White Paper

The Importance of Fabric-Based Architectures for Storage

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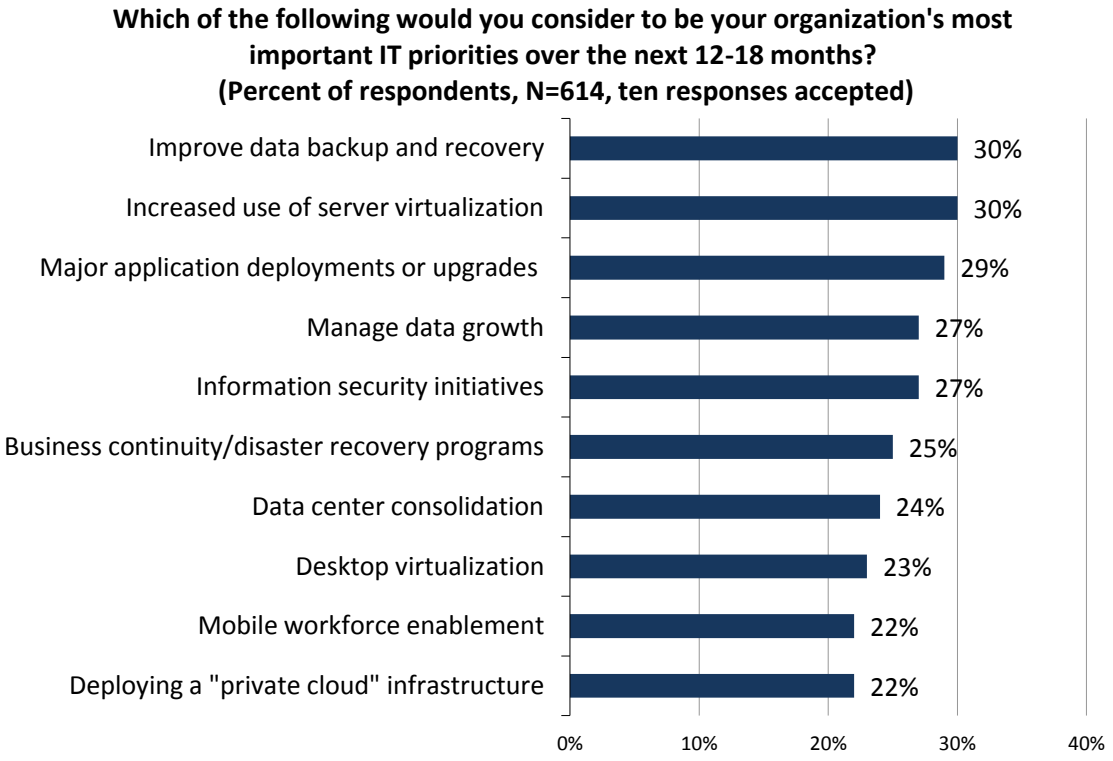
Virtualization and Consolidation Still Driving Change

In order to remain more competitive in a global market, businesses rely on their IT infrastructure to give them a competitive edge. However, in order for that to happen the IT environment needs to be agile and responsive to the needs of the business. Thus many organizations are transforming their IT infrastructure from a legacy rigid and physical environment to a consolidated and highly virtualized one. In fact, according to ESG research findings:

- Organizations continue to increase their use of server virtualization. Increased use of server virtualization is the most commonly cited IT priority of 2012, chosen by 30% of survey respondents, and in fact has been the top overall priority reported in the previous two years of ESG's annual IT spending intentions survey (see Figure 1). In addition to being a top priority, it has also consistently been reported as one of the top areas of increased annual spending. As these server virtualization environments mature and move beyond the simple consolidation benefits to realize higher levels of agility, a natural progression into private cloud environments begins. Validating this is the fact that deploying a private cloud infrastructure was—for the first time—among the top ten most important IT priorities reported by respondents.[1]

Figure 1. Top Ten IT Priorities for 2012



Source: Enterprise Strategy Group, 2012.

- Organizations are rapidly consolidating data centers. Another perennial favorite that has appeared in the top ten list of ESG research respondents' most important IT priorities for the past three years is data center consolidation. This drive to consolidate data centers has resulted in far fewer, but much larger and more complex environments. In a separate ESG research survey on data center networking, 63% of the respondents stated that they had either just completed a data center consolidation or were in the process of consolidating data centers. Furthermore, of that 63%, almost half, or 48%, stated that they were building out multitenant environments, which will only increase the complexity.[2]

[1] Source: ESG Research Report, *2012 IT Spending Intentions Survey*, January 2012.
[2] Source: ESG Research Report, *Data Center Networking Trends*, January 2012.

The combination of these IT initiatives is placing more strain on the network environment to be able to dynamically adjust as well as accommodate increased throughput requirements.

Impact on the Storage Network

These initiatives are having a profound impact on the storage network. Storage network architectures must be highly flexible and scalable to handle not only data growth, but also the unpredictable demand of self-service cloud portals. Additionally, VM densities, or the numbers of VMs hosted on each physical server, are steadily increasing, from 5-10 VMs per physical server to over 25 VMs per physical server which is driving demand for higher performance (bandwidth and I/O) and availability from the storage infrastructure. In highly virtualized environments, any congestion, poor I/O performance, or failures in the storage network will impact many more applications.

In addition, the ability to rapidly provision and move VMs and storage resources requires a vastly simpler and easy-to-manage infrastructure. That means not just greater automation of network tasks, but management across the domain instead of by individual device. Automation enables the network to be more flexible and agile as highly virtualized/clouds demand, simplifies administration, and reduces costs. Forty percent of the respondents from the aforementioned data center networking research report having a problem with too many manual processes in their network operations, which results in delays configuring and provisioning network devices (see Figure 2).[3]

[3] Source: Ibid.

Figure 2. Challenges with Existing Networks

Source: Enterprise Strategy Group, 2012.

New Requirements for Storage Networks

More than ever, there is a strong interdependency between the server virtualization environment, the network, and the storage environment. After all, it's the network that seamlessly connects all of the server and storage resources together. In order to keep up with highly virtualized and consolidated environments, organizations need to architect better networked storage environments capable of:

- **Cloud scale/Performance**. Highly virtualized/cloud environments provide on-demand access to shared pools of infrastructure resources, and often include self-service portals. As a result, they must be able to quickly increase resources on demand—without impacting performance. The storage network must be able to scale to great heights, and then easily scale back down with minimal intervention.
- **High Availability**. Built for dynamic, 24x7 IT service delivery, storage networks supporting cloud infrastructures must provide high availability of applications and data. That means storage networks must be fault tolerant and redundant; provisioning and maintenance must be done without downtime; and data must be protected and available in the event of a failure or corruption.
- **Operational simplicity.** To meet increasing business demands, new applications and services need to be deployed as quickly as possible, driving the need for simplified storage network configuration and cross-

domain management. In addition, automated features should be available to handle certain tasks such as network load balancing and failover, bandwidth trunking, and dynamic fabric provisioning. To achieve the efficiency and agility required by highly virtualized/cloud environments, automating manual processes and high levels of task automation and orchestration are required.

Taken together, this is a hefty list of requirements—and one that is likely to grow in the future. Increasing virtualization and cloud usage will no doubt escalate workload variations as well as the size of deployments. It seems fair to say that it is not a trivial decision to choose the appropriate storage network to support a highly virtualized/cloud environment.

Storage Requires Fabric-Based Networks

As a result of many of the IT initiatives and requirements outlined in the previous section, it is clear that most legacy storage networks will struggle to keep pace with highly virtualized and consolidated environments. The evolution of storage and storage networking technology enables enterprises to address these new and diverse set of requirements with a variety of Fibre Channel and Ethernet storage solutions based on purpose-built fabric architectures.

Fabric technology replaces legacy point-to-point and hierarchical networks with flatter, flexible, resilient, and scalable networks. Fibre Channel was originally introduced as a purpose-built network for storage traffic designed for low latency, high performance, and reliable transport of storage traffic. Over time, it evolved from a point-to-point to a fabric-based architecture that proved to be the preferred networking infrastructure for storage capable of addressing reliability, performance, and scalability requirements.

Ethernet has been the de facto general purpose networking infrastructure for data networks. Originally, storage had to be adapted to Ethernet in order to overcome performance and reliability limitations. Traditional hierarchical 3-tier architectures proved to be inadequate for large scale Ethernet storage environments due to the concerns over complexity, flexibility, and scalability.

Recent technology innovations and architectural changes have led to fundamental changes to Ethernet to adapt it to storage for critical applications and data. The gradual migration from 1 to 10 GbE addresses the performance limitations. The introduction of lossless Ethernet via Data Center Bridging (DCB) addresses the reliability and congestion control concerns. Finally, Ethernet fabric technology was introduced to flatten and simplify traditional hierarchical Ethernet networks. Ethernet fabrics that include the storage enhancements provide the best network infrastructure for deploying 10 GbE block (iSCSI) and file (NAS) storage.

Depending on the needs of the application or workload, organizations may choose different protocols and storage devices to address cost, scalability, reliability, and performance criteria. For instance, organizations typically deploy block-based Fibre Channel for transactional applications such as OLTP and databases with I/O intensive, latency sensitive workloads where performance and reliability are important. Non-transactional, less critical applications such as e-mail, video or collaboration could leverage block-based iSCSI or file-based NAS. Server virtualization technologies have predominantly leveraged block-based Fibre Channel, but there is increasing adoption of Ethernet-based storage.

It is clear that organizations will continue to deploy multiple types of storage to meet the needs of the wide spectrum of applications and workloads. Regardless of storage type, Fibre Channel and Ethernet fabrics should be the network foundation that connects virtual and physical servers to storage resources to address the reliability, scalability, and simplified management requirements.

Brocade Data Center Fabric Solutions

Brocade Fibre Channel and Ethernet fabrics were designed to deliver lossless, deterministic network services that keep latency low, scale rapidly, are simple to manage, and are highly available. Brocade fabric-based switches and adapters are built for highly virtualized/cloud environments. They offer the requisite high performance and resiliency for Fibre Channel, iSCSI, and NAS storage environments, and deliver the simplicity, high level of features, and virtualization awareness that clouds demand. Brocade solutions support:

- **A Fabric-based Approach**. Brocade fabrics are different from standard hierarchical networks; they provide higher levels of performance, utilization, availability, and simplicity. They are designed to be flatter and include properties such as self-aggregation, self-healing, transparent internal topology, and Layer 2 multilayer multi-pathing, all of which help to minimize manual intervention. Fabrics take advantage of distributed intelligence, which allows network policies and devices to be known at every port. Brocade Fabrics include:

    - **Fibre Channel Fabric.** Brocade DCX 8510 Backbones and enterprise-class Fibre Channel switches are easy to deploy and simplify scale-out network design, reducing complexity, management, and costs. With "pay-as-you-grow" scalability and 16 or 8 Gb Fibre Channel line-rate connectivity on all ports, Brocade Fibre Channel fabrics provide the flexibility and performance that clouds need. For organizations with considerable existing investments in Fibre Channel SANs, the consolidation of legacy SANs will optimize port density and space utilization, saving money as multiple environments combine into a single fabric. Brocade's industry-leading and data center proven reliability meets the needs of dynamic cloud environments, offering enhanced diagnostics and reliability, availability, and serviceability (RAS) functionality to minimize disruption and maintain uptime.

    - **Ethernet Fabric.** Brocade VCS Fabric Technology provides a flatter, more reliable Ethernet network. By eliminating the Spanning Tree Protocol, it delivers active-active server connections, doubling network utilization, and improving resilience. This flat, multi-path, deterministic mesh network is ideal for IP storage environments, virtualized data centers, and cloud computing. It supports a flexible topology so that it can handle changing application demands, and seamlessly interoperates with all industry-standard Layer 2 switches. In addition, it offers elastic scalability—switches can be added and removed without manual configuration. It scales out in a modular fashion with consistent performance and latency, and IP storage traffic can be configured for transmission over lossless Ethernet channels for optimal performance.

- **Any I/O included Fabric Adapters**. Featuring Brocade AnyIO technology, Brocade fabric adapters support native 16 Gb Fibre Channel and 10 GbE Ethernet Data Center Bridging (DCB) connectivity, offering a single fabric adapter to meet all the connectivity needs of highly virtualized, cloud-enabled data centers. With Brocade fabric adapters, you can configure the server once and then seamlessly repurpose that server with minimal disruption, an important capability for hosted and public cloud providers. Brocade fabric adapters extend Fibre Channel and Ethernet fabric services to the server and applications, delivering unmatched performance, application-aware services, and reduced cost and complexity**.**

- **Centralized Management with Brocade Network Advisor.** Brocade Network Advisor unifies the management of adapter, Fibre Channel, and Ethernet fabric resources, reducing management complexity and costs. With "at-a-glance" health and performance dashboards, Brocade Network Advisor provides advanced monitoring, diagnosing, and troubleshooting capabilities that avoid problems and minimize downtime. In addition, Brocade Network Advisor is integrated with leading hypervisors and virtualization management solutions such as Microsoft SCOM and VMware vSphere to enable a single point of data center management**.**

The Bigger Truth

Organizations are rapidly transforming their IT landscapes to better serve the business. As part of this transformation, organizations are increasing their use of server virtualization technologies and clouds. In these environments, the network plays a vital role, especially the storage network environment.

IT has always recognized that it is important to have the right infrastructure to support the environment. Even with the ability to consolidate, organizations have determined critical storage requires dedicated, purpose-built storage networks; Fibre Channel fabrics being a case in point. Ethernet storage will also benefit from a dedicated Ethernet fabric that provides flatter, DCB-enabled infrastructure to deliver higher levels of performance and availability.

Brocade data center fabrics have been designed from the ground up to enable dynamic virtualized and cloud environments. The company's heritage in producing high performance, extremely reliable storage network infrastructure serve as a solid foundation to evolve its technology into more abstracted and virtualized data center fabrics. By adding innovative technology, and by supplying complementary technology in the form of fabric adapters and management software that allows organizations to have better end-to-end insight and control, Brocade is enabling the storage network to keep pace with the dynamic nature of the data center environment.

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