

# White Paper

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## The Evolution of IP Storage and Its Impact on the Network

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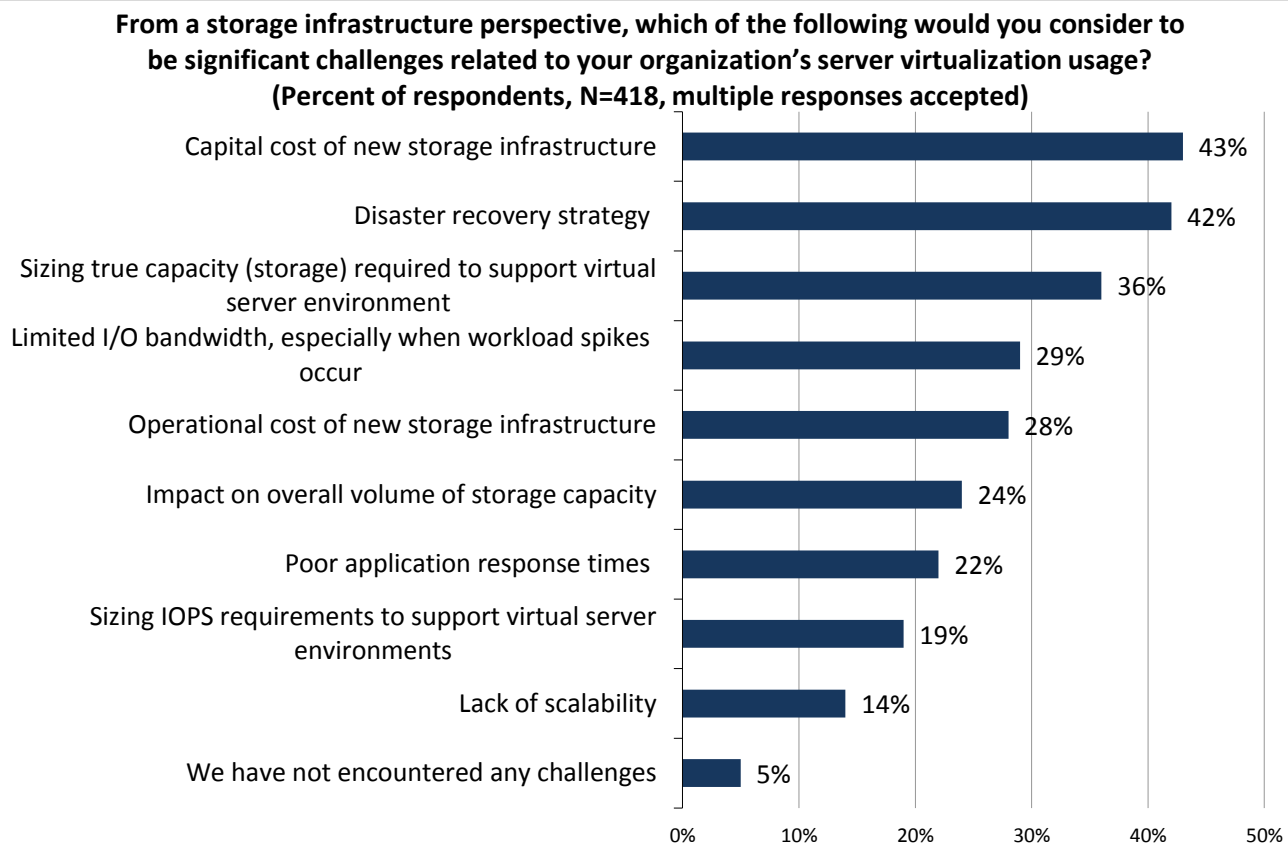
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## The Rise of IP Storage Networks

As data growth skyrockets, technology innovations must keep pace. With processing power ramping at the rate of Moore’s Law without a hint of slowing down, a single server can handle more operations and more workloads than ever before. It is no surprise that server virtualization has become increasingly popular over recent years. As organizations look to reduce hardware expenses through consolidation with server virtualization, more workloads find themselves shoved into the same hardware, placing greater pressure on the network. Each workload still needs to move the same amount of data regardless of whether it resides on dedicated or virtual hardware. With multiple workloads serving multiple data types on the same hardware, the possibility of one application having some kind of adverse impact on another increases. If one workload suddenly demands more resources, it can quickly eat into the available bandwidth of its neighbors.

In a research study of over 400 IT and data storage professionals, ESG investigated the challenges that organizations are experiencing with virtualized environments. In addition to the most-cited challenges related to protecting the IT infrastructure and paying for it, almost one-third of respondents called out limited bandwidth, especially when spikes occurred, as a significant challenge.<sup>1</sup> To compensate for the increased stress resulting from virtualization and provide a more predictable environment, it is important for IT organizations to pay more attention to infrastructure design and support, especially in regard to the network.

Figure 1. Storage Challenges Stemming from Server Virtualization Usage



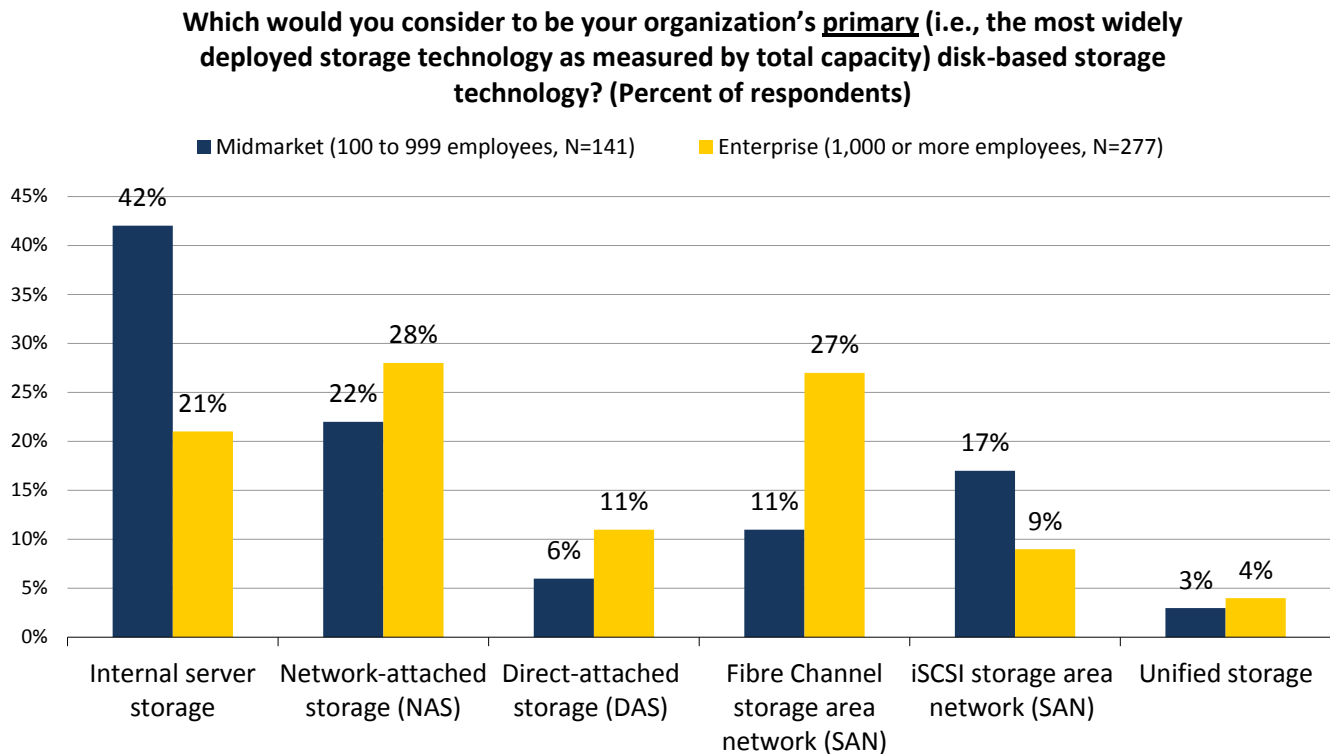
Source: Enterprise Strategy Group, 2014.

The benefits of consolidation do not, however, eliminate the need to provide a reliable and predictable IT ecosystem, regardless of whether the infrastructure is server, storage, or networking. While designing infrastructures for reliability, mission-critical applications tend to dominate the priority, but care in planning is important for non-mission-critical applications, as well. For instance, if 20 non-mission-critical applications go offline at once, it becomes a mission-critical problem.

<sup>1</sup> Source: ESG Research Report, [2012 Storage Market Survey](#), November 2012.

Over the past few years, as server virtualization has become a de facto standard, IP storage networks have also gained interest from professionals within the data center. ESG research on disk-based storage technologies in use revealed that, in terms of capacity, outside of internal server storage, NAS is the primary file-based storage technology reported by both enterprise and midmarket respondents. For block storage SAN, Fibre Channel (FC) continues to be the predominant choice for enterprises while iSCSI is slightly more popular for midmarket.<sup>2</sup>

Figure 2. Primary Disk-based Storage Technology in Use, by Company Size



Source: Enterprise Strategy Group, 2014.

Unlike FC networks that are dedicated to FC traffic and managed by the storage team, IP storage traffic protocols, such as NAS, are often deployed over the general-purpose LAN infrastructure sharing bandwidth with non-storage traffic. Also contrary to FC, this shared IP network is often managed by the network team as opposed to the storage team.

While the opportunity to drive efficiencies by leveraging the existing IP network infrastructure to carry storage traffic may seem attractive, it also creates challenges such as the inability to guarantee the stringent SLAs that mission-critical workloads require.

Which raises the question: Why are IP and FC storage networks treated differently? FC networks are purpose-built for storage, and storage traffic is the only workload that runs over the infrastructure. This isolation from other network traffic provides greater predictability and reliability. Herein lies the paradox. The data that traverses FC or IP storage networks is often the same, and the workloads are often the same. If the importance of data accessibility is the same, why isn't the network treated the same?

## The Case for Dedicated IP Storage Networks

On the surface, the case to deploy IP storage over the general-purpose network seems to make sense. After all, the infrastructure already exists. The potential for cost savings may seem enticing, but a number of issues can arise when consolidating networks that outweigh any potential benefits. For example, typically the general-purpose

<sup>2</sup> Source: Ibid.

network isn't optimized for storage traffic, which can lead to availability and performance issues. Additionally, failure domains cannot be contained and troubleshooting is complex.

With workload consolidation from server virtualization placing extra pressure on the networking infrastructure, consolidating IP storage and LANs can serve to only further exacerbate the issues. Storage networks need a high-performance environment to achieve application service level agreements (SLAs). Traffic on storage networks tends to be more predictable because even high-traffic or heavy-bandwidth events, such as backups, can be anticipated and scheduled. LAN traffic patterns are more difficult to predict.

By isolating the storage network, high-traffic non-storage events that could impact mission-critical workloads can be eliminated, providing more predictability for workload bandwidth, along with higher performance and availability.

There are also organizational and operational challenges associated with managing the network separately from storage. The storage team must coordinate with the network team to add storage capacity, or secure a change window. If an application is experiencing performance degradation or it cannot access the storage, who is going to take the service call? Who is responsible for ensuring the data is available? Chances are it will be the storage team. In turn, they must coordinate with the network team to isolate the root cause of the problem. The extra cycles and bureaucracy created through cross-organization interaction between storage and networking teams slows down response times and inhibits an organization's ability to meet SLAs. Additionally, workloads or data going offline is difficult enough to diagnose. Trying to isolate an issue across multiple organizations can make it even more challenging. When an issue occurs, response speed is critical because downtime can result in lost revenue, a poor customer experience, or damage to the business' reputation. As organizations invest in ensuring that the right management and diagnostic tools are in place, it is also important to invest in the right organizational structure. A single owner for storage can reduce confusion and speed up the resolution process, thereby improving reliability and predictability.

## What to Look for When Building an IP Storage Environment

When evaluating storage networking infrastructure providers, there are a few important elements to keep in mind. In addition to working with a partner with a history of experience and innovation in storage networking, it is important that the provider understand the unique characteristics of mission-critical storage workloads and offer solutions that are optimized for an IP storage environment delivering the levels of performance, availability, and simplicity that organizations have come to expect from their FC SAN infrastructures. Some capabilities to look for include the following:

- **Ground-up design:** Five years ago, it was inconceivable that an enterprise would trust its mission-critical data to an IP storage solution. However, times have changed. Today, business-critical data is increasingly being stored on IP-based storage. Choosing the right networking solution can help to ensure that your infrastructure delivers the network performance and utilization that these workloads demand. Look for fabric solutions that provide load-balanced multipathing, similar to FC, for predictable performance and efficiency. Another capability to look for is support for deep buffers, which helps to better handle spikes in network traffic and reduce packet drops. However, it's important to consider that most switches are optimized for either deep buffering or low latency, which means you generally must trade off one attribute for another. Look for a solution that offers deep buffers without substantially compromising latency.
- **Automation and simplicity:** You know how easy it is to provision a FC SAN. An IP storage network should be no different. Look for a solution that is highly automated and provides zero-touch provisioning to minimize human intervention and error. Also, consider solutions that enable you to centrally manage and configure multiple switches, treating them as a single logical switch. If your organization leverages a data center orchestration framework, such as OpenStack, it's important that your switching infrastructure support this as well to enable orchestration of the network.
- **Management, monitoring, and diagnostics:** Other important elements to investigate are tools to help storage administrators manage IP networks. While many storage administrators already possess familiarity

with IP technology, simple tools can ease the learning curve if necessary. Some vendors provide unified storage management consoles to manage both FC and IP networks as one entity, an approach that can significantly improve operational efficiency. Another issue to consider is the availability of robust tools to enable visibility and insight across the entire storage environment with monitoring and diagnostics for both FC and IP. Integration with third-party storage analytics solutions, such as VMware vRealize, is another important factor to consider.

## Customer Case Studies

While isolating storage networking hardware and consolidating ownership of the entire data path can make sense logically, results from actual customer environments can go a long way in providing credibility to the real benefits of separate IP networks. ESG gathered data on several customer environments that isolated the storage network from the LAN to understand the possible benefits and trade-offs.

### Predictable Hosted Cloud Delivery with IP Storage Networks

#### Organization Profile

##### Industry

Global IT services provider

##### Challenges

- Scaling and supporting high-bandwidth virtualized applications

##### Benefits

- High availability and predictability
- Simple management of SAN and IP storage environments

#### About the Organization

Recently, this global IT services provider built a new data center with the intent to deliver hosted cloud services to customers. Within the data center, the storage team manages both the storage systems and the storage networks. Additionally, the storage network infrastructure required high storage network bandwidth to support the backup of large Oracle databases.

#### Business Needs

To provide storage resources for the firm's hosted cloud offering, the storage team chose to deploy a separate IP storage network. The driving factor for this decision was the desire to eliminate reliance on the LAN team for bandwidth and port allocation. Based on business considerations, the storage team deployed NAS technology via IP storage networks to support the virtualized applications.

#### The Solution

Isolating storage from LAN traffic provided the IT department with a high-performance and predictable network environment. The design allocated multiple traffic paths between the source and destination to the storage networks for high availability. The organization also found that separating the IP storage network and deploying a fabric-based design greatly simplified the network infrastructure. The resulting flat network was easier to manage and secure. The offering deployed for this solution offered a deep buffer hardware capability to support high load conditions. The result was the delivery of reliable and predictable performance regardless of traffic load by reducing latency and the likelihood of packet drops. Additionally, when selecting a partner, the organization chose one with a long history in storage networking to ensure that

the partner's support teams better understood the entire storage ecosystem and could speak the language of the storage organization. By enabling the storage team to manage the entire storage infrastructure, including the storage network, the environment was able to scale as needed and to keep pace with the growth of the business.

## Efficiency through Storage IP Network Isolation

### Organization Profile

#### Industry

Leading North American bank

#### Challenges

- Reliance on network team for network port provisioning limited the ability to keep pace with business demands
- Demand for “always-on” availability and flexibility to enable future storage capacity growth

#### Benefits

- Gained autonomous administrative control over IP storage switches for flexibility in addressing storage needs
- Implemented a low-latency, high-performance network for mission-critical storage traffic

### About the Organization

The customer represents one of the largest banks in the world, with a leading portfolio of diversified financial services. With over 16 million clients, the firm offers a comprehensive range of personal and commercial banking, wealth management, insurance, investor, and capital markets services.

### Business Needs

For its IP storage network, the bank was leveraging its general-purpose Ethernet data network infrastructure with the network team owning both the LAN and storage ports. As its storage capacity grew to meet business demands, the storage team would request more storage access ports from the network team. However, the internal process to secure additional network capacity often took weeks or even months, slowing down new storage deployments. For the storage team, this arrangement resulted in significant and unacceptable process latency. Workloads couldn't be scaled easily or quickly enough without the storage network paths available to support them.

### The Solution

In a move to improve the pace of deployments to support the growing storage infrastructure demands, the bank isolated the data and storage networks to provide a dedicated IP infrastructure for its storage environment. The goal of the segregation was to reduce further delays and disruptions and gain greater control and flexibility to meet growing business demands. Allowing the storage

team to own the network storage ports and isolate those ports from the data networks provided the deployment speed and flexibility they required. Additionally, the partner the bank selected to isolate the IP storage network also provided a rich management and visibility tool suite to simplify the storage network management process. The bank sought out a storage networking provider to handle management similar to that of the FC networks, thereby simplifying management and easing the transition to managing IP.

*“Robust network infrastructure ideally suited for dedicated IP storage environments, similar to our Fibre Channel fabric, which made the migration to Ethernet much easier.”*

## Faster Scale and Issue Resolution from Storage Ownership of IP Storage Networking

### Organization Profile

#### Industry

Not-for-profit healthcare system

#### Challenges

- Downtime resulting from performance degradation and traffic storms as a result of data network traffic
- Requirement to improve agility to keep pace with storage demands and capacity growth

#### Benefits

- Improved IP storage network availability
- An increase in storage delivery to meet business needs

### About the Organization

The firm in this study is an award-winning healthcare system, recognized numerous times for quality and performance excellence. The healthcare system focuses on leveraging advanced technology to deliver high-quality care. The system supports four acute-care hospitals, three specialty hospitals, two medical groups, and a health plan.

*“Mixing that stack up lets me get a price/performance punch. Basically for me it came down to performance, reporting, and price.”*

### Business Needs

The healthcare system’s SAN supports the firm’s mission-critical applications, requiring high levels of availability and reliability. The prior infrastructure design leveraged the data networking IT team for IP storage network connectivity. However, the data network infrastructure leveraged spanning tree protocol technology and was initially designed for more general-purpose data traffic. Not being designed for mission-critical workloads, the network experienced spanning tree data network anomalies, resulting in frequent outages that significantly affected the accessibility to the storage environment.

With storage network ownership residing within the LAN team, troubleshooting and issue resolution was inefficient, requiring cross-organizational coordination. Adding new storage to scale with business demands was delayed with new storage network ports taking weeks to be configured. When a spanning tree-related disruption took down the storage network along with a number of

mission-critical applications for eight hours, the IT organization knew they had to make a change.

### The Solution

The organization decided to build a dedicated IP storage network and eliminate the dependency on the data network team to provide answers for securing mission-critical storage availability. For their selection of an IP storage networking infrastructure partner, the storage team chose one with a history in storage networking, providing management familiarity and easing the transition. For the solution, the healthcare organization deployed a network infrastructure that provided automated provisioning tools for speedy deployment along with self-healing capabilities and an architecture that eliminated the risk of outages caused by data network spanning tree protocol problems. The resulting environment enabled the storage team to quickly scale and provision new storage, allowing the IT organization to keep pace with the business’ growing demands.



## The Bigger Truth

As data grows dramatically, ever-increasing demands are placed on IT organizations to implement faster provisioning and more scalability while maintaining reliability, predictability, and some level of cost control. In an effort to keep costs down in the wake of these demands, organizations need to consolidate wherever possible, whether through server virtualization or more efficient storage technologies.

While IP storage networking has allowed storage traffic to flow over similar technology to LAN traffic, the data from the industry and the end-users in the field suggests that in many cases IP networking is not a great area of opportunity for consolidation. The findings show that more emphasis should be placed on the type of data and SLA responsibility than the infrastructure technology when considering factors for consolidation. Storage networking tends to carry more mission-critical, high-performance data than LANs, and therefore should be isolated and managed differently. Having a single organization—in this case, the storage team—as the owner responsible for workload uptime speeds up issue resolution and helps ensure reliability. Additionally, the resulting storage network will likely be a simpler design and therefore easier to manage and secure, providing greater IT agility with the ability to scale and provision storage in a more timely and efficient manner.

When evaluating IP storage hardware, look for storage-centric tools, especially if you will be deploying a mixed FC and IP storage network. Look for a partner that can help manage both environments and provide a resilient non-blocking architecture with self-healing and protection against spanning tree protocol problems. Some offerings provide the ability for the network to automatically recognize all the devices within its domain. This resulting awareness allows administrators to perform tasks such as adding or removing switch hardware or connecting physical or virtual servers without manual configuration. Automated tools such as these can provide greater flexibility and help speed up storage provisioning. Moreover, combining the right partner with the right infrastructure design can help ensure a more reliable and predictable IT environment even in the wake of ever-increasing IT demands.



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