments, “manage out” using a single tool for all Hitachi and virtualized storage, and “manage deep” via integration with the Hitachi Command Suite for operational efficiency. This unified element manager simplifies management and reduces operating expenses for all of Hitachi’s storage platforms—something other enterprise storage vendors have promised, but have not yet delivered. Dynamic provisioning and tiering optimize data placement and can reduce storage costs dramatically. Host-transparent migration to and from multivendor storage devices can deliver up to 80% less effort and cost. Common interfaces for task management, scheduling for multithreaded operations, additional data sharing, and synchronization all help reduce administrative costs.

Energy Efficient

According to Hitachi, VSP systems offer up to a 48% reduction in power over the previous generation. They are built with air flow that moves from front to back for energy efficiency in standard data center hot/cold aisle designs. Numbers and types of processors were selected for energy efficiency; in addition, VSP uses SAS for internal drive connections instead of Fibre Channel to reduce cost and complexity while increasing density and efficiency.

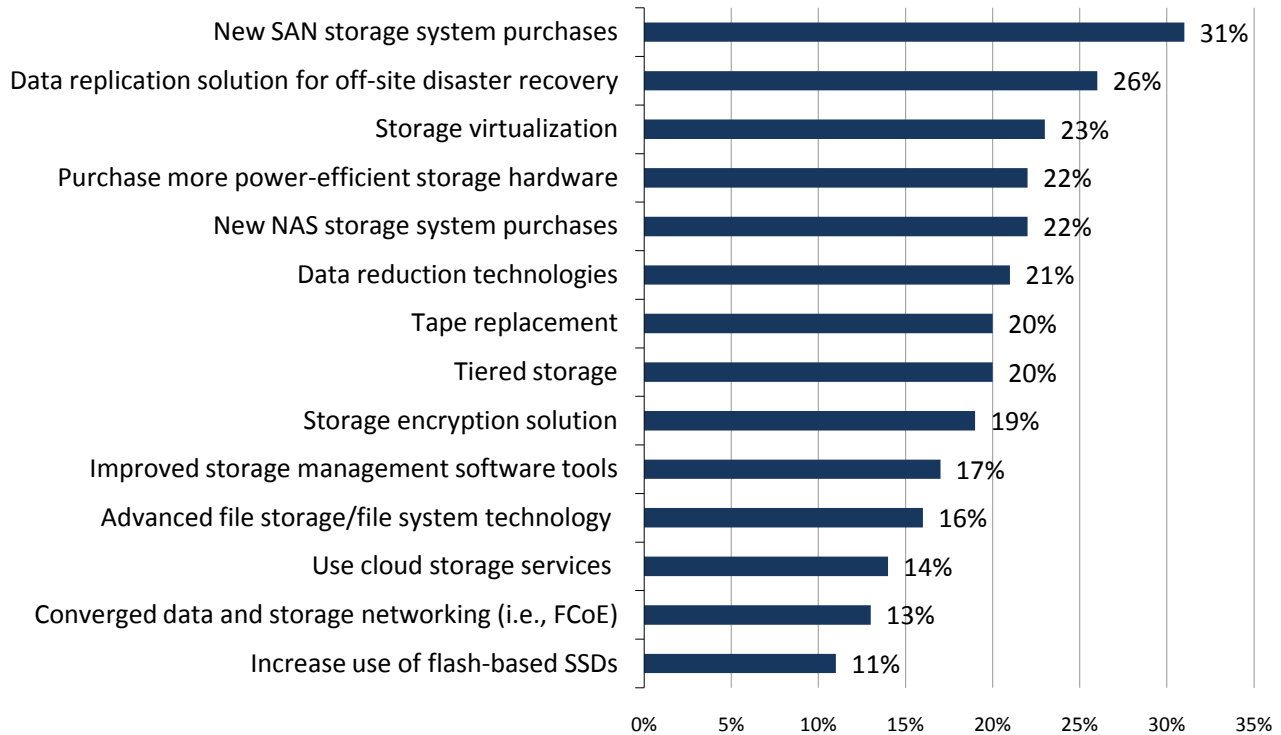
To sum up, the VSP is roughly twice as fast and requires about one third less data center footprint (power, cooling and floor space). Because it provides a single, virtualized, scalable storage and management platform for all types of data, VSP can enable a cloud service structure. Multivendor storage, once virtualized, inherits the characteristics and functions of the Virtual Storage Platform to extend the life and value of older technology.

Good Timing

The combination of Brocade One and the Hitachi VSP is well-timed given the priorities of IT organizations. ESG research indicates that the top IT priority is to increase the use of server virtualization and, for storage, the top four investments over the next 12 to 18 months will be seen in new SAN storage, disaster recovery replication solutions, storage virtualization, and more power efficient storage devices (see Figure 3). Solutions that enable optimized end-to-end virtualized environments will be in high demand.

Figure 3. Expected Storage Spending

With regards to specific spending plans for data storage, in which of the following areas will your organization make the most significant investments over the next 12-18 months? (Percent of respondents, N=286, five responses accepted)



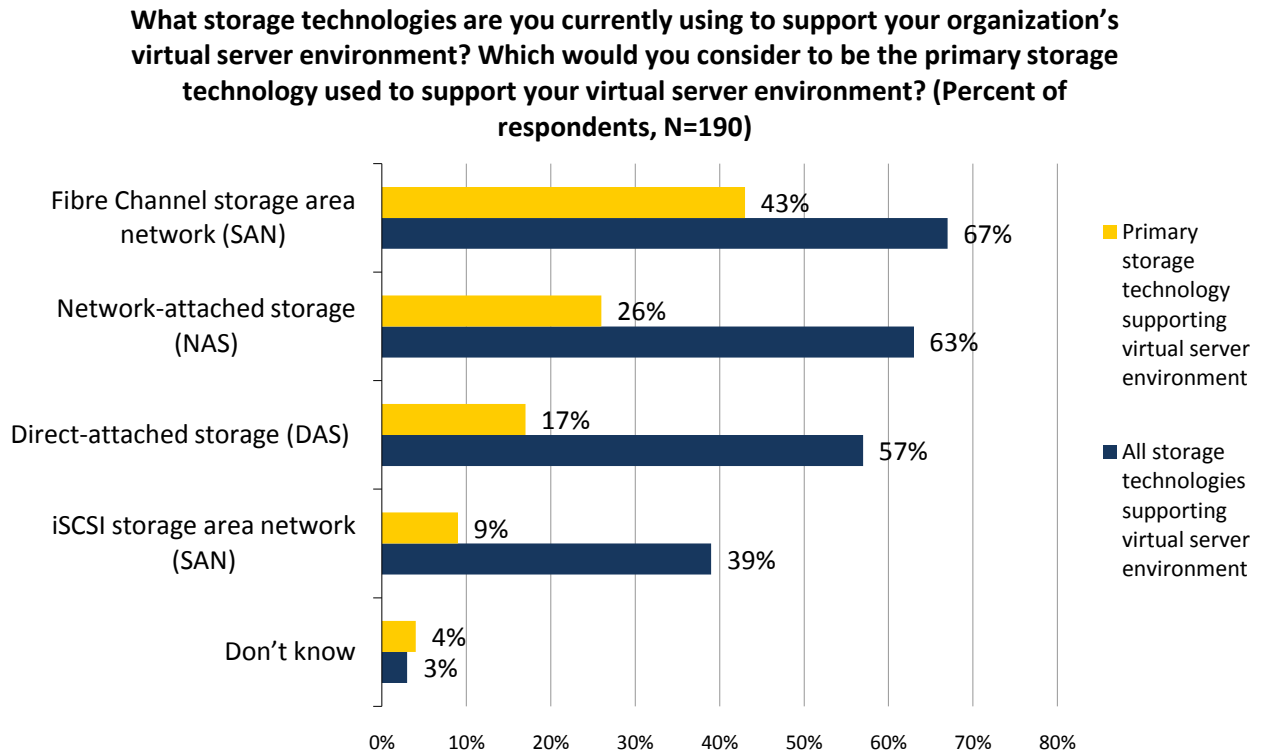
Source: Enterprise Strategy Group, 2010.

Fibre Channel is the Choice for Today’s Virtualized Data Center Environments

While it is not the only protocol used in virtual server environments, Fibre Channel remains the most widely adopted. As ESG uncovered in recent research, 67% of responding organizations support virtual servers using a Fibre Channel SAN with 63% using NAS, 57% using DAS, and 39% using iSCSI (see Figure 4).² When asked which they consider to be the primary storage technology supporting virtual servers, 43% indicated Fibre Channel SAN. Only 26% called NAS their primary storage for virtual servers, along with 17% for DAS and 9% for iSCSI. Clearly, Fibre Channel remains the dominant storage technology for virtual server environments. As the number of workloads running on virtualized environments continues to increase, Fibre Channel is well positioned for next generation data centers deployments, especially with the recent approval of the 16 Gbps Fibre Channel standard (FCIA in 2010). ESG also expects that, as FCoE matures as a standard and technology, FCoE can provide a means for further consolidation of data and storage traffic.

² Source: ESG Research, 2010.

Figure 4. Storage Technologies in Virtual Server Environments



Source: Enterprise Strategy Group, 2010.

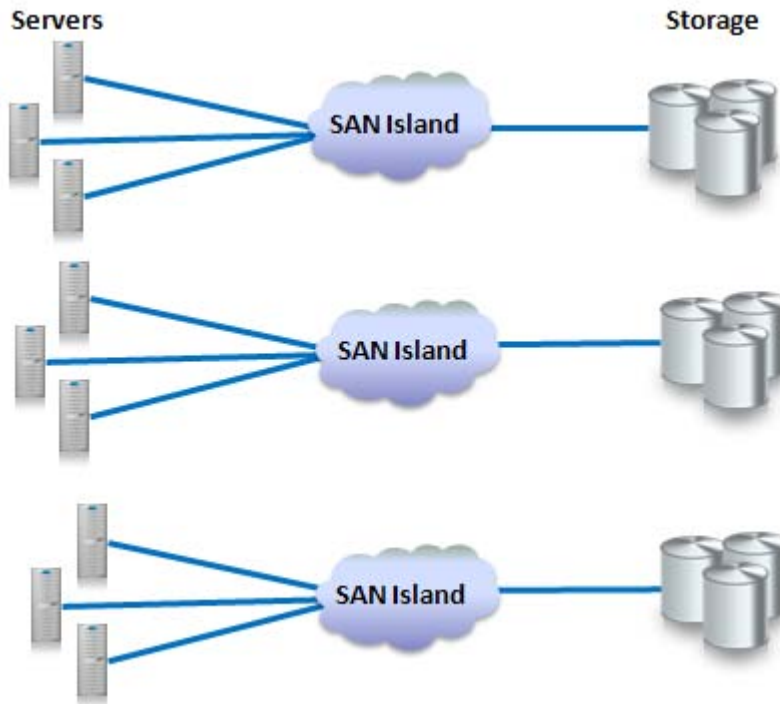
Investment protection

Creating this type of network and storage infrastructure does not have to mean a disruptive rip-and-replace event with Brocade One and Hitachi VSP. Both architectures were designed to make the transition to a highly flexible network and storage environment simple and cost-effective with minimal disruption and risk. Both solutions deliver simplified architectures for their respective domains, letting organizations continue to utilize their current assets while introducing extended capabilities and future technologies like 16 Gbps FC and FCoE. This strategy presents the option to have a dedicated storage network or a converged data and storage network, depending on customer preference. It also makes the entire computing environment more robust and resilient and lets internal (or external) customers deploy flexible, cloud-based service delivery.

Reference Architecture

Developing new and innovative technology is great, but the ability to apply the technology to solve a business problem is even better. As businesses demand greater agility from their IT environments, IT needs to be able to respond in a timely manner. By combining the technology that HDS and Brocade have developed, organizations can create a highly virtualized, dynamic environment to deliver higher levels of service to the business. To understand the value of the Brocade and HDS solution, first consider the current state of the data center. Figure 5 represents a common data center configuration, leveraging legacy infrastructure and static design principles. The typical configuration consists of islands of compute, networking, and storage that are inefficient and create increased complexity. The ability to respond to changes or requests for new services is limited and manually intensive. Provisioning times are measured in weeks or months.

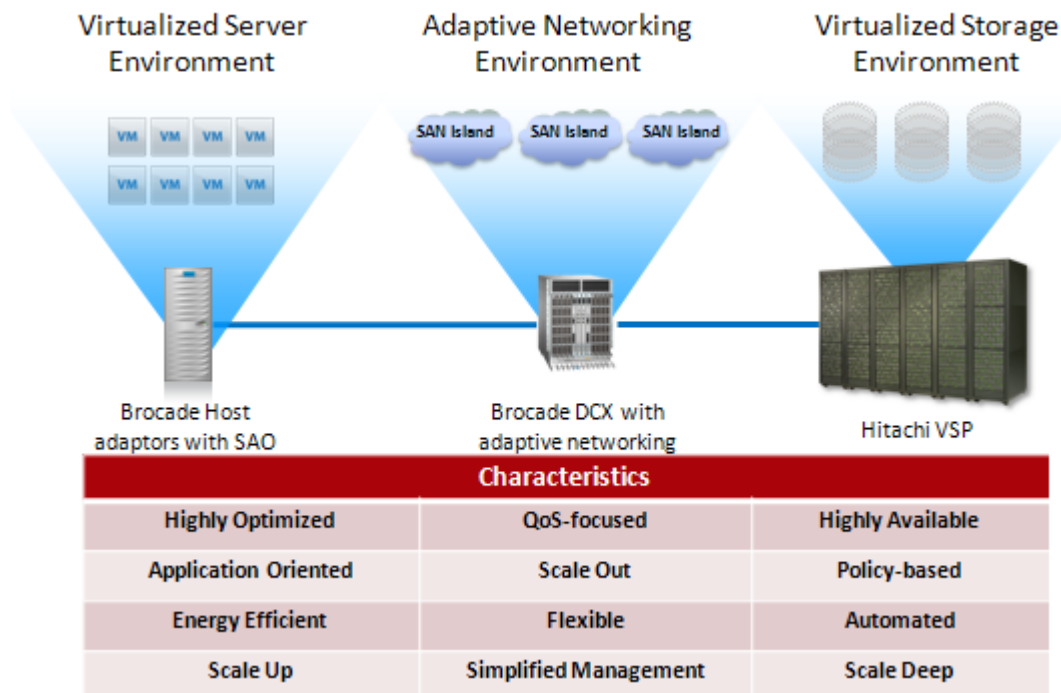
Figure 5. Current IT Architecture



Source: Enterprise Strategy Group, 2010.

To create an optimized end-to-end virtualized environment, organizations need to deploy solutions that simplify the environment while delivering greater levels of automation and scalability. Moving forward, organizations will need to deploy innovative technologies like those provided by HDS and Brocade. The data center of the future will look more like Figure 6.

Figure 6 Reference Architecture for End-to-end Virtualized Environments



Source: Enterprise Strategy Group, 2010.

Getting Started

The reference architecture shown in Figure 6 does not require a wholesale change of your current environment. Starting points will vary; for example, organizations in the process of expanding their use of server virtualization technology typically deploy new servers and augment existing SANs. This presents an opportunity to leverage Brocade HBAs in the new servers and DCX Backbones (if not already deployed) leveraging Adaptive Networking Services and clustering capabilities. The Hitachi Virtual Storage Platform was designed to incorporate almost all other storage arrays behind a layer of abstraction, which can be done as time permits.

Of course, in order to achieve all of the benefits described in the previous section, deploying and utilizing all the technology as soon as possible will yield the highest returns on investment. Every data center environment is unique and has its own challenges. To help organizations navigate to the desired end state, both Brocade and Hitachi have professional services organizations that can help accelerate time to value as the data center is transformed from a fixed and rigid architecture into a highly optimized and dynamic infrastructure.

The Bigger Truth

What business executives envision, IT must deliver. The global business environment moves fast—those organizations that can adjust quickly will be much better positioned to increase revenue and market share.

IT departments realize that new architectures are needed to deliver the adaptability businesses require. Legacy infrastructures that segregate information, are complex to manage, and cannot scale quickly hold an organization back. And, while virtualization is certainly an important part of the solution, the consolidation of server workloads, network services, and storage can cause application performance degradation if not implemented properly.

Brocade and Hitachi have developed innovative solutions to help deliver the flexibility, scalability, automation, and energy efficiency needed. The Brocade One Architecture, with Server Application Optimization, Adaptive Networking Services, and high-density DCX Backbones, helps to position the networking infrastructure to take advantage of consolidation and virtualization while improving service delivery. Hitachi's new Virtual Storage Platform provides a single storage platform for all data types, enabling a virtualized, automated, cloud-ready, sustainable storage architecture. The ability to scale up, out, and deep offers the kind of streamlined, cost-efficient, agile infrastructure businesses need. For both Brocade and Hitachi, QoS features enable prioritization of services so that budget is spent for maximum return.

Innovation can be difficult to incorporate. Building reference architectures makes it much simpler for customers to incorporate end-to-end virtualization—Brocade and Hitachi have done the work up front so their customers don't have to.

Organizations need to transform the data center in order to meet the demands of the business. Deploying innovative architectures like the Hitachi VSP and Brocade One to accelerate that transformation should be a strategic differentiator in a very competitive global market.



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