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Benefits Of SAN/LAN Convergence
Evaluating Interest In And Readiness For Unified Fabric

A commissioned study conducted by Forrester Consulting on behalf of Dell

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Executive Summary

In August 2009, Dell commissioned Forrester Consulting to evaluate the current state of storage and perceptions/interest regarding new storage technologies, including unified fabric — the concept of using the same physical network or common network protocol for storage and application network traffic. A key goal of this study is to gauge the current level of interest in unified fabric (UF) and associated products, including iSCSI storage, which is a key enabling technology for unified fabric and SAN/LAN convergence.

For the purposes of this study, Forrester conducted 213 online surveys with storage professionals in the US, UK, China, and the Netherlands, and conducted 10 in-depth interviews of the same audience. It should be noted that these respondents are self-selected storage decision-makers. Any respondents who reported a low level of storage expertise were eliminated from the survey. Additionally, there were multiple exclusion criteria that identified contradictions in responses and eliminated noncredible responses. That said, this report should be considered to be a directional survey of the perceptions of respondents. There appears to be a reasonable degree of confusion around terminology, especially around some of the emerging Ethernet SAN technologies, such as FCoE and iSCSI. The data presented here can be seen as representative of the perceptions of individuals with varied levels of technical expertise rather than absolute factual indicators of current deployments of specific technologies.

Key Findings

Forrester's study yielded four key findings:

- **iSCSI usage is clearly on the rise.** Compared with previous studies of iSCSI adoption, the numbers in this survey are very high. While there may be some overstatement due to confusion or expectation of future adoption, the trend is clearly pointing toward higher levels of use than previously recorded.

- **Interest in SAN/LAN convergence is high.** Sixty-six percent of respondents overall said that they are very interested or moderately interested in the concept of unified fabric or SAN/LAN convergence. 10 Gbps iSCSI emerges as the most compelling choice of protocols among respondents with an interest in this convergence.

- **Server virtualization adoption is high, with iSCSI growing as protocol of choice.** In a Forrester Research survey from January 2009, Fibre Channel (FC) led strongly in protocol selection for virtual server connection.[1] In this study, FC still leads, but iSCSI is closer behind, showing significant traction compared with previous data.

- **10 Gbps Ethernet switching leads near-term purchase intentions.** Among a list of storage product categories, respondents chose 10 Gbps switching, storage resource management software, and iSCSI-enabled storage arrays as upcoming purchases in the next 12 months. This points to strong interest in paving the way toward unified fabric, as well as interest in iSCSI in 10 Gbps format as a viable alternative to FC storage.

Storage Networking: An Evolution In Progress

For the past 10 years or so, the data center has been in the phase of adopting central, shared storage architectures. Coming out of the mainframe era, the distributed computing model was for each department to purchase its own server, generally with disk onboard or direct attached. This was costly, due to low utilization, and difficult to manage, due to inconsistency. Storage area networks (SANs) emerged as a way to get storage out of the server, using a network infrastructure to connect servers to external shared storage devices. The network of choice for open systems servers during the period of SAN has predominantly been Fibre Channel, owing largely to the following characteristics:

- **High performance and low latency.** Compared with general-purpose LAN networking protocols, FC has had an edge in terms of data throughput and latency. When Ethernet has been at 100 Mbps, FC was at 1 Gbps. When 1 Gbps Ethernet was becoming ubiquitous, FC was at 2 Gbps and 4 Gbps. Infiniband has had some performance advantages in recent years, but by the time it became broadly available, FC had already become entrenched in data centers that were loath to change over to a network protocol they were unfamiliar with.

- **Deterministic performance.** While Ethernet is intended to work around packet losses — expecting dropped packets and retransmitting them — FC is designed to get the data delivered every time. This lossless characteristic is better suited to data traffic where applications would get bogged down waiting for retransmissions.

- **Broad support by storage vendors and user communities.** Once FC became widely adopted by the industry, the momentum built significantly. Data center buyers make significant investments in technology acquisition and want these investments to last. The skill sets for managing FC SANs are specialized, and once these were developed, buyers and vendors tended to stick with the technology.

Over the past two to three years, though, the dominance of pure FC as a storage network protocol has been challenged by alternatives that use Ethernet as a transport mechanism. Although FC has been generally effective, the benefits of Ethernet are compelling due to the following:

- **Reduced acquisition cost of network components.** FC requires a significant investment in dedicated components, which are generally sold in smaller numbers than Ethernet is today, keeping pricing high. An Ethernet-based SAN uses industry standard components that sell for less. Ethernet compatible switches, server-side networking components, cabling, and related software are generally available for significantly less than FC counterparts.

- **High level of staff familiarity with Ethernet.** If the alternative to FC was another special-purpose network, the cost benefits probably wouldn't be enough to move buyers away. However, Ethernet is made more attractive by its ubiquity. Every firm has Ethernet in its data center today, and leveraging it for use in data traffic in addition to front-end networking makes a great deal of sense. Server and network administrators today know Ethernet top to bottom, so leveraging this skill set for data traffic is likely to yield significant synergies. Conversely, FC is a more specialized skill: Training is scarcer, and firms often report difficulty hiring qualified experts.

- **Increasing choices of protocols for Ethernet SAN.** There are a number of protocol options that have emerged to carry storage network traffic on Ethernet. The main ones are iSCSI, Fiber Channel over Ethernet (FCoE), and Network File System (NFS). iSCSI is a

block-based protocol that uses standard 1 Gbps or 10 Gbps Ethernet without changes; it has been in production use for several years. FCoE is an emerging block protocol that uses a new, lossless version of Ethernet that requires compatible switches. FCoE is meant to preserve zoning and skill sets from FC, so it can provide greater continuity and ease of transition from an FC environment, although the requirement for lossless 10 GbE switching means upgrades are required. NFS is a file-based protocol but increasingly viable for application data traffic, especially with virtualization software and some databases. The fact that there are a number of options means that buyers looking to transition to Ethernet storage are more likely to find a protocol that fits their needs.

The evolution of the SAN is under way today, and it's clear that the world of storage is moving toward Ethernet. Storage changes slowly, however, with conservative buyers and high stakes for application performance and availability. Making any transition represents risk, which is anathema to the very mission of centralized storage in data centers today. The following data is designed to shed light on the pace of the transition; variations in adoption intention by geography, organization size, and storage environment size; as well as the technology and organizational drivers that will shape this evolution.

Is The Promise Of Fabric Unification Finally Here?

Vendors and analysts have been talking for some time about the benefits of a common network for user-application traffic (or front-end networking) and storage-data traffic (or back-end networking). While the theoretical benefits are clear, such as reduced acquisition and management costs, skill synergies, parts sparing, reduced cabling complexity, the path to getting there is daunting. It's clear that the future of unified fabric lies in Ethernet, and as Ethernet storage is on the rise, this should mean that we are moving closer to the dream. The respondents to this survey appear interested in the benefits but skeptical about the ability to get there in the near term. Specific responses related to the move toward fabric unification include the following:

- **Interest in UF is high, but the time frame is fairly long.** Sixty-six percent of the respondents to this survey are very interested or moderately interested in unified fabric within their data center environment. Only 7% of respondents say that they are not interested. However, when it comes to timing, the road is somewhat long. Seventy-five percent of respondents who have interest in UF say that their firm is not likely to begin moving in that direction sooner than two years from now. Still, it's not an eternity, as a solid 23% do predict beginning the journey within one year, while only 8% say it will take them more than five years to get started. The details of the interest level and timing for UF initiation can be found in Figure 1.

- **Interest in UF is evenly distributed between small and large firms.** When the adoption intentions for UF are cut by firm size, there is little difference in interest levels. In fact, the numbers are nearly identical: 67% of large enterprise respondents and 65% of SMB/SME firms are very interested or moderately interested in UF. Large firms can be seen as slightly more skeptical, with 29% minimally or not interested, compared with smaller firms at 26%; however, smaller firms may have less awareness of UF, with 9% stating that they are not aware or don't know about UF, compared with 4% of larger firms. Figure 2 shows the breakdown of interest in UF by firm size.

- **Consolidation and application advantages are key benefits of UF.** The top perceived benefits for UF include improved ability to consolidate infrastructure, server virtualization benefits, application performance advantages, and hardware cost reduction. The only category of benefits that ranks low on the list is reduction of staff costs, which can often be a politically charged issue anyway. Only 5% of respondents stated that they saw no benefits associated with fabric unification. Figure 3 shows the breakdown of this data.

- **Upgrade costs and complexity of migration represent the biggest UF barriers.** A clear trend in the quantitative survey and qualitative interviews was concern over the cost to implement new switching and server technologies and the risks and complexities of moving data from the current SAN fabric to a new switching environment. The requirement to retrain staff and develop expertise in a new technology environment is also seen as a challenge. Responses about barriers to adoption of unified fabric are detailed in Figure 4.

- **10 GbE iSCSI ranks the highest among protocols to support UF.** UF will happen on some form of Ethernet, but the protocol selection is unclear at this time. However, the overwhelming opinion of the respondents in this study on the best-suited choice is 10 GbE iSCSI, with more than double the respondents selecting it versus the next closest choice, FCoE. 1 GbE iSCSI and NFS are not seen as particularly likely choices by this set of respondents. The numbers on this can be seen in Figure 5.

- **Cooperation at an enterprise level is seen as a key to UF success.** Whether or not users are moving toward UF today, being on the same page and moving forward as a company was described in interviews as a critical aspect of success. One respondent stated, "Our interest in UF as an organization is extremely high; LAN, storage and server [groups] all working together to get the most out of the switching environment [will] reduce [the] cost of support, improve BC/DR, etc. UF will be a facilitator for all of this."

- **Cost savings is not the only thing, but it is significant.** Interviewees stated that cost savings is important but would not be compelling enough to take on additional risk. When asked what benefit percentage would push them to adopt UF, answers hovered around 20%. However, one respondent stated that "If it's a big technology change, then we will require higher level of cost savings to motivate us. Right now, there's not enough value to retrofit, [and] we would only look to it when replacing gear on a new project or investment."

Figure 1: Interest Levels And Time Horizons For Unified Fabric

"How interested are you in unified fabric or network convergence between LAN and SAN?"

Category	Percentage
Very interested	26%
Moderately interested	40%
Minimally interested	21%
Not interested	7%
Not aware/Don't know	7%
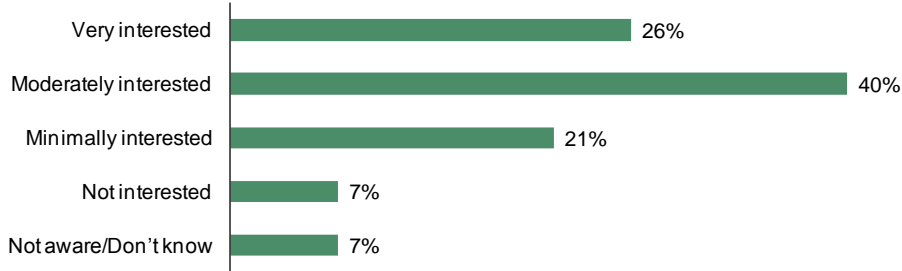
Base: 213 storage decision-makers

"What time frame do you predict your company might begin to move toward a unified fabric or network convergence between LAN and SAN?"

Time frame	Percentage
Within 1 year	23%
Within 2-3 years	43%
Within 3-5 years	25%
Beyond 5 years	8%
Never	1%
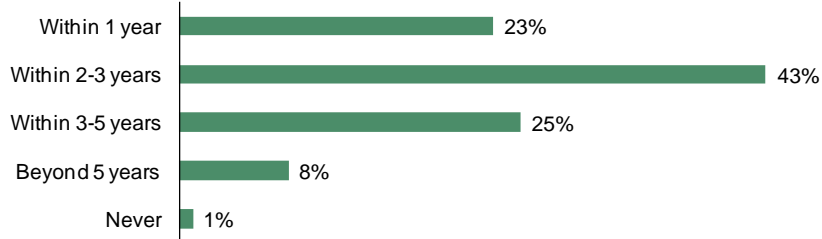
Base: 185 storage decision-makers with interest in unified fabric

Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

Figure 2: Interest Levels In Unified Fabric By Firm Size

"How interested are you in unified fabric or network convergence between LAN and SAN?"

Legend: ■ Not aware/don't know ■ Not interested ■ Minimally interested ■ Moderately interested ■ Very interested

Firm Size	Not aware/don't know	Not interested	Minimally interested	Moderately interested	Very interested
Large Enterprise (1,000 or more employees) (N = 102)	4%	7%	22%	42%	25%
SMB/SME (Less than 1,000 employees) (N = 111)	9%	6%	20%	38%	27%

Base: storage decision-makers in each organization size

Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

Figure 3: Predicted Benefits Of Unified Fabric

"Regardless of your current interest, what do you see as potential benefits of unified fabric or network convergence between LAN and SAN?" (select all that apply)

Improved infrastructure consolidation capabilities	55%
Improved server virtualization capabilities	53%
Application performance improvements	51%
Hardware/software cost reduction	50%
Application performance benefits	49%
Facilities benefits (such as reduced cabling complexity, reduced footprint for switching infrastructure, etc.)	48%
Improved disaster recovery (DR) capabilities	46%
Reduction of staff/management costs	36%
Other	1%
None. I envision no clear benefits of unified fabric or network convergence between LAN and SAN.	5%

Base: 199 storage decision-makers with awareness/knowledge of Unified Fabric

Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

Figure 4: Potential Barriers To Adoption Of Unified Fabric

"What barriers do you see for unified fabric or network convergence between LAN and SAN?" (select all that apply)

Cost to upgrade network switches	55%
Cost to upgrade servers and/or associated network components	54%
Cost and complexity of associated data migration activities	48%
Skills gaps to make it work	44%
Lack of maturity of converged protocols	39%
Data security concerns	38%
Organizational issues related to common management of SAN and LAN components	37%
Performance concerns	36%
Lack of maturity of convergence capable storage hardware	31%
Availability concerns	30%
None. I see no barriers to adoption of unified fabric.	3%

Base: 199 storage decision-makers with awareness/knowledge of unified fabric

Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

Figure 5: Protocol Options For Unified Fabric

"Which of the following protocols do you think is best suited for supporting unified fabric or convergence between LAN and SAN?"

Protocol	Percentage
10 GbE iSCSI	56%
FCoE	27%
1 GbE iSCSI	9%
NFS	8%

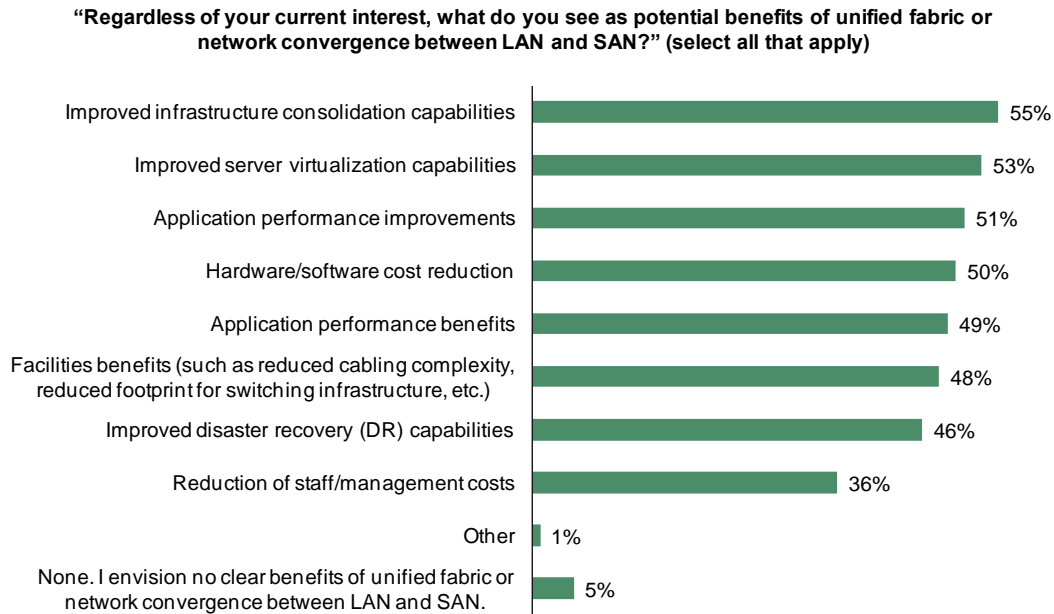Base: 199 storage decision-makers with awareness/knowledge of unified fabric

Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

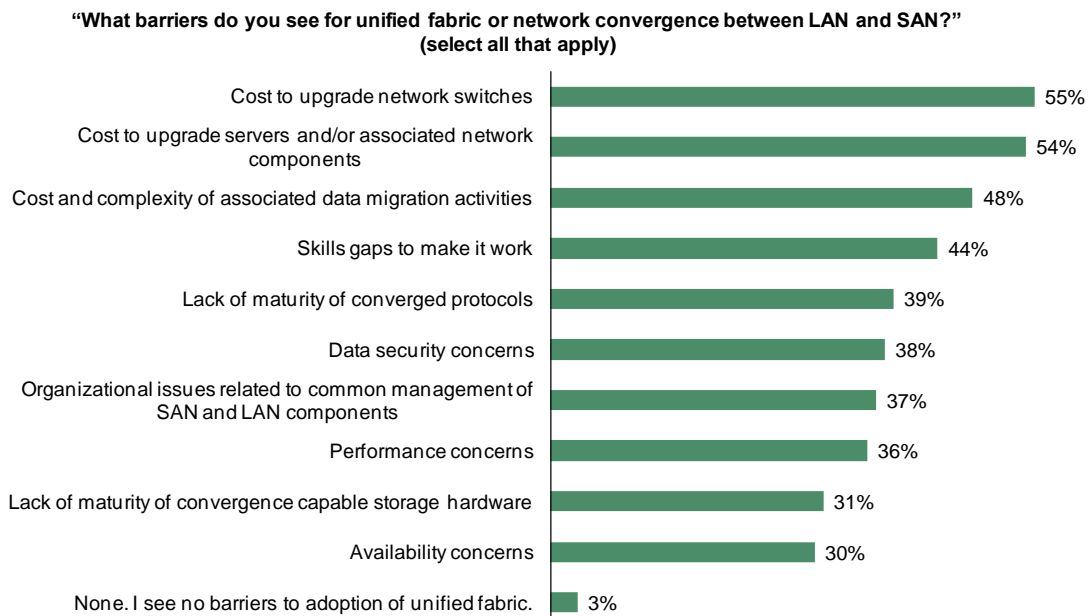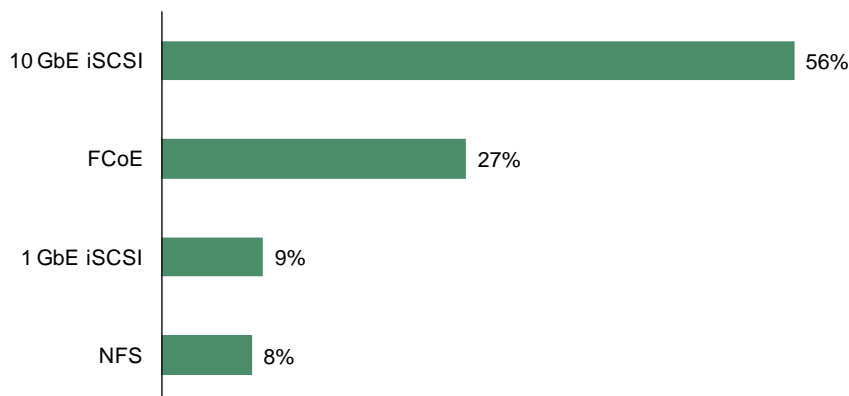# Ethernet SAN Adoption Is Showing Rapid Growth

The move toward Ethernet storage networking is under way. Respondents to this survey show a high level of aggressiveness in terms of interest and current adoption of Ethernet-based protocols. Every survey has some bias, and it's likely that this study attracted respondents who are particularly interested in the transition of storage networking given the subject matter. However, even accounting for some degree of bias in the results, there is a marked trend toward near-term and current adoption of Ethernet-based storage options. Some of the key elements of this rapid adoption include the following:

- **Sixty-six percent of respondents report using iSCSI today.** This is a very high number compared with data from a September 2008 study commissioned by Dell that showed iSCSI adoption by 51% of respondents.[2] iSCSI appears to be turning the corner of mainstream adoption at this time. Protocol adoption patterns among respondents are shown in Figure 6.

- **Respondents appear to be using iSCSI in combination with other protocols.** About one-third of the 66% of iSCSI users have only iSCSI. The largest respondent group reports using all three: iSCSI, FC, and FCoE. This is an interesting finding, indicating that many environments have mixed protocols. This could imply that buyers are tiering their storage network or that they are in the process of replacing FC with iSCSI and are doing so gradually. Figure 7 shows a set of responses that further characterize the adoption intentions of iSCSI users.

- **FCoE interest appears very high.** There may well be some confusion regarding the adoption of FCoE, as anecdotal evidence suggests that the 34% current usage number is very high for this emerging protocol. Products are just now coming onto the market and are usable only for the server side of storage networking, aggregating traffic in top of rack and edge switches. The reality here is likely that respondents have interest in or plans to move forward with FCoE but have not yet implemented FCoE in such high numbers. Confusion

with FCIP, used to carry FC traffic over the WAN for distance replication, may also be increasing the adoption rates reported in this survey. Another area of confusion relates to the adoption of 10 GbE. Respondents who stated that they currently have FCoE in place in the quantitative survey revealed in interviews that they actually have 10 GbE for file data traffic but are not using FCoE equipment [WHX]. Suffice it to say that interest in FCoE is high at this point, with vendors offering new products, but confusion about what really constitutes FCoE is clouding the adoption picture.

- **FC numbers remain high, but the dominance is waning.** The largest single protocol selection is still FC, meaning that a reasonable number of environments have not yet initiated any transition away from FC. However, this number is lower than it has been in previous years, and the majority of FC users do report having an Ethernet protocol in use as well.

- **Smaller storage environments are adopting iSCSI rapidly.** As has been seen in past research, the cost avoidance and complexity reduction benefits of iSCSI appear to resonate strongly with smaller storage environments. Smaller storage environments in this study are twice as likely to use iSCSI only, whereas larger environments are much more likely to use multiple protocols or FC only. Figure 8 shows the distribution of storage environment sizes combined with protocol selections.

- **10 GbE, SRM, and iSCSI rank highly in near-term purchase intentions.** When respondents were asked to indicate what they planned to purchase over the next 12 months, 10 GbE switching components, storage resource management (SRM) software, and iSCSI-enabled storage arrays topped the list. Segmenting the data by small and large firms shows that respondents at smaller firms plan to buy iSCSI arrays, 10 GbE, and NAS devices most. Respondents at larger firms point to SRM, 10 GbE, and FC arrays most. Figures 9, 10, and 11 detail the results from this question.

- **Virtual server environments motivate iSCSI adoption.** The numbers for usage of iSCSI in virtual server environments are very high, especially compared with previous studies. Production adoption of server virtualization is high, with 74% stating that they have implemented it or are in the process. Another 20% state they have plans to do so. Among all of these respondents, 59% say they are using or will use FC, and 57% pointed to use of iSCSI, which statistically speaking are basically equal. Figure 12 shows the breakdown of server virtualization adoption and protocol selection.

- **Smaller firms are tending toward iSCSI for virtual servers.** While FC still has a slight edge in this survey for virtual server environments overall, segmenting by company size shows a different story. Firms with fewer than 1,000 employees show a strong tendency toward iSCSI, with 66% of respondents saying they use or are planning to use it, while only 50% point to FC. Firms in this survey with 1,000 employees or more stated that FC was their top choice — selected by 70% of respondents — and interestingly, NFS was the second highest selection, with 57%. iSCSI was selected by 47% of enterprise level firms. Figure 13 shows the data on virtual server storage protocol selection by company size.

Figure 6: Storage Protocol Overlap: Respondents Show A Variety Of Protocol Combinations
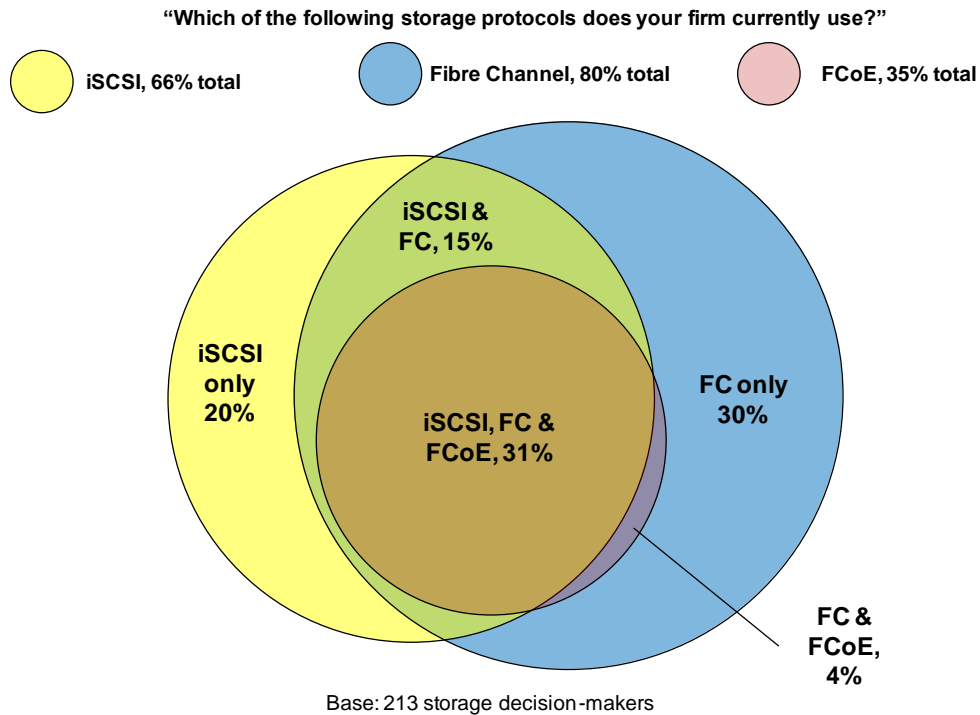
"Which of the following storage protocols does your firm currently use?"

iSCSI, 66% total   Fibre Channel, 80% total   FCoE, 35% total

iSCSI & FC, 15%

iSCSI only 20%

FC only 30%

iSCSI, FC & FCoE, 31%

FC & FCoE, 4%

Base: 213 storage decision-makers

Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

Figure 7: iSCSI Adoption Scenarios
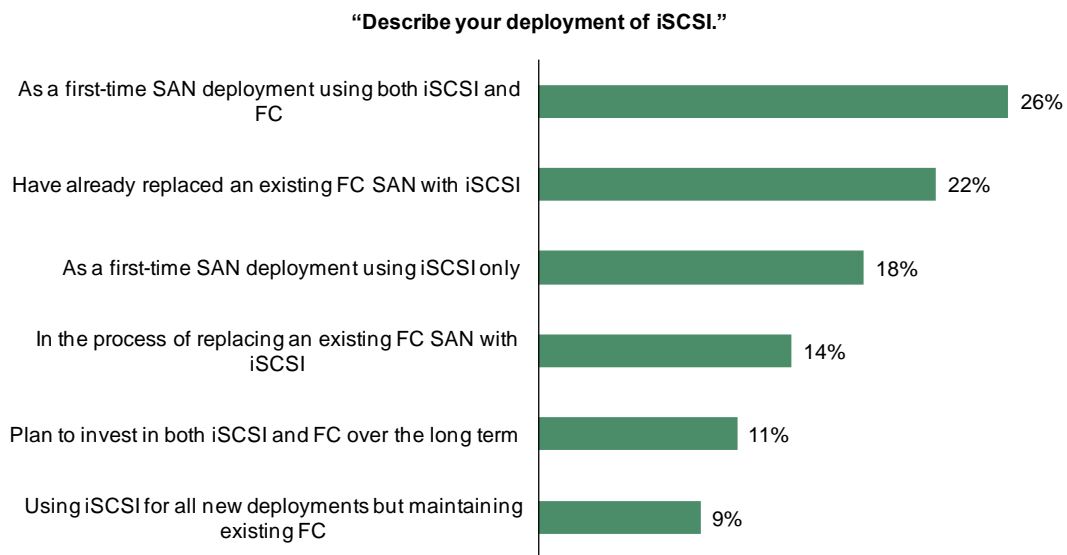
"Describe your deployment of iSCSI."

As a first-time SAN deployment using both iSCSI and FC	26%
Have already replaced an existing FC SAN with iSCSI	22%
As a first-time SAN deployment using iSCSI only	18%
In the process of replacing an existing FC SAN with iSCSI	14%
Plan to invest in both iSCSI and FC over the long term	11%
Using iSCSI for all new deployments but maintaining existing FC	9%

Base: 141 storage decision-makers currently using iSCSI

Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

Figure 8: Protocol Selections And Environment Size

Pooled responses:
**"Which of the following storage protocols does your firm currently use?" and
"How big is your networked storage environment (in raw terabytes)?"**

■ Less than 40 TB   ■ 40-500 TB   ■ 500+ TB

Protocol	Less than 40 TB	40-500 TB	500+ TB
iSCSI, FC, ad FCoE	2%	11%	17%
FC only	8%	13%	10%
iSCSI only	10%	5%	5%
iSCSI and FC	4%	6%	6%
FC and FCoE	1%	2%	

Base: 213 storage decision-makers

Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

Figure 9: Near-Term Storage Purchase Intentions Of All Respondents

**"What categories of storage purchases do you expect your firm to make within the next 12 months?"
(select all that apply)**

Category	%
10 Gbps Ethernet switching and/or related components or software for storage data traffic	45%
Storage resource management (SRM) software	42%
iSCSI enabled storage array(s)	39%
NAS integrated disk array(s) or gateway(s)	38%
FC enabled storage array(s)	38%
Disk based backup system(s) (VTL or pure disk backup targets)	37%
1 Gbps Ethernet switching and/or related components or software for storage data traffic	37%
Multi-protocol enabled storage array(s) (combined FC/iSCSI/FCoE)	32%
FC switching and/or related components or software	32%
Archive disk system(s) or content addressable storage (CAS) system(s)	31%
FCoE enabled storage array(s)	28%
None. We do not plan to make any significant storage purchases in the next 12 months.	4%

Base: 213 storage decision-makers
Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

Figure 10: Near-Term Storage Purchase Intentions Of Smaller Firms

"What categories of storage purchases do you expect your firm to make within the next 12 months?"
(select all that apply)

iSCSI enabled storage array(s)	45%
10 Gbps Ethernet switching and/or related components or software for storage data traffic	44%
NAS integrated disk array(s) or gateway(s)	41%
Storage resource management (SRM) software	35%
Disk-based backup system(s) (VTL or pure disk backup targets)	34%
FC enabled storage array(s)	31%
1 Gbps Ethernet switching and/or related components or software for storage data traffic	31%
Multi-protocol enabled storage array(s) (combined FC/iSCSI/FCoE)	30%
FC switching and/or related components or software	28%
FCoE enabled storage array(s)	28%
Archive disk system(s) or content addressable storage (CAS) system(s)	27%
None. We do not plan to make any significant storage purchases in the next 12 months.	6%

Base: 111 storage decision-makers in SMB/SMEs (less than 1,000 employees)
Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

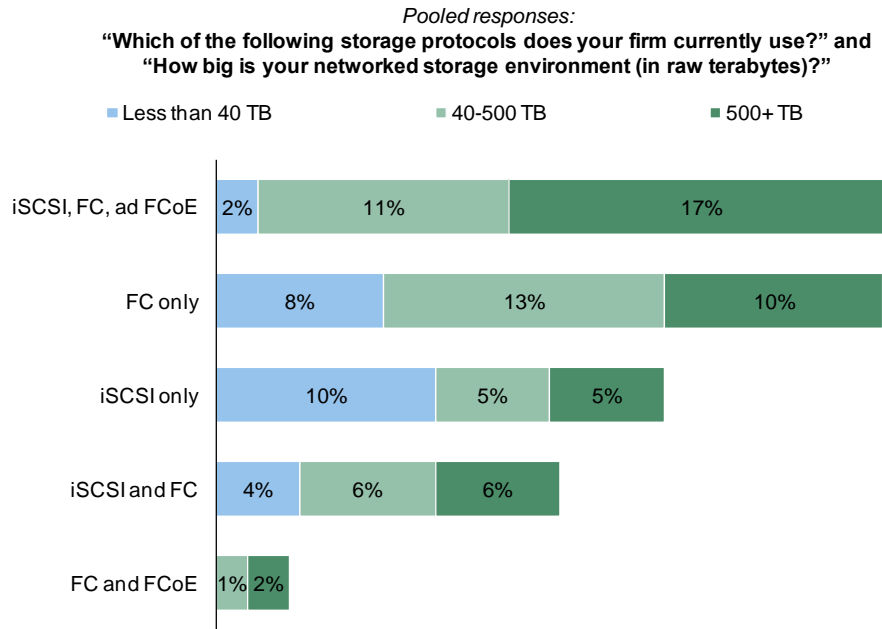**Figure 11: Near-Term Storage Purchase Intentions Of Larger Firms**

"What categories of storage purchases do you expect your firm to make within the next 12 months?"
(select all that apply)

Storage resource management (SRM) software	49%
10 Gbps Ethernet switching and/or related components or software for storage data traffic	46%
FC enabled storage array(s)	45%
1 Gbps Ethernet switching and/or related components or software for storage data traffic	43%
Disk0based backup system(s) (VTL or pure disk backup targets)	40%
NAS integrated disk array(s) or gateway(s)	36%
FC switching and/or related components or software	36%
Multi-protocol enabled storage array(s) (combined FC/iSCSI/FCoE)	35%
Archive disk system(s) or content addressable storage (CAS) system(s)	34%
iSCSI enabled storage array(s)	33%
FCoE enabled storage array(s)	28%
None. We do not plan to make any significant storage purchases in the next 12 months.	2%

Base: 102 storage decision-makers in large enterprises (1,000 or more employees)
Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

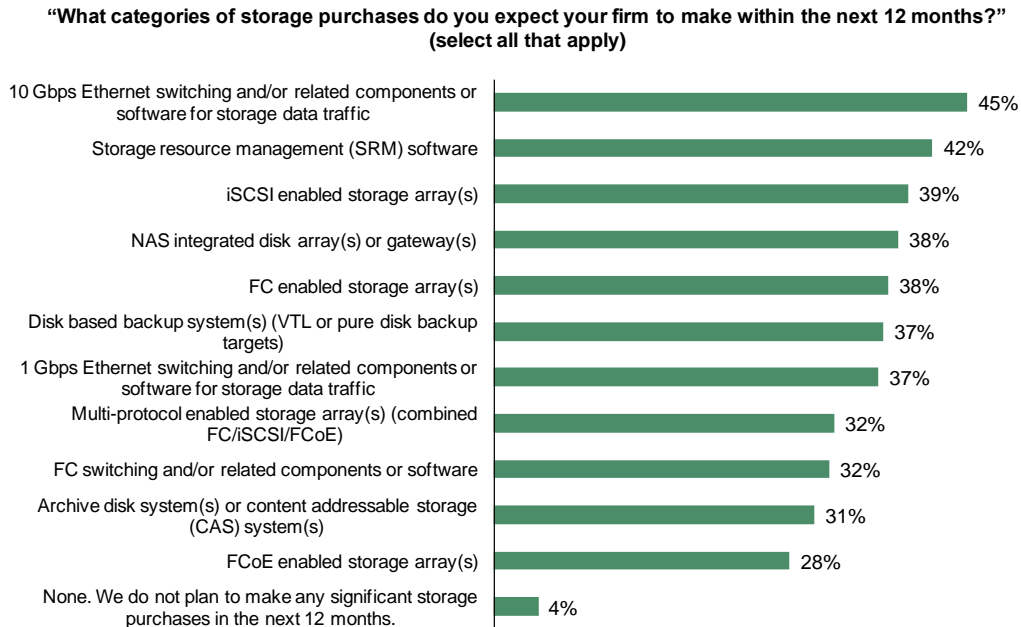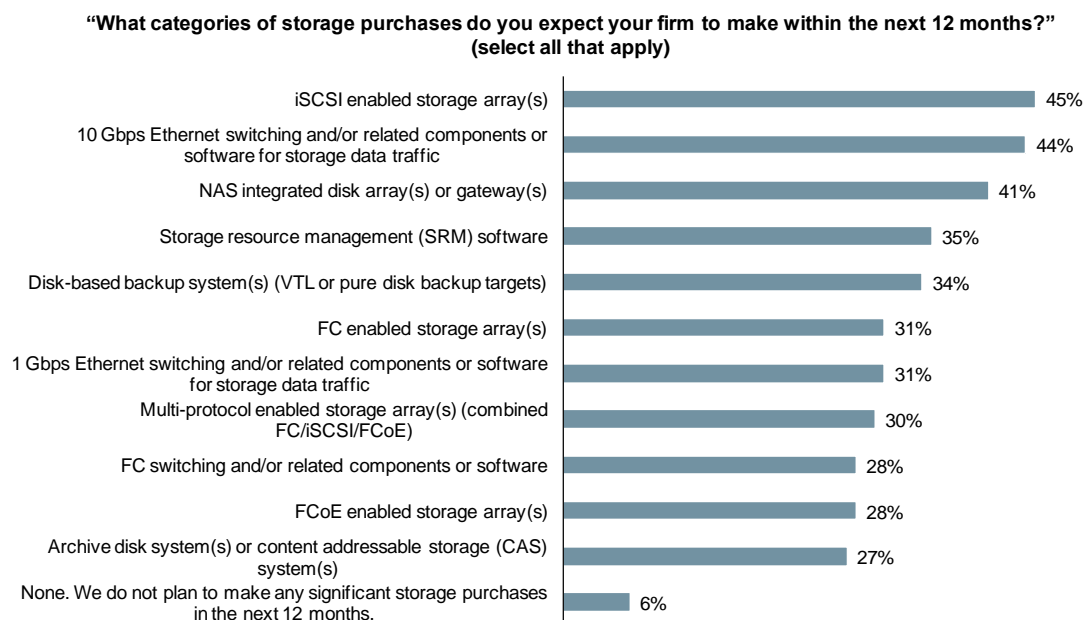**Figure 12: Server Virtualization Adoption Progress And Storage Protocol Selection**

"Is your organization currently using server virtualization technology?"

Implementation is complete, virtual servers are in production, and further expansion is planned or expected	34%
Implementation is complete, virtual servers are in production, and no further expansion is planned	10%
Implementation is currently under way	30%
No, but we have plans to implement this technology	20%
No, and we have no plans to adopt	6%

"What storage network protocol(s) are you using (or plan to use) for your virtual server environment?" (select all that apply)

Fibre Channel	59%
iSCSI	57%
NFS	52%
FCoE	33%
Non-networked: direct attached disk/disk onboard server	3%

Base: 200 storage decision-makers using or planning to use server virtualization

Base: 213 storage decision-makers

Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009
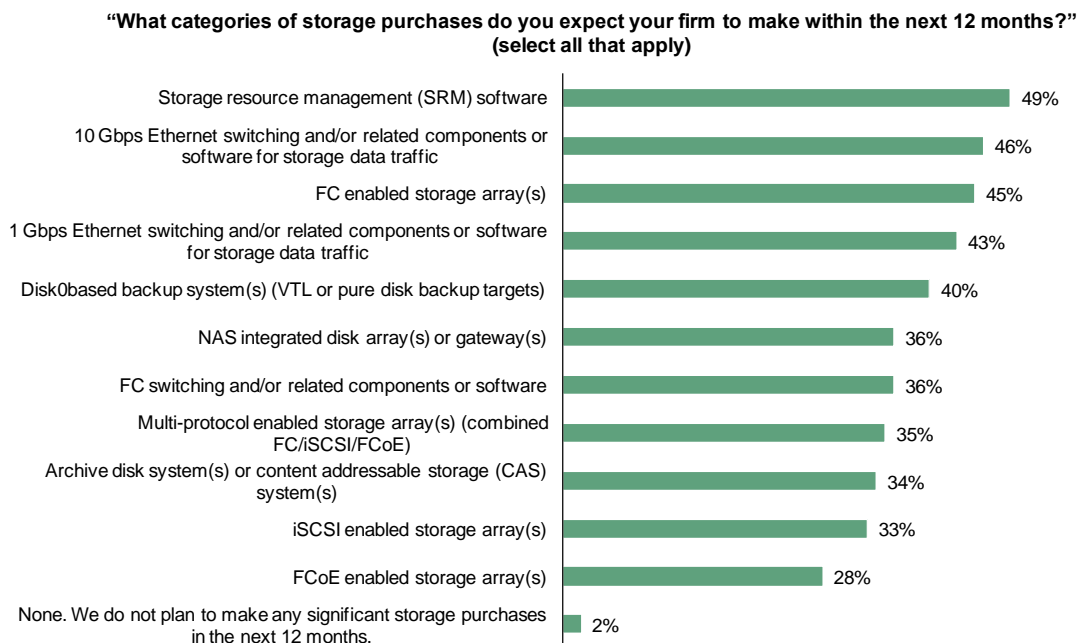
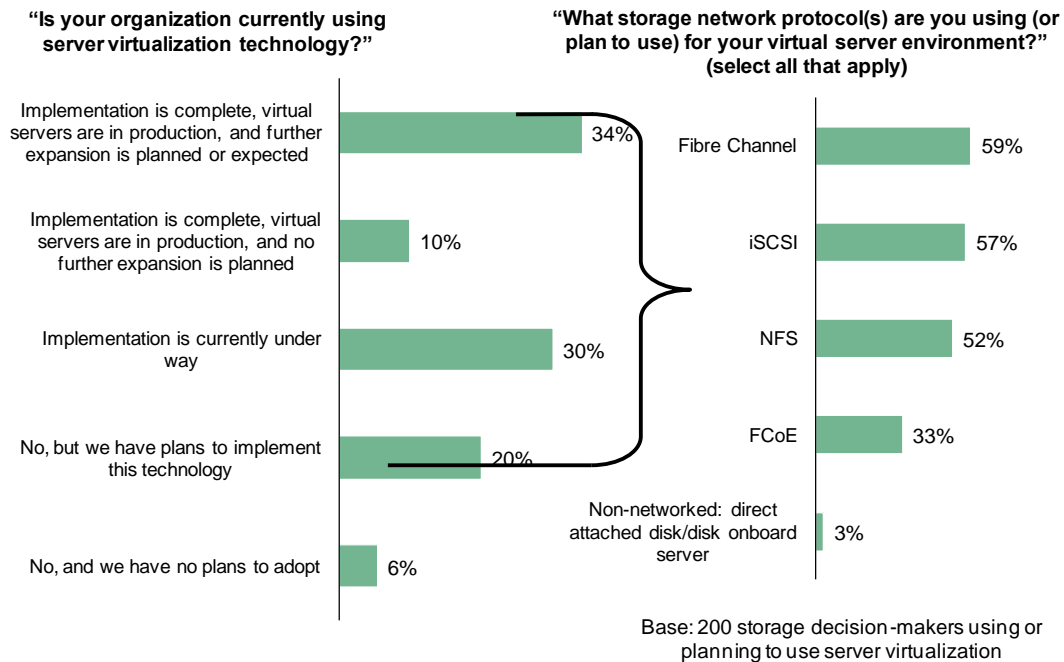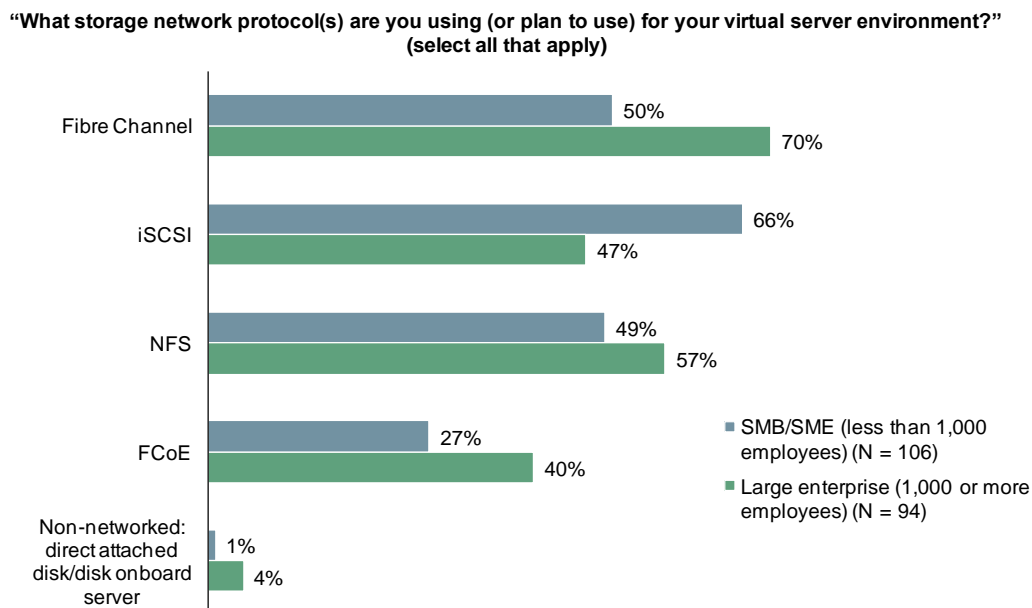**Figure 13: Storage Protocol Selection For Virtual Server Environments By Company Size**

"What storage network protocol(s) are you using (or plan to use) for your virtual server environment?" (select all that apply)

	SMB/SME (less than 1,000 employees) (N = 106)	Large enterprise (1,000 or more employees) (N = 94)
Fibre Channel	50%	70%
iSCSI	66%	47%
NFS	49%	57%
FCoE	27%	40%
Non-networked: direct attached disk/disk onboard server	1%	4%

Base: storage decision-makers in each organization size indicating use or interest in server virtualization
Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

Fibre Channel Users Value Stability

Most current users of FC have been using it for some time and tend to value the stability of the environment. FC is often used in mission-critical application environments where performance and availability requirements are significant, and making changes related to these workloads is not a small undertaking. Respondents who use FC currently had the following to say:

- **FC users have deep experience with the protocol.** Sixty-eight percent of surveyed respondents who currently use FC indicate that they have had the protocol in use for three or more years. Only 6% state that they have begun using the protocol within the past year. This paints a picture of long-term adherents and few new adopters. Figure 14 shows the details of responses to this question.

- **Maturity and compatibility top the list of valued features.** When current users were asked which aspects of FC they valued most, attributes related to protocol maturity, stability and compatibility with servers and applications stood out as top factors. Figure 15 shows data on this set of responses.

- **Concerns about iSCSI maturity and best practices color FC user perceptions.** When asked about the viability and strength of iSCSI, FC users cite a lack of clear best practices, concern over maturity of the protocol, and performance worries as major barriers. Compatibility issues and difficulty of transition also rank high. Figure 16 shows the ranking of concerns.

- **FCoE leads as the likely Ethernet choice for FC users, but iSCSI and NFS rank highly.** It's not a surprise that FC users favor FCoE as their likely choice for Ethernet SAN given the protocol's compatibility with existing zoning and skill sets. We asked respondents who use only FC what protocol they might use if they did move to an Ethernet SAN, and a majority said FCoE. What is surprising though, is the closeness of the responses. Forty-four percent chose FCoE, but 30% chose iSCSI, at a close second, and 26% chose NFS, in third. Figure 17 shows the breakdown of the responses from these FC users.

- **Interviews confirm the conservatism of FC users.** In speaking with current users of FC, we found a clear concern over maturity and peer adoption levels. One respondent stated that "readiness of the technology will be a big factor in moving to Ethernet from pure fibre." Another respondent pointed to the cost of transitioning from FC to any protocol, stating that, "we have a big investment in FC, and would need a very compelling reason to abandon it."

Figure 14: Duration Of Experience With FC Among Current Users

"How many years of experience does your firm have using an FC SAN?"
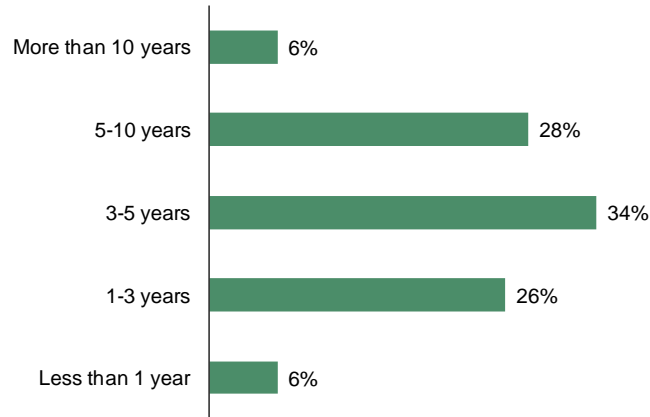
Category	Value
More than 10 years	6%
5-10 years	28%
3-5 years	34%
1-3 years	26%
Less than 1 year	6%

Base: 170 storage decision-makers currently using Fibre Channel

Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

Figure 15: Key Value Proposition Of FC For Current Users

"What are the top three aspects of FC SAN technology you value most? Please rank in order of value."

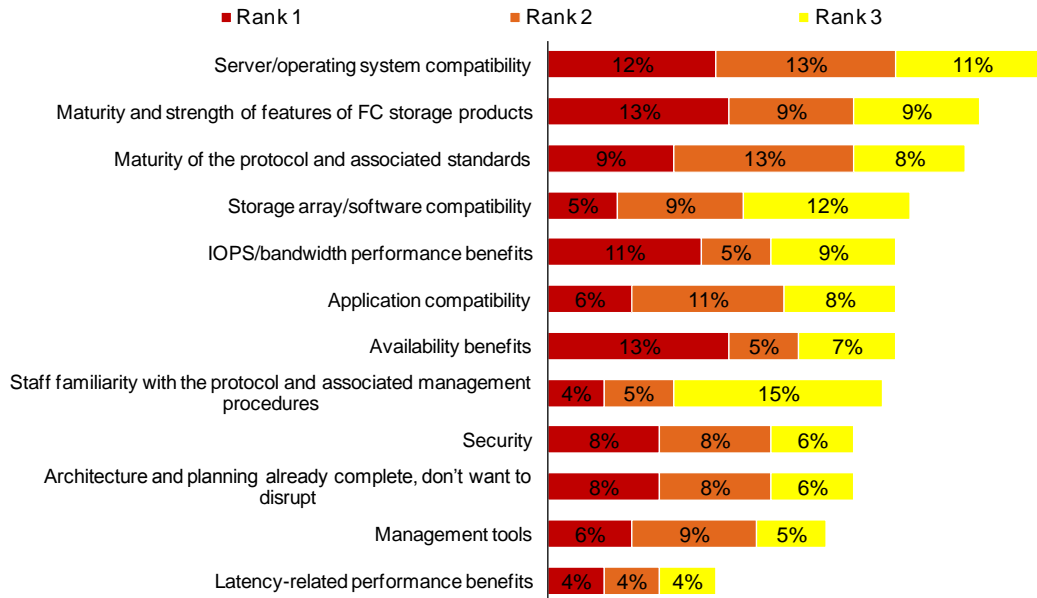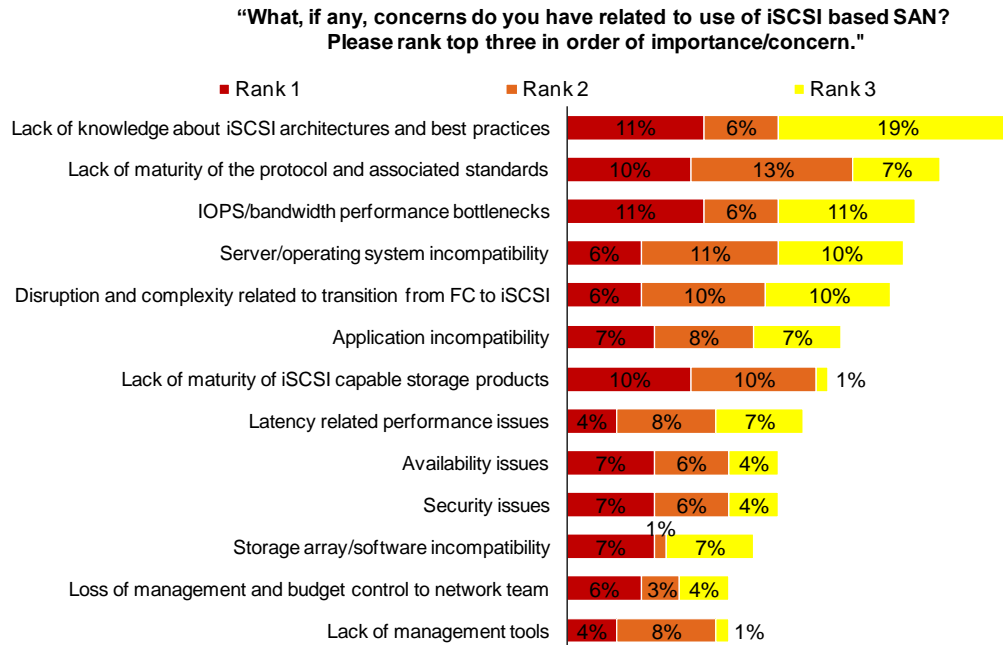|	Rank 1	Rank 2	Rank 3
Server/operating system compatibility	12%	13%	11%
Maturity and strength of features of FC storage products	13%	9%	9%
Maturity of the protocol and associated standards	9%	13%	8%
Storage array/software compatibility	5%	9%	12%
IOPS/bandwidth performance benefits	11%	5%	9%
Application compatibility	6%	11%	8%
Availability benefits	13%	5%	7%
Staff familiarity with the protocol and associated management procedures	4%	5%	15%
Security	8%	8%	6%
Architecture and planning already complete, don't want to disrupt	8%	8%	6%
Management tools	6%	9%	5%
Latency-related performance benefits	4%	4%	4%

Base: 170 storage decision-makers currently using Fibre Channel

Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

Figure 16: FC Users' Concern With iSCSI Revolves Around Maturity And Best Practices

**"What, if any, concerns do you have related to use of iSCSI based SAN?
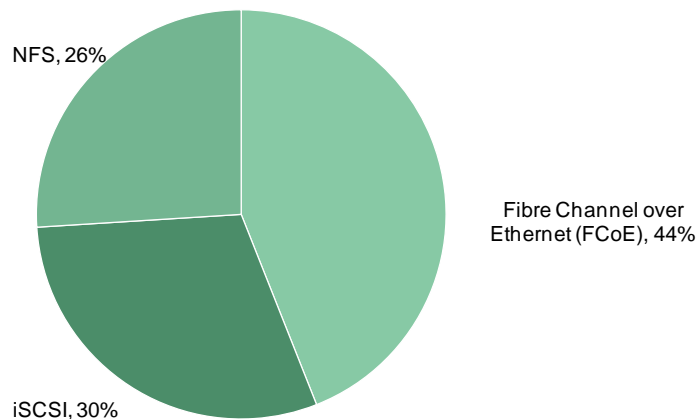Please rank top three in order of importance/concern."**

Base: 72 storage decision-makers not currently using iSCSI

Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

Figure 17: Likely Ethernet Storage Protocols For Users Of FC Only

"If you were to adopt an Ethernet storage protocol for application data traffic, which would you be most likely to consider?"

- NFS, 26%
- Fibre Channel over Ethernet (FCoE), 44%
- iSCSI, 30%

Base: 43 storage decision-makers currently using only Fibre Channel

Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009
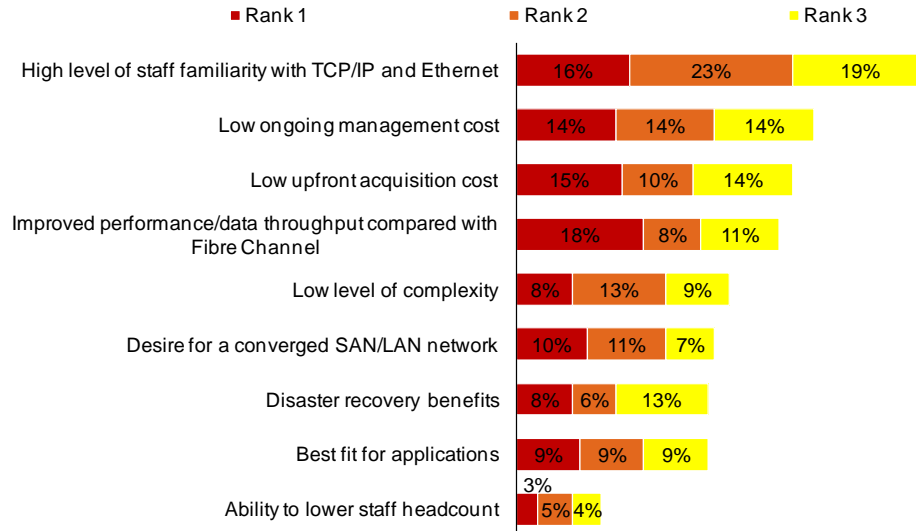
iSCSI Offers Simplicity And Cost Reduction

Because the process of moving from FC to iSCSI can be a challenge and building momentum for an alternative protocol in the conservative world of storage is no small feat, there must be some compelling reasons to push so many users down this path. This section of the report looks at the reasons buyers have chosen iSCSI and what their experiences have been like. Some of the results include:

- **Staff familiarity and cost reduction lead iSCSI motivations.** Fifty-eight percent of iSCSI users point to a high level of staff familiarity with TCP/IP and Ethernet as a key driver toward use of iSCSI as a storage protocol, the most common motivation in this survey. Forty-two percent point to low management costs and 39% to low cost of acquisition. Figure 18 shows the full details of motivations for implementation of iSCSI.

- **Before implementing iSCSI, users had disruption and compatibility concerns.** When asked about their main concerns regarding the adoption of iSCSI prior to making the leap, respondents point to the transition from FC to iSCSI as the most common. Thirty-three percent of iSCSI users in this study point to that issue, and obviously, these are individuals with previous FC experience. Other key concerns such as server compatibility and lack of knowledge of iSCSI best practices are relevant both to previous FC users and to those using iSCSI for their first SAN. The ranking of concerns can be found in Figure 19.

- **After implementing, issues were fewer than predicted concerns.** While there are clearly issues reported by current users, the severity seems to be lower than expected based on pre-implementation concerns. While only 2% of users reported no pre-implementation concerns, 16% of users report no post-implementation problems whatsoever. Lack of best practices seems to be the biggest real challenge, more than anticipated by the pre-implementation concerns, as were security issues. The full details on post-implementation iSCSI concerns can be found in Figure 20.

- **iSCSI tops the list of desired emerging technologies.** From a list of five emerging storage and data center technologies — iSCSI, storage virtualization, blade servers, 10 Gbps Ethernet, and FCoE — respondents in this survey showed the strongest interest in iSCSI. Sixty-eight percent of all respondents stated that they are currently using, implementing, or have near-term plans to implement iSCSI, higher than any other category in the question. The full data set for this question can be found in Figure 21.

- **Interviews point to more use of iSCSI in targeted use cases.** From discussions with iSCSI users, it's clear that ease of use and familiarity are key drivers. One respondent stated that he "kept FC for . . . key databases to guarantee performance at peak load," but that "iSCSI was easier to support and manage." A governmental user of both iSCSI and FC stated that "[virtualization software] is the only application on iSCSI so far," but that "long term we would like to move away from FC and onto iSCSI; database testing so far has been good."

Figure 18: Motivations For iSCSI Selection Among Current Users

"What were your top three motivations for selecting iSCSI as a storage networking protocol? Please rank in order of importance."

■ Rank 1   ■ Rank 2   ■ Rank 3

Motivation	Rank 1	Rank 2	Rank 3
High level of staff familiarity with TCP/IP and Ethernet	16%	23%	19%
Low ongoing management cost	14%	14%	14%
Low upfront acquisition cost	15%	10%	14%
Improved performance/data throughput compared with Fibre Channel	18%	8%	11%
Low level of complexity	8%	13%	9%
Desire for a converged SAN/LAN network	10%	11%	7%
Disaster recovery benefits	8%	6%	13%
Best fit for applications	9%	9%	9%
Ability to lower staff headcount	3%	5%	4%

Base: 141 storage decision-makers currently using iSCSI

Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

Figure 19: Pre-Implementation Concerns About iSCSI Use

"What were your top three pre-implementation concerns regarding use of iSCSI SAN? Please rank in order of importance."

■ Rank 1   ■ Rank 2   ■ Rank 3

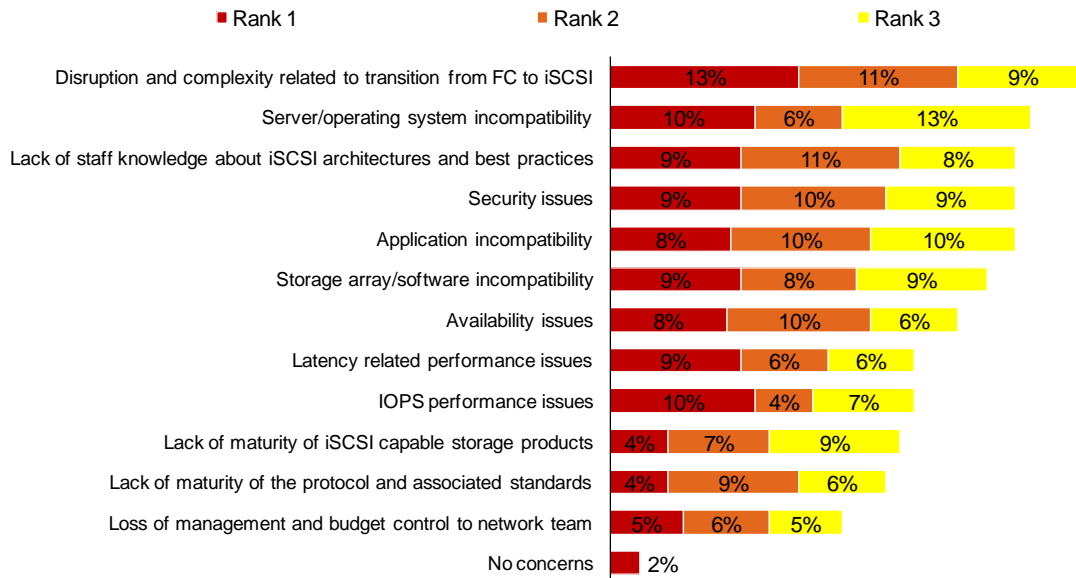| Concern	Rank 1	Rank 2	Rank 3
Disruption and complexity related to transition from FC to iSCSI	13%	11%	9%
Server/operating system incompatibility	10%	6%	13%
Lack of staff knowledge about iSCSI architectures and best practices	9%	11%	8%
Security issues	9%	10%	9%
Application incompatibility	8%	10%	10%
Storage array/software incompatibility	9%	8%	9%
Availability issues	8%	10%	6%
Latency related performance issues	9%	6%	6%
IOPS performance issues	10%	4%	7%
Lack of maturity of iSCSI capable storage products	4%	7%	9%
Lack of maturity of the protocol and associated standards	4%	9%	6%
Loss of management and budget control to network team	5%	6%	5%
No concerns	2%		

Base: 141 storage decision-makers currently using iSCSI

Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009
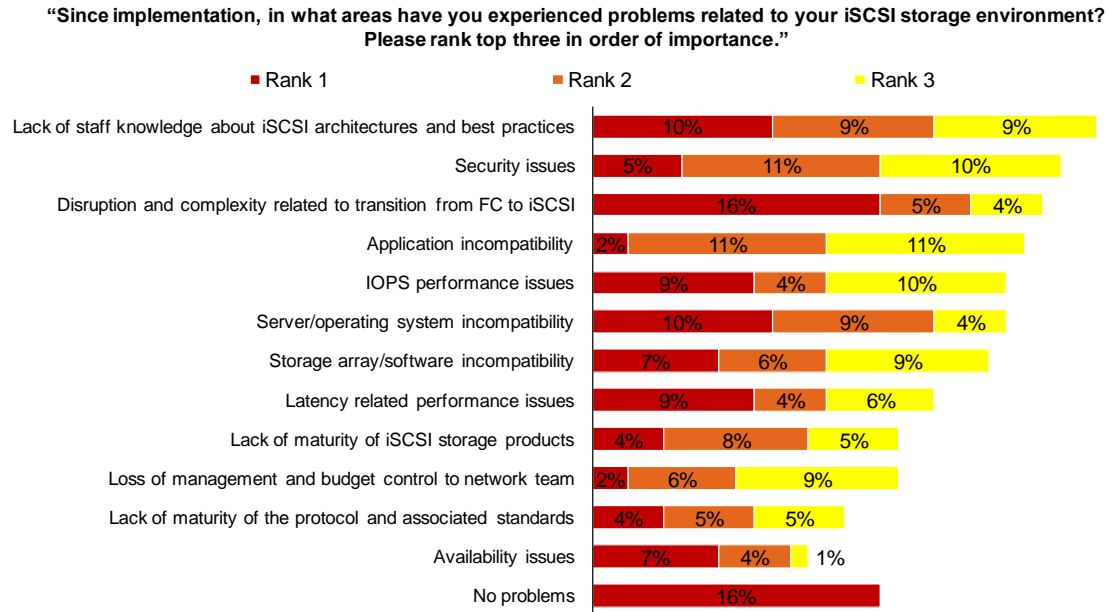
Figure 20: Post-Implementation Issues With iSCSI

"Since implementation, in what areas have you experienced problems related to your iSCSI storage environment? Please rank top three in order of importance."

■ Rank 1   ■ Rank 2   ■ Rank 3

Issue	Rank 1	Rank 2	Rank 3
Lack of staff knowledge about iSCSI architectures and best practices	10%	9%	9%
Security issues	5%	11%	10%
Disruption and complexity related to transition from FC to iSCSI	16%	5%	4%
Application incompatibility	2%	11%	11%
IOPS performance issues	9%	4%	10%
Server/operating system incompatibility	10%	9%	4%
Storage array/software incompatibility	7%	6%	9%
Latency related performance issues	9%	4%	6%
Lack of maturity of iSCSI storage products	4%	8%	5%
Loss of management and budget control to network team	2%	6%	9%
Lack of maturity of the protocol and associated standards	4%	5%	5%
Availability issues	7%	4%	1%
No problems	16%		

Base: 141 storage decision-makers currently using iSCSI
Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009
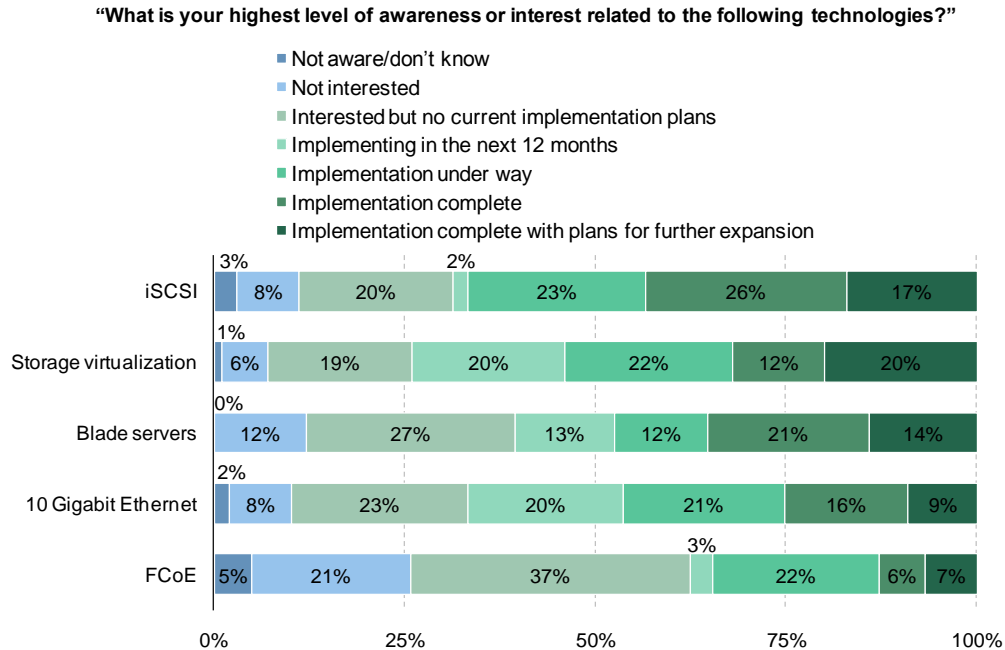
Figure 21: Interest Levels In Emerging Storage And Data Center Technologies

"What is your highest level of awareness or interest related to the following technologies?"

■ Not aware/don't know
■ Not interested
■ Interested but no current implementation plans
■ Implementing in the next 12 months
■ Implementation under way
■ Implementation complete
■ Implementation complete with plans for further expansion

Technology	Not aware	Not interested	Interested no plans	Next 12 months	Under way	Complete	Complete + expansion
iSCSI	3%	8%	20%	2%	23%	26%	17%
Storage virtualization	1%	6%	19%	20%	22%	12%	20%
Blade servers	0%	12%	27%	13%	12%	21%	14%
10 Gigabit Ethernet	2%	8%	23%	20%	21%	16%	9%
FCoE	5%	21%	37%	3%	22%	6%	7%

Base: 213 storage decision-makers
Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

Conclusions

This report is intended to be a study of current interest levels and perceptions regarding unified fabric and enabling storage technologies. It is not a referendum on which architectures will win, but rather a directional document intended to shed light on the current trends in the market. Users would do well to give attention to these trends now because the infrastructure foundation will take significant time to develop. Some key conclusions from this study include:

- **Unified fabric is a key technology trend to plan for.** Use of Ethernet for both LAN and SAN appears to be a concept with significant momentum that is likely to provide considerable benefits for adopters. While there remain some questions about what it will look like and when most firms will move toward adoption, it makes good sense to gain further understanding of the concepts and supporting technologies, and to begin evaluating Ethernet storage offerings now as a precursor to eventual fabric unification.

- **Many organizations have adopted Ethernet SAN already.** A significant number of respondents in this survey have already adopted forms of Ethernet storage networking, and many have several different storage protocols in place simultaneously. Use of Ethernet storage can no longer be seen as emerging or cutting edge, as present usage appears so common in firms of many sizes and storage capacity requirements.

- **Transition to unified fabric will be gradual.** The cost and risk associated with wholesale replacement of existing storage network equipment is prohibitive. Most early adopters, as well as those expressing near-term interest in the benefits of unified fabric, point to a phased approach to moving in this direction. Begin by identifying the applications that are best suited to shifting to Ethernet and the protocols that fit the environment best, and gain a solid understanding of options and best practices to plan an effective and gradual transition. Coordinate the move with refresh cycles, replacing legacy network equipment as it reaches the end of useful life with technology that supports UF.

- **Interested buyers must balance current offerings with future potential.** Some of the protocols that can support unified fabric are available today, while others are still in the works. Buyers interested in the benefits of convergence should compare the increased momentum proposed by iSCSI and NFS, which are available today, with possible improved continuity of skill sets and architecture promised by FCoE, knowing that FCoE products and capabilities still require further development for end-to-end support.

Appendix A: Methodology And Respondent Demographics

In this study, Dell commissioned Forrester Consulting to conduct an online survey of 213 storage decision-makers in the US, UK, China, and the Netherlands, as well as 10 in-depth interviews with these professionals, to evaluate current storage trends. Questions provided to the participants asked about current storage management, priorities, and goals, and perceptions regarding different storage protocols — specifically, awareness and interest in unified fabric technology. The study began in September 2009 and was completed in November 2009.

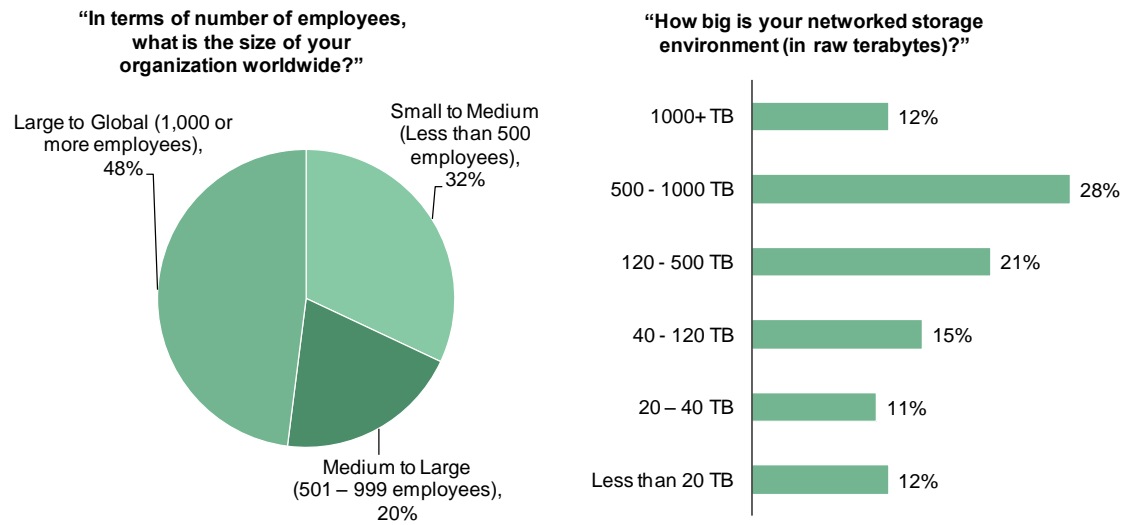Respondents of this survey fell into the following demographic categories:

- Of the 213 respondents, 120 worked for organizations based in the US, 31 for organizations based in China, 32 for organizations located in the Netherlands, and 30 for organizations based in the UK.

- Respondents represented a broad range of industries (see Figure A.1).

- Respondents represented small, medium, and large organizations, with 48% representing organizations with 1,000 or more employees (see Figure A.2). Organizations represented also showed a wide range of storage environment sizes.

Figure A.1: Respondents Represent A Broad Range of Industries
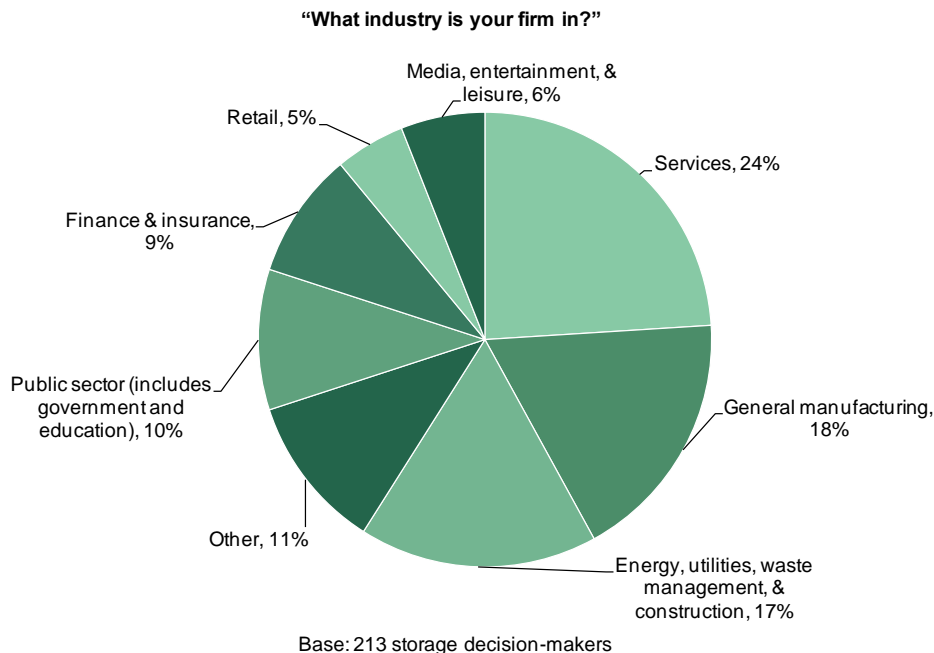
"What industry is your firm in?"

Base: 213 storage decision-makers

Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

Figure A.2: Organizational and Storage Environment Size

"In terms of number of employees, what is the size of your organization worldwide?"

- Large to Global (1,000 or more employees), 48%
- Small to Medium (Less than 500 employees), 32%
- Medium to Large (501 – 999 employees), 20%

"How big is your networked storage environment (in raw terabytes)?"

- 1000+ TB — 12%
- 500 - 1000 TB — 28%
- 120 - 500 TB — 21%
- 40 - 120 TB — 15%
- 20 – 40 TB — 11%
- Less than 20 TB — 12%

Base: 213 storage decision-makers

Source: "The Future of Unified Fabric," a commissioned study conducted by Forrester Consulting on behalf of Dell, November 2009

Appendix B: Endnotes

[1] Source: "Storage Choices For Virtual Server Environments," Forrester Research, Inc., January 15, 2009.

[2] Source: "Addressing Significant Growth Of Data With The iSCSI Protocol," a commissioned Thought Leadership Paper produced by Forrester Consulting on behalf of Dell, September 16, 2008.