



ESG REPORT

Building an Information Infrastructure

Focus on iSCSI

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Introduction

It is difficult to understand why anyone would not want to network their storage. By now, we have all learned the value of sharing IT resources. However, the majority of data is still on direct attached storage (DAS)¹. While DAS may make economic sense for some environments, the challenges of DAS environments include complexity of management, risk of data loss, lack of flexibility, wasted physical assets, power and cooling issues and the inability to scale.

Despite the disadvantages of DAS, storage networking is still not nearly as pervasive as other technologies such as desktop PCs, servers, e-mail, Internet access, firewalls and LANs. Even the enterprise companies that have implemented storage networking have not networked 100% of their data. This is due to the effort required to network storage. Inhibitors include the capital cost of the equipment, the time it takes to plan, evaluate and implement as well as increased complexity and resource requirements for ongoing support and management.

There are a number of elements that must be considered from an IT perspective when implementing or extending storage networks. But first, let's take a step back and take a look at the value to the business. Too often, we look at networking as connecting all of our servers to all of our storage. We should really see it as connecting all of our users to all of our information. *Having all of your storage networked enables the universal access of information.* The mission should be to reach a level of excellence with an information infrastructure. However, this level of excellence can never be attained if information is scattered and decentralized. Networking your storage really means networking your information on centralized, protected and optimized platforms.

Even if every business—and subsequently, every IT group—came to this realization, there are still practical considerations. Resources are not unlimited and time is not infinite. If the mission is to network all information, then how it is manifested must be considered and reasoned.

Although FC is the leading storage networking interconnect, it is not ubiquitous because ultimately, it is more expensive and complex than traditional IP networks. For those companies that have implemented FC SANs, they see the value in terms of performance, interoperability and reliability. However, FC has not reached universal adoption and therefore requires either a complementary or alternative technology. NAS is widely used, but it lacks the performance of SAN for a number of applications and is not well-suited for others (e.g. e-mail). This is where iSCSI plays a vital role.

ESG has found that iSCSI is living up to its promise of lower cost and easier management. iSCSI brings a number of compelling capabilities to the table: It leverages existing IT skills such as IP networking; the infrastructure costs less; it leverages IP routing and it enables faster deployments. One of the most compelling aspects of iSCSI is that it flattens the IT organization. Once all information is moving over the same network infrastructure—not the same network, but the same *type* of network—the journey towards information infrastructure excellence can begin.

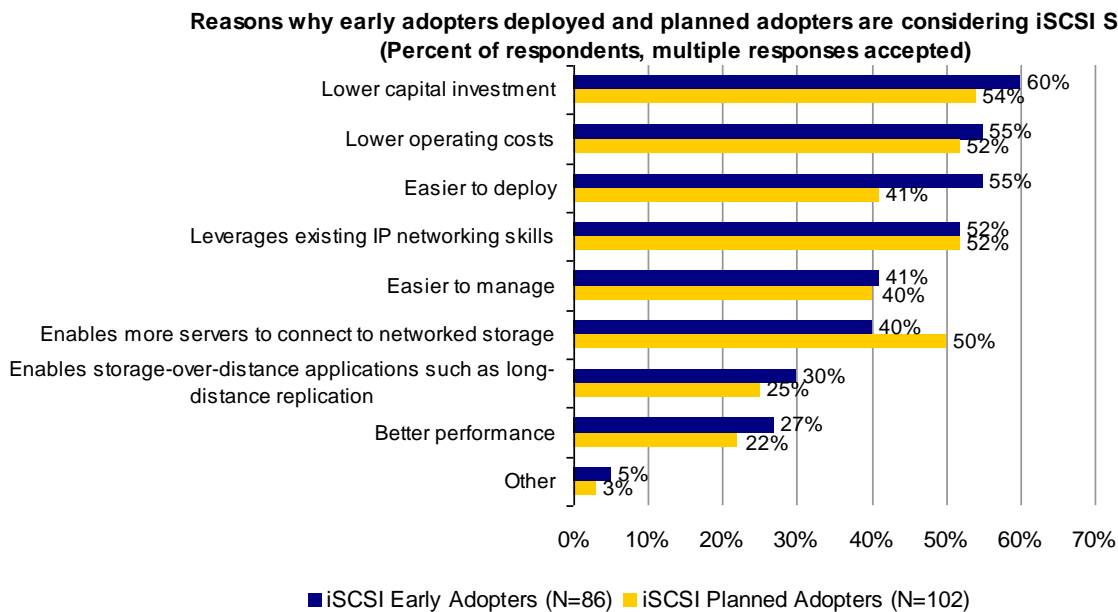
¹ For the purposes of this report, ESG defines direct attached storage as internal disks within a server and direct attached external storage systems.

The Impact of iSCSI Storage

In order to achieve information infrastructure excellence, we have to be able to afford it. Lower capital and operational costs are the primary reasons customers have implemented or plan to implement an iSCSI SAN (see Figure 1). Both early adopters (60%) and planned adopters (54%) cited lower capital investment as a main reason to implement iSCSI and 55% of early adopters and 52% of planned adopters felt that decreased operating cost was also a main goal.

Ease of use is also a high priority. Early and planned adopters believe that iSCSI will provide lower operating costs, easier of deployment, the ability to leverage current IT skills and easier management—which all equate to easier management over its lifecycle compared with FC. In terms of value, the conclusion is that ease of management and lower operational and capital costs are the main drivers for customers. ESG conducted a number of one-on-one interviews and found that customers were able to quickly provision storage on an iSCSI storage system. Additionally, they felt that specialized storage management skills were not necessary to manage or deploy new iSCSI solutions. As shown in Figure 1, planned adopters are also driven by the advantage of connecting of more servers to the SAN.

FIGURE 1. ESG RESEARCH: END USER REASONS FOR DEPLOYING iSCSI



Source: Enterprise Strategy Group: iSCSI Enters the Mainstream 2006 and Ongoing Analysis

SAN Inclusion

Comprehensive information management cannot be achieved until all information is stored on the network. Many organizations still have stranded servers that are isolated and not connected to the SAN. These are servers in departments, remote offices and branch offices with internal or direct attached storage that end-users could not cost-justify including in their SANs. The number of stranded servers in an organization can run from dozens up to thousands of servers—many of which are commodity-based systems running Windows. For the most part, IT groups have not been able to cost-justify using FC for connecting these servers to their organizations’ SANs due to the upfront infrastructure costs.

Because iSCSI uses lower-cost Ethernet infrastructure, one of the early promising applications for iSCSI in storage networks involved connecting those stranded servers to the SAN. This would go a long way toward eliminating the majority of internal storage in large enterprises.

SAN inclusion can be implemented in two ways. The first method (Figure 2) is to install a new storage system that natively supports iSCSI. The organization can realize additional benefits via the decreased infrastructure and connectivity costs of iSCSI as compared with FC.

FIGURE 2. ADDING NEW STORAGE SYSTEMS

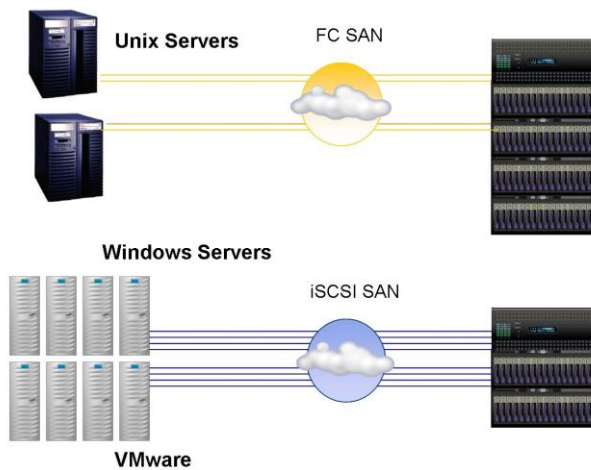
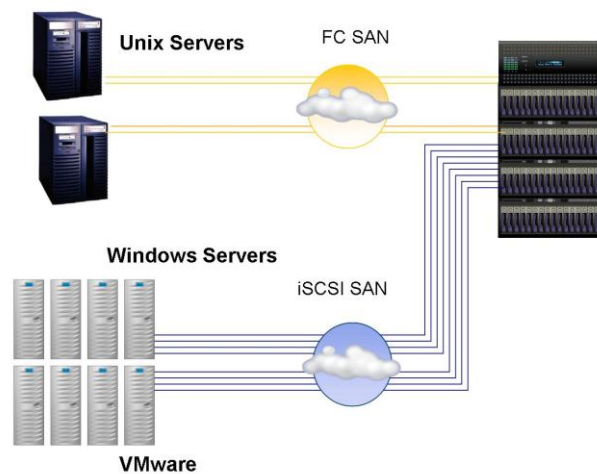


FIGURE 3. LEVERAGING EXISTING STORAGE SYSTEMS

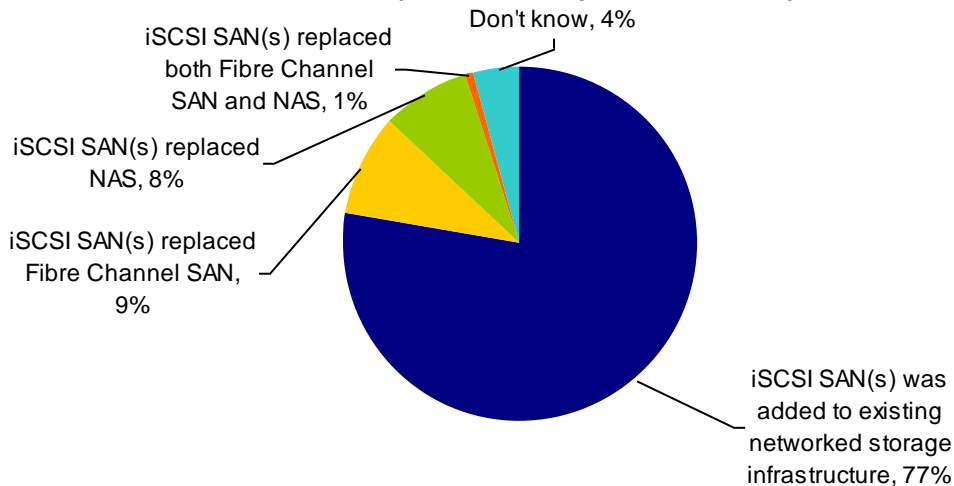


The other method of SAN inclusion (Figure 3) leverages your existing storage system. If your storage system already natively supports both iSCSI and FC, you can leverage both of these interconnects within the same system. If your storage system only supports FC, you can use an intelligent device that supports iSCSI on the front-end and FC connectivity on the back-end to interface with the FC-based storage system. Either of these methods is valid. The aim is to actually implement a SAN Inclusion product leveraging iSCSI.

SAN inclusion is already taking place. ESG Research found that iSCSI early adopters are adding to their current storage network infrastructures. As shown in Figure 4, 77% of all iSCSI SANs were added to existing networked storage infrastructure. This clearly demonstrates that the value of SAN inclusion has been embraced by early iSCSI adopters who recognize that it is critical to get all stranded servers onto the network in order to centralize the storage of valuable information and provide access to all users.

FIGURE 4. ESG RESEARCH: iSCSI IS BEING ADDED TO EXISTING FC INFRASTRUCTURES

Did your organization's iSCSI SAN(s) replace existing networked storage infrastructure (e.g. SAN/NAS arrays, switches) or was it added to your existing infrastructure (Percent of respondents, N = 76)



Source: Enterprise Strategy Group: *iSCSI Enters the Mainstream 2006 and Ongoing Analysis*

Storage Networking Drivers

The cornerstone reasons for storage networking have been fairly constant over the years. These include storage consolidation, the continuous and rapid growth of data capacity, centralized data management and disaster recovery. However, these reasons have failed to drive universal adoption of network storage within mid-sized enterprise companies. While they remain important and have driven a great deal of adoption, new drivers are emerging that will further accelerate implementation. Both IT and business drivers exist.

Virtual Machines

ESG believes that virtual machine technology is a major driver of universal storage networking adoption. ESG recently conducted research focused on the impact of server virtualization on storage networking. In August 2007, we surveyed 706 companies and organizations across different industries, countries and segment sizes.

As a result of this research, ESG discovered some interesting information regarding how virtual servers will impact storage networking. Here are a few highlights.

- The amount of virtual server storage capacity on the storage networks of early adopters will grow from 60% to 74% over the next 18 months. This indicates that people are reducing the amount of DAS they have and are putting more of their data onto networked storage as a direct result of implementing virtual servers.
- Users increase storage networking based on their virtual server environments because of the mobility of virtual machines between physical servers (66%), easier and more cost effective disaster recovery (61%), increased uptime and availability (56%), easier upgrading of physical servers (55%) and the ability to store multiple copies of virtual machine images for high availability (54%).
- We found that 71% of adopters will buy new storage systems. As adopters expand their virtual machine implementations, they grow their storage networks accordingly (63%), need larger storage systems to accommodate consolidated server data (56%) and want to use storage systems that are easier to manage in their virtual machine environment (48%).

- Specific to virtual servers, the top challenges experienced by adopters included performance (51%), general lack of information and best practices (35%) and the need to perform more testing and qualification (31%) with storage.

Virtual machine technology is a viral phenomenon that enables true consolidation at the server layer. When multiple virtual servers are consolidated into a single physical server, it becomes impractical and imprudent to utilize internal storage as well. The implementation of multiple virtual servers on a single physical platform creates risk, which can be completely mitigated by storing virtual server images and their corresponding applications and data on a reliable storage networking platform.

Maintenance tasks—such as physical server upgrades, the addition of new online applications and the ability to transparently move virtual servers to other platforms based on performance needs—are greatly simplified and provide a leap in efficiency. Virtual servers create other value including reduced floor space, a reduction in power and cooling and the ability to implement cost-effective and simplified disaster recovery. The benefits are far reaching—end-users are consolidating their servers, which will drive the need to consolidate storage. Server consolidation drives storage networking adoption and extension.

iSCSI offers some advantages for virtual machine technology. Because iSCSI leverages IP routing, you assign an individual IP address to each virtual machine. With FC, you have a concept called World Wide Names (WWN), which are assigned to a physical FC HBA port. All of the virtual machines utilizing that FC HBA share the same WWN, which exposes all your applications and users to each other. The FC HBA vendors are working to resolve this issue, but iSCSI inherently addresses it.

Increased Retention Periods

End-users are retaining data on disk storage for longer periods than ever before. Conceptually, these retention periods can span from years to forever. ESG recently spoke to a 300-person architectural firm that is doing just this: keeping their drawings, designs and corresponding documents and notes permanently online. It becomes difficult and imprudent to use individual DAS systems to store data for extended periods of time. DAS storage doesn't scale and is not centrally accessed or managed.

Power and Cooling

ESG has found that power and cooling issues are emerging drivers that, to end-users, are either very important or not important at all. Companies in regions with denser populations are more likely to regard power and cooling as a real issue. All of the disk drives within an organization's internal storage servers are constantly powered on and spinning. When considering the power and cooling requirements of dozens or hundreds of servers—all with disk drives spinning—the potential impact is substantial. Moving all of the data from internal DAS to a single storage system will enable users to significantly reduce power consumption just by shutting down all of the drives in those servers. Without a doubt, a great deal of capacity goes unused in internal disk drives and the resulting consolidation will yield cost and consumption savings.

Flatten IT Networks

We think that IT network flattening will be a fundamental driver going forward. Using common skill sets, components, products, management tools, security solutions and leveraging a single network type—especially one that is so pervasive and mature—holds limitless value.

Universal Access to Information

The thesis of this report is that it is essential to have 100% of your company's or organization's data stored on the network. This enables you to have access to any and all intellectual property and information that is valuable to your business. Having access to all of this information can ensure that no project will "reinvent the wheel." It can also enable the development of new services and products, protect you from losing data and be an essential resource for litigation or compliance purposes. ESG often talks about elevating IT to become more strategic to the business. Building an information infrastructure with universal access to information is an important step toward achieving this.

iSCSI SAN: An Enabling Technology

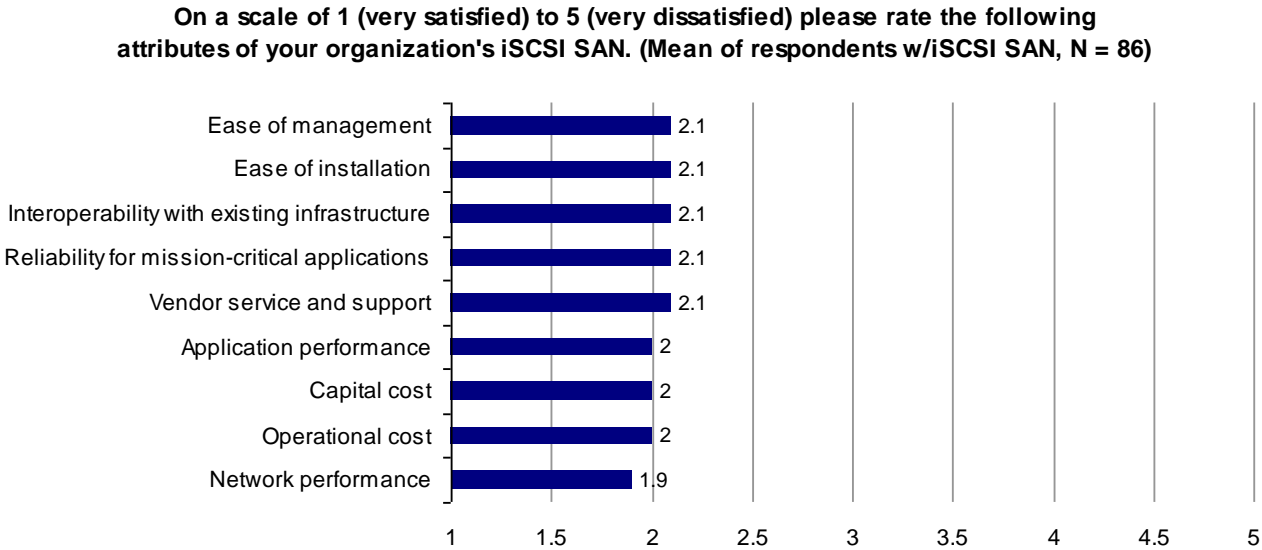
ESG has watched iSCSI evolve from a standard, to a technology, to an architecture that spawns specific products—now a large number of vendors provide iSCSI solutions. More importantly, we are seeing end-user customer adoption of iSCSI growing rapidly. There are a number of key factors are driving the adoption of iSCSI including:

- The entire iSCSI ecosystem is maturing—providing more products, support, functionality, stability and interoperability.
- There is greater awareness of iSCSI, based on increased customer adoption that provides real-world experiences—allowing us to quantify and qualify customers’ positive experiences.
- iSCSI is living up to its promise of providing ease of use and lower cost.
- There has been no market backlash or negativity associated with iSCSI—early adopters are satisfied with their iSCSI SAN solutions.
- Microsoft has been a major supporter of iSCSI, which is important because much of the iSCSI adoption is Windows-based.
- Additionally, VMware support is becoming a major driver, as described previously.
- iSCSI leverages existing network infrastructure, making it easy for customers to adopt.

Early iSCSI adopters are satisfied with their iSCSI SAN across all attributes

As shown in Figure 5, ESG research respondents that have deployed an iSCSI SAN indicated that they are satisfied with their deployment across the board. ESG believes that the level of awareness regarding the success of iSCSI deployments needs to be much more widely communicated. Our quantitative data and recent one-on-one interviews clearly show that customers are pleased with the results of implementing iSCSI. The success and satisfaction of current adopters should eliminate the concerns and misunderstandings around poor performance and reliability.

FIGURE 5. ESG RESEARCH: iSCSI EARLY ADOPTER SATISFACTION



Source: Enterprise Strategy Group: iSCSI Enters the Mainstream 2006 and Ongoing Analysis

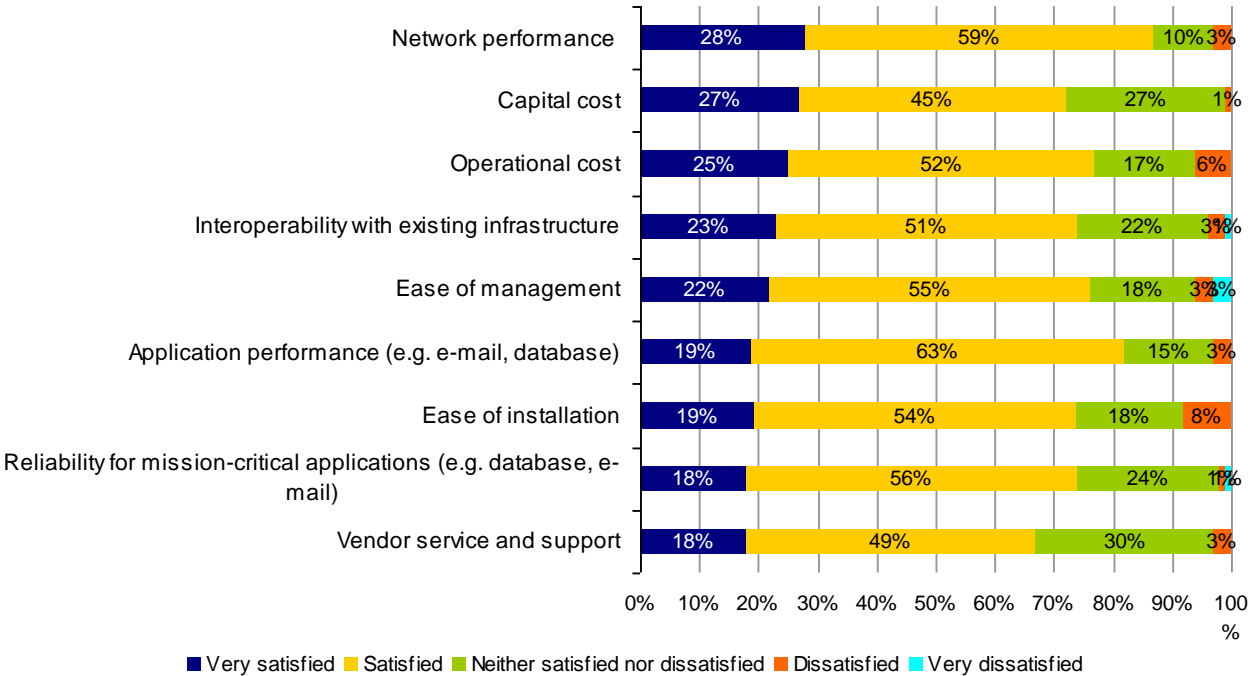
iSCSI adopters have experienced positive results

Respondents that have deployed iSCSI are satisfied with their iSCSI SANs (Figure 6):

- 87% of early adopters were either very satisfied (28%) or satisfied (59%) with iSCSI network performance.
- 82% were either very satisfied (19%) or satisfied (63%) with iSCSI application performance.
- 77% of early adopters were either very satisfied (25%) or satisfied (52%) with operational costs.
- 77% of early adopters were either very satisfied (23%) or satisfied (55%) with ease of management.
- Operational cost and ease of management are tightly connected and rate high on customer satisfaction levels.
- 74% of early adopters were either very satisfied (23%) or satisfied (55%) with interoperability of existing infrastructure.
- 73% of early adopters were either very satisfied (19%) or satisfied (54%) with ease of installation.
- 72% of early adopters were either very satisfied (18%) or satisfied (56%) with reliability with mission-critical applications.
- 72% of early adopters were either very satisfied (27%) or satisfied (45%) with capital costs.
- 67% of early adopters were either very satisfied (18%) or satisfied (49%) with vendor support and service.

FIGURE 6. ESG RESEARCH: iSCSI EARLY ADOPTER SATISFACTION

How would you rate your organization's satisfaction with the following attributes of its iSCSI SAN(s)? (Percent of respondents, N = 76)



Source: Enterprise Strategy Group: iSCSI Enters the Mainstream 2006 and Ongoing Analysis

Benefits early adopters have realized since deploying iSCSI

Consistent with the previous data, early adopters believe they have reduced capital expenditures since deploying an iSCSI SAN (59%). In addition, 46% of early adopter respondents found they had decreased SAN deployment time and increased their rate of server connectivity (46%). Forty-three percent of respondents also say they have realized easier ongoing management of their SAN resources since deploying an iSCSI SAN. Thirty-seven percent of early adopters have realized that their organization can leverage storage over a distance now that they have iSCSI and 36% of early adopters say they have reduced operational expenditures (see Figure 7).

End-User Voices

“We did benchmarking on Fibre Channel and iSCSI performance. We got the same performance for a better dollar amount on the iSCSI side.” (Banking)

“No one has complained of performance. We have a SQL application that we found has great performance for development that’s using iSCSI.” (Retail)

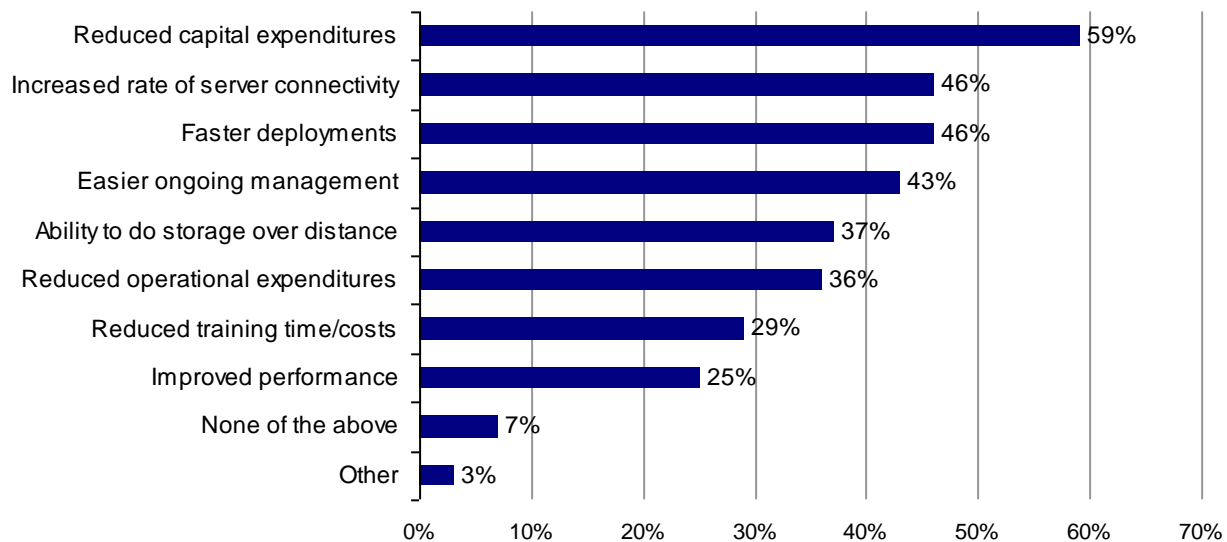
“We benchmarked Exchange on iSCSI and Fibre Channel and they came up the same. Performance was identical.” (Banking)

“Before I got a chance to do some testing, the biggest concern really was: Will it perform as well as we needed it to perform? Can I get the IOPS that I need to get for Exchange and SQL? We are also thinking about bringing back an Oracle database that we currently have being hosted somewhere else. So we wanted to make sure that we were going to get all the performance out of iSCSI we needed to. And in my initial testing, iSCSI was actually outperforming our Fibre Channel SAN. So I had a lot of confidence that iSCSI was going to be beyond anything we were going to need in the near future.” (Education)

“We replaced a 1Gb Fibre Channel SAN that supported a SQL database and we are extremely impressed with the performance of iSCSI when compared to the 1Gb Fibre Channel SAN. The iSCSI SAN provides impressive transactional performance that solved the user access time issues with e-mail. In fact, we have been experiencing screaming performance.” (Law Firm)

FIGURE 7. ESG RESEARCH: iSCSI EARLY ADOPTER BENEFITS

What benefits - relative to other networked storage technologies such as NAS and SAN - do you believe your organization has realized since deploying an iSCSI SAN(s)? (Percent of respondents, N = 86, multiple responses accepted)



Source: Enterprise Strategy Group: iSCSI Enters the Mainstream 2006 and Ongoing Analysis

iSCSI SAN Requirements for an Information Infrastructure

Whether as a complement to your existing SAN or NAS environment or as a core storage network solution, iSCSI will enable an information infrastructure. However, as part of an information infrastructure, an iSCSI SAN needs to be considered from a holistic perspective. Here is a list of questions to consider when determining your requirements for a storage network and how it fits into your overall information infrastructure strategies:

What are the short-term priority objectives?

This could be a specific application, a virtual machine implementation, a remote or branch office or even a first deployment of a storage network. The first step when developing an information infrastructure is to begin moving all of your data onto the network. But you have to walk before you run.

What are the long-term objectives?

As you add more applications and servers to the storage network, it is important to consider the long term objectives. The thesis of this report is that it is essential to have 100% of your company's or organization's data stored on the network. This enables you to have access to the intellectual property and information that is valuable to your business. Having access to all of this information can ensure that no projects "reinvent the wheel." It also can enable you to develop new services and products, it can protect you from losing data and it can be an essential resource for litigation or compliance purposes. ESG often talks about elevating IT to become more strategic to the business. Building an information infrastructure with universal access to information is an important way to achieve this.

What are your resource considerations?

If you have an unlimited budget and infinite resources, then you may not need to be concerned with this question. However, most people have neither. You must always consider what resources you can dedicate to implementing a universal information access infrastructure. That is where iSCSI can be an important enabler since it has proven to lower capital and operational costs. Additionally, you should consider an idea that this report proposed earlier: Leveraging iSCSI flattens the IT organization by utilizing existing IT resources including people, process and technology. This fits as an underlying enabler for universal information infrastructure.

Have you considered the implementation holistically?

Time and again, end-users tell us that they want more than just point products. However, end-users often treat their assessment of storage systems from a point product perspective and don't consider the holistic aspects of this endeavor. Other considerations—including data protection and backup, migrating data to new systems, security issues, performance analysis, disaster recovery, application integration and ongoing support should all be considered.

ESG's View

This report has offered a number of key issues for your consideration. First, storage networking is not as pervasive as other IT infrastructure. This is tied directly to the cost, complexity and capabilities of networking all of an organization's storage via FC and NAS. We believe that iSCSI fills a big gap in this regard. Second, it isn't enough to have just some of your data on the network. All of it should be accessible in order to reach higher levels of value in the business. Third, while it is important to approach implementing a storage network from an IT perspective, it is vital to remember that it is the access and use of that information that is the priority. Deploying a SAN is certainly valuable, but building an information infrastructure is the bigger goal—adding more and greater value to the business. You can't have the latter without the former. And in order to reach the full potential of an information infrastructure, you must network all of your data.

ESG has worked with IT groups for years and a recurring theme in our conversations is that IT is important, but not considered strategic to the business. Our observation is that IT is complicit in this view of itself. For IT to elevate itself beyond technology gurus and operational excellence, it must take a business view with every activity. We believe an important shift in consciousness is required: Instead of seeing storage as the focus, consider the access, movement, management and protection of information as the goal.



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