

Asset Resource Consolidation: The Migration from DAS to SAN

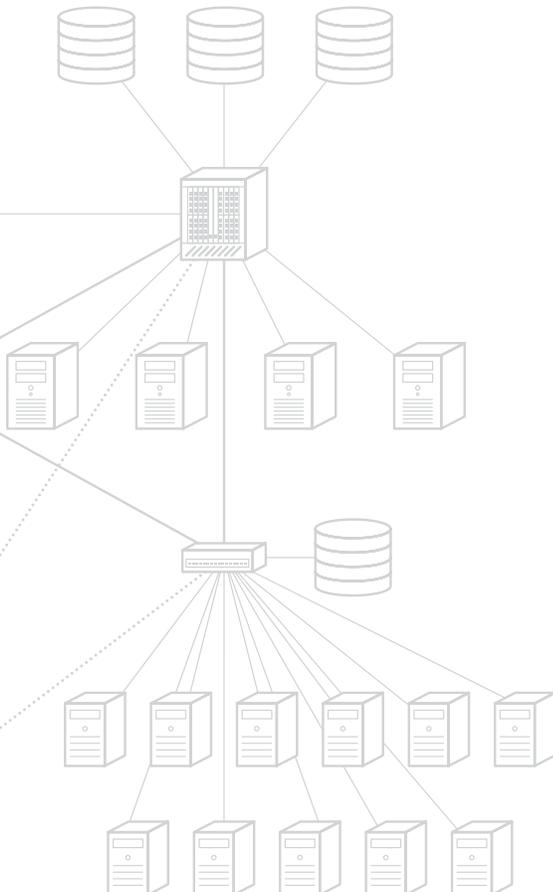


EXECUTIVE SUMMARY

This white paper is for information technology (IT) administrators and executives in small-to-medium sized enterprises (SMEs). It discusses ways to maximize the value they deliver for their IT dollar. It also looks at ways to more effectively manage mushrooming data and satisfy expanding data availability requirements.

For those currently using direct attached storage (DAS) as an approach to storing data, or those looking to build out their company or departmental storage area network (SAN), this paper attempts to answer “why should I do this?” IT professionals should also gain a clearer understanding of the business, financial and technical cases for migrating to, or expanding a SAN. Additionally, we provide a checklist of questions to help IT staffers determine if such action is appropriate for their company.

Finally, we discuss the essential building block of a small-to-medium-sized SAN, the fabric switch. The McDATA Sphereon™ 4500 passes the many tests described herein for a reliable fabric switch to ensure access to data enterprise-wide and get the most value out of flat or shrinking IT budgets.



STORAGE CHALLENGES

Today's IT executives face an economic climate that is but a shadow of its former self in the late 1990's. Falling or flat revenues along with increasing competition combine to make it more difficult to deliver shareholders the returns they expect. As a result, business executives pursue corporate-wide initiatives to boost revenues and cut expenses. Inevitably, these drivers filter down to IT departments that are called upon to do more with the same or shrinking budgets.

"More" in this case means managing, protecting, backing up and restoring data that is growing at a rate of 50 to 70 percent compounded annually.² This is particularly true in industries such as financial services where data growth is driven strongly by Internet and customer-oriented applications along with 24 x 7 business operations. In order to compete, or more accurately survive, businesses must have fast, problem free access to their applications and associated data to meet customer expectations. This places an increasing burden on companies' IT resources.

IT executives in turn, through flat or shrinking budgets, have been forced to apply even more stringent return on investment (ROI) litmus tests to prioritize projects. And they've had to consider new technologies or approaches to achieving their goals to meet more challenging corporate requirements.

Fortunately, one such approach offers substantial ROI, operational and technical benefits. For many enterprises, storage consolidation can be the answer to their storage availability, management and utilization problems.

CONSOLIDATION OVERVIEW

Consolidation is defined as moving from a large number of small-capacity lower-performance devices to a small number of large capacity high performance devices. IT professionals are encouraged to take a holistic view of consolidation to include

server, disk array and tape assets. This approach maximizes performance gains at a lower total cost of ownership to deliver superior value for the investment.

Servers may be physically consolidated by replacing a number of low-performance servers with one or more high-performance servers. As large numbers of dated servers come off lease, an enterprise can deploy fewer, more powerful servers, to capture significant increases

in performance and functionality. This is made possible by prices that are lower relative to significant performance gains.

In terms of storage resources, consolidation takes the form of migrating from a direct-attached storage (DAS) environment to the establishment or expansion of a storage area network (SAN). A single SAN attached disk array can displace multiple direct-attached devices to make storage resources more available and manageable at the enterprise level.

The primary benefit of moving from a DAS to SAN environment is the ability to decouple storage resources from servers, placing them on a shared network to leverage maximum asset utilization for the cost.

"IT infrastructure is just something that companies use to make business work. Anything that saves money and does the same job increases efficiency. Hence, one of the basic premises of storage is that consolidation allows you to get better utilization out of equipment, more with less hardware and makes it cheaper to manage."¹

Simon Gordon
Sr. Technical Consultant and 15-year industry veteran

Tape storage resources may also be consolidated through the creation of tape drive pools and the deployment of tape libraries. This results in significantly higher disk and tape device/media utilization rates in a SAN environment compared to direct attach tape when leveraging a SAN environment. Libraries automate previously manual tape handling for robust productivity gains, lower media failure rates and fewer lost cartridges.

SAN BENEFITS ARE DRIVING MAINSTREAM ACCEPTANCE

According to a Gartner report, SAN topologies have gained wide market acceptance with spending expected to exceed \$25B by 2005.³ The drivers speeding SAN acceptance over DAS topologies include:

- Lower total cost of ownership (TCO)
- Higher availability of data to meet 24 x 7 business operations



- Greater reliability of components and redundant architecture to support business continuity
- Consolidation of storage resources to achieve significantly higher utilization rates
- Significant reduction in labor hours and personnel needed to manage network resources
- Substantially greater flexibility in dynamically assigning server and storage resources in a fraction of the time DAS topologies allow

New technologies and ways of managing storage gain acceptance through cost-effectively and efficiently achieving enterprises' objectives. Fortunately for IT executives, the cost of SAN implementation has gone down dramatically since the technology's inception. Businesses can now implement a SAN with the expectation of substantial overall system savings, as illustrated in Figure 1.

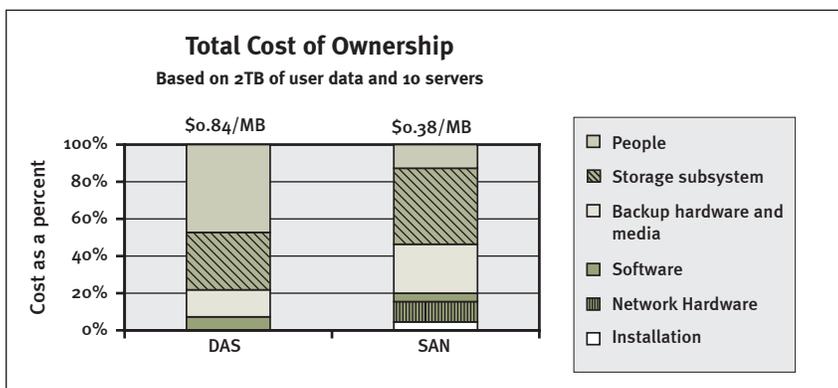


Figure 1

Low total cost of ownership and significant resource efficiencies of a SAN⁴

And while capital equipment expenditures do rise for switches and centralized storage resources, SANs are invariably easier to manage, requiring much less in personnel resources as Figure 1 shows.

THE DAS APPROACH IS REACHING ITS LIMITS

A direct-attached point-to-point topology links disks, disk arrays and/or tape drives directly to a server via a SCSI connection. This coupling represents a single point of failure and limits access to disc space by other servers throughout the enterprise. Additionally,

SCSI technology has other limitations for growing companies, including problems with bus disruption, physical size limitations, and a much slower data transmission speed compared to now-standard SAN Fibre Channel links.

Another drawback of DAS topologies is that they are highly inflexible when deploying new servers to meet a business need. Significant configuration is required and maintaining such an architecture as a DAS network scales requires ever-rising headcounts. Required management resources typically grow linearly, in lockstep with server growth.

By contrast, consolidation reduces the number of hardware resources, management resource costs can correspondingly be reduced to achieve a much lower operational cost per terabyte deployed. And with consolidation, centralized management may be realized to achieve further management cost savings

A SAN approach allows tape resources to be fully utilized 24 hours a day while also reducing backup windows by allowing backups to be completed at the maximum speed of the tape drive technology.

DAS solutions have their advantages to be sure. Adding more storage is inexpensive. When scaling storage, the addition of its accompanying server adds to a company's computing power. And no training is required to get staff up to speed on legacy systems.

But the sum total of costs and benefits to this solution pale in comparison to emerging SAN topologies as the most efficient infrastructure to optimize resource productivity and overall cost through consolidation to a fewer number of overall hardware devices.

THE SAN APPROACH: STORAGE WITH ROOM TO GROW

A SAN is comprised of storage devices, one or more fabric switches, a director for larger networks (essentially a supercharged switch featuring ultra-high availability and capacity) and the servers they support. One of the many advantages of this topology is that it offers any-to-any connectivity within the SAN fabric versus one-to-one in a DAS environment. Another advantage is redundancy. Architecturally, redundancy is built into a SAN by adding switches in pairs, and

³ S. Zaffos, "Using SAN and NAS Technologies to Consolidate Storage," Gartner Research, 2002.

⁴ James Berlino, et al, "The Storage Report - Customer Perspectives & Industry Evolution," McKinsey/Merrill Lynch, 2001

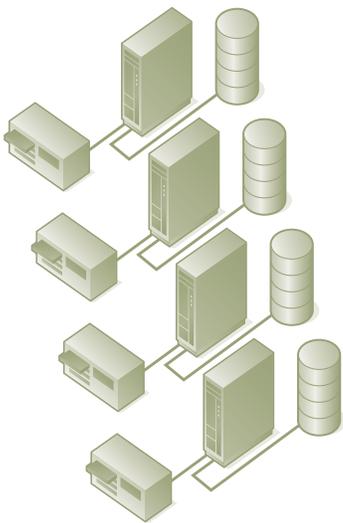


Figure 2
Typical DAS topology

through interconnected cabling that eliminates single points of failure.

SANs also centrally support heterogeneous platforms like UNIX, Windows 2000 and Sun with consolidated storage devices. This greatly simplifies network management and backup activities and requires a lower headcount to manage ever-growing data volumes.

What's more, SANs typically make use of Fibre Channel (FC) connectivity to deliver data transmission rates many times over its slower SCSI

cousin. Coupled with lower latency rates in the two-microsecond range, FC is a compelling choice.

EXTERNAL STORAGE CONSOLIDATION

Storage components consist of pooled devices and may include both disk arrays and tape libraries. Whereas tape DAS solutions require a drive for each server they support, SAN library tape drives may be consolidated to achieve greater utilization of these assets and consequently require fewer to implement tape operations. This architecture also enables better capacity management to improve utilization, the implementation of more performance options, and a wider range of business continuity options. Enterprises can also

select best-of-breed storage and media and more flexible migration options inherent in going to external storage attached on a shared SAN network.

By migrating to a SAN, backup operation efficiencies may be substantially improved. Operationally, a company can set enterprise-wide standards for backup and restore functions. This is more difficult in DAS environments where backing up discrete storage islands can be inconsistent.

Tactically, tape media may also experience substantial increases in utilization (e.g., from 40 to 80 percent). Moreover, much higher capacity tape cartridges are available today. Enterprises consolidating their storage assets may migrate their data from a large number of small-capacity cartridges to many fewer high-capacity cartridges. For space-strapped data centers, the footprint savings alone could be substantial.

SERVER CONSOLIDATION

There are many advantages to server consolidation in a SAN topology. First, as an enterprise's servers come off lease, it can choose to economically replace a large number of obsolete servers with a smaller number of more powerful ones at lower cost points. Enterprise software applications can likewise be consolidated onto a small number of servers. And while many more users will be drawing upon the processing power of fewer servers, the technological advances in newer models more than make up for the greater work load.

A second major advantage is the flexibility SAN-based servers deliver. Servers can easily be added to and removed from the SAN fabric, requiring minimal configuration and administration. Consequently, IT department's response times can be substantially shrunk when deploying servers in support of emerging projects. This dovetails with enterprises' needs to be more nimble in the competitive business environment-starting projects on a moment's notice in support of corporate objectives.

FABRIC SWITCHES TO FACILITATE SERVER AND STORAGE CONSOLIDATION

A fabric switch routes data traffic between servers and storage resources to enable any-to-any connectivity. Small- to medium-

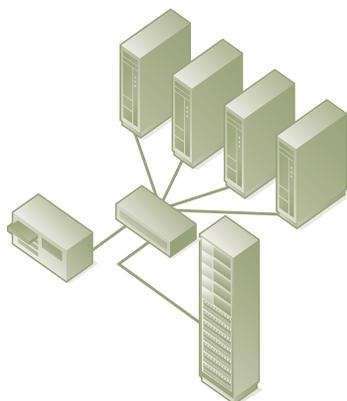


Figure 3
Typical SAN topology



sized SANs may use them to form the backbone of a storage network. Fabric switch port counts typically range from eight to 32 (for larger SANs, directors are a better choice with well over 100 ports in a single chassis). A 2-gigabit-per-second (Gb/s) data traffic throughput is today's standard with 10 Gb/s capacity on the horizon. Fibre Channel connectivity is also standard, giving SANs a significant data access speed advantage over DAS SCSI connections.

Because switches are vital to the effective, continued operation of a SAN, availability is an important feature to consider. Lower end switches might save IT dollars up front, but they can be costly in the long run when downtime, maintenance and upgrades are taken into account. A better strategy is to start with a more reliable switch that can grow with expanding storage needs. Switches that feature 99.99 percent or greater availability typically include components like redundant hot-pluggable power and cooling. These features help ensure access to business-critical data as required by internal and external customers alike.

Other important switch criteria include simplified management and an open systems design which ensures the switch is interoperable with devices from multiple vendors. To maximize availability, a switch should be able to upgrade its firmware non-disruptively as well. This frees IT administrators from the need to schedule and carry out powering down of their networks for this task.

And with flat IT budgets based on ROI business cases, the ideal switch will allow the addition of ports as needed rather than requiring the purchase of a fully-loaded chassis. IT managers today can choose to purchase a more advanced switch with only 8 or 16 of its ports enabled. As storage networking needs grow, an administrator can enable the remaining ports on the existing switch using a firmware key, instead of purchasing and installing a separate switch. This is the sort of SAN technology that helps eliminate the over-allocation of resources that is symptomatic of a DAS environment.

WHEN DOES A CONSOLIDATION STRATEGY MAKE SENSE?

There are many telltale signs that point to the technical and business reasons an enterprise may be ready to migrate to or build out a SAN.

Does your business require 24 x 7 high-availability to your data?

More and more enterprises find that 24 x 7 x 365 access to data by internal and external customers is a corporate requirement. Downtime, or long data access latency times translate into lower employee productivity and/or unhappy customers.

DAS solutions fail to meet the high availability standard. The server-storage link represents a single point of failure, and data access can be lost for long periods of time when a server fails. Even routine server administration tasks require scheduling downtime to complete, thus rendering server-attached storage inaccessible.

SANs eliminate single points of failure, pooling storage resources and routing data traffic across redundant paths. As an enterprise grows, additional storage can be added non-disruptively. Likewise, many of the administrative tasks needed to maintain the network can also be performed without impeding access to data. For instance, the addition or subtraction of servers to a SAN can easily be done non-disruptively to achieve a level of IT support flexibility not possible for DAS systems.

Is your enterprise currently managing, or do you expect to be managing over 1 terabyte of data?

This data volume threshold is a good measure of whether it may be economical to migrate to a SAN. For enterprises that have exceeded the 1TB demarcation or soon will, the financial, business and technological case to implement a SAN is much easier to make.

Are you called upon to manage larger data volumes with fewer people?

Scaling storage devices using a DAS model is cumbersome beyond the 1TB range for most enterprises. And growing numbers of servers with their attached storage can substantially add administrator labor hours to an IT team's workload. This commonly results in IT departments that spend the majority of their time fighting fires rather than optimizing their resources in support of corporate objectives.

By migrating to a SAN, storage resources can be consolidated into fewer storage devices that are physically and/or logically pooled. This topology requires significantly less administrative time to

manage. For example, in the case of data backups, DAS solutions require separate backups for each server platform. Within a SAN environment, the pooled data is backed up centrally regardless of server platform. Programming backup jobs for a few storage resources, independent of the server platform it supports is significantly easier than setting up, monitoring and troubleshooting backup jobs for dozens of servers with attached storage.

SAN administrators garner the maximum benefits of consolidated storage resources when they use SAN management software applications. The more robust among these applications can automate many manual DAS tasks, like having to personally check various devices in the network to confirm that a server or storage device hasn't gone down. Moreover, criteria can be established beforehand to automate alarms or redirect traffic to proactively manage the SAN.

According to many IT administrators, migrating to a SAN and utilizing a SAN management software application can cut administration labor hours by up to 50 percent.

Is it difficult to scale your current storage devices to meet greater demand?

For most companies, rapid data growth is pressuring IT departments to be much more efficient. As a result, economical and flexible scaling of storage assets is a primary consideration when looking ahead to near-future needs.

As alluded to earlier, one of the few advantages of DAS is the ease with which storage can be added at low expense. Unfortunately, placing additional storage into service disrupts data availability, something enterprises running 24 x 7 operations may not be able to afford.

Moreover, as a DAS architecture builds out, so too do the number of storage islands, separate from each other with data volume sets unavailable enterprise-wide. Add to that the personal attention that routine backups and administration require, and the maintenance requirements of attending to a DAS environment outstrip its benefits.

SANs on the other hand overcome these challenges. They are designed to be centrally managed from a single location, as

opposed to discrete DAS islands throughout the enterprise. In addition, with the right storage components, storage capacity may easily be added non-disruptively—ensuring continuity of business operations and access to critical data.

Do you need to substantially increase your storage utilization?

DAS solutions, due to their inability to share storage resources, deliver low aggregate utilization rates averaging about 40 percent. With the hassles of adding additional storage, which necessitates bringing a server down, administrators often over-allocate storage capacity to begin with to help forestall this scenario.

SANs, by contrast, allow tremendous flexibility in storage allocation and thus utilization rates can rise up to 80 percent in practice. So rather than stranding unused capacity on a direct-attached server, SANs can dynamically allocate data capacity as needed. And if a user exceeds this capacity, allocating additional capacity can be done in minutes versus typical hours (or days) required in scaling a DAS solution.

Do you need greater flexibility and speed in deploying servers to support end-user projects?

IT administrators supporting dynamic business environments would benefit from the greater flexibility a SAN enables. Pulling a DAS server off the line to reconfigure it for new projects is time-consuming. By contrast, SAN servers may be added, subtracted or rotated with comparative ease. This empowers IT executives and administrators to better support fast-paced business environments by quickly deploying servers to a SAN and dynamically allocating storage resources.

If you answered yes to any one of these questions, it may be time to seriously investigate transitioning to a SAN topology. If you answered yes to all of the questions, your network may have already grown to the point where the DAS benefits are delivering diminishing returns.

It is never too early to begin researching and planning a new SAN. While SANs deliver significant performance advantages, they can be complex to plan and implement. Investing more time up front in the planning phase will yield significant dividends in the form of a smooth transition and fewer hassles.



SAN SOLUTIONS FOR SMALL-TO-MEDIUM ENTERPRISES

When IT executives and administrators are ready to implement a SAN, there are a few sound principles to help guide them in the right direction.

“Storage and file server consolidation is the solution of choice for coping with staff and budget shortages and delivering 24 x 7 data availability.”⁵

S. Zaffos
Gartner Research

At the center of an effective, consolidated small- or medium-sized SAN is a high-performance fabric switch. Because this switch makes up the backbone of the SAN, it must be evaluated for:

- High availability and reliability
- Ease of manageability
- Rapid, simple scalability, and
- Interoperability with other devices
- Decouple server and storage resources
- Improved resource sharing

The McDATA Sphereon™ 4500 Fabric Switch is ideal for small-to-medium enterprises because it combines the most important features of a good fabric switch.

AVAILABILITY

The Sphereon 4500, for example, offers several availability features to significantly reduce network downtime and ensure continued access to critical data. These include:

- Hot-plug redundant power and cooling components
- Advanced error detection to react proactively to potential problems
- On-line, non-disruptive firmware upgrades

Together, these features combine to deliver a 99.99 percent availability rating.

MANAGEABILITY

There are a variety of management tools that deliver a range of management options suited for small to very large SAN fabrics. All of these software applications help minimize downtime and greatly simplify the day-to-day management and optimization of a SAN.

Some software features that can greatly enhance small fabric management include auto-discovery of all of the devices on the SAN regardless of make or model, an intuitive user interface, and planning tools to help plan for future growth. Some of the more advanced software applications are more customizable and offer proactive notification capabilities, sophisticated analysis tools (to help analyze performance trends, for example), and report generation in a variety of formats.

McData's Sphereon 4500 Fabric Switch supports a variety of management options, from simple monitoring and configuration to integration into enterprise-wide framework management applications. The SANpilot™ management application integrated into every Sphereon switch is ideal for managing small fabrics (less than eight switches), and includes an intuitive interface and essential features such as zoning, simple fabric management, and complete configuration tools for McDATA switches. A command-line interface (CLI) lets administrators automate tasks to boost productivity.

SCALABILITY

Flexibility is the watchword for scalability. Those solutions featuring “pay as you grow” in-the-box scalability give enterprises flexibility to match their budgets. FlexPort technology, for instance, which is included on the Sphereon 4500, enables companies to minimize their initial investment and build out their network on an as-needed basis. This approach allows for the activation of additional port capacity as demand grows.

There are two main advantages to this strategy. First, enterprises get the performance benefits of a larger port-count switch while paying for only the capacity needed. Second, by deploying a switch with a higher port count capacity, companies can build out their SAN with fewer switches. This facilitates ease of administration and boosts the total available ports because fewer inter-switch links are required.

⁵ S. Zaffos, "Using SAN and NAS Technologies to Consolidate Storage," Gartner Research, 2002

Another feature to look for in a switch is a “future-ready” design. IT departments should be able to protect their initial investment in switches as new technologies emerge. Switches should be backward and forward compatible with other devices and be able to economically incorporate new technologies as they become available.

Intelligently built fabric switches such as the Sphereon 4500 are designed to accommodate future technologies. This enables IT executives to protect their capital investments in legacy equipment while simultaneously extending the switch's service life and boosting overall return on investment.

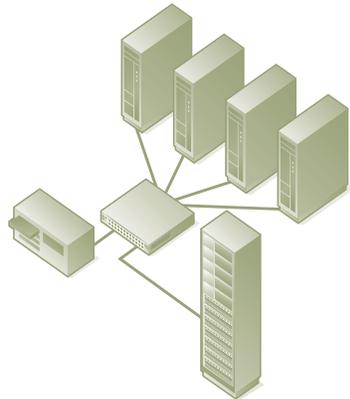


Figure 4
Typical SAN with Sphereon™ 4500

INTEROPERABILITY

As IT executives build out their SANs, they want the freedom to select components that deliver the best value for their budget dollar. With this in mind, many businesses are opting to deploy only those elements that interoperate seamlessly in multi-vendor, heterogeneous environments. This strategy also protects capital investments in legacy devices and extends their useful lives to lower their lifetime cost of ownership.

McDATA devices are designed to effectively perform in heterogeneous environments. Sphereon Fabric Switches must pass stringent interoperability tests to ensure their ability to work well with the leading vendor devices deployed in SANs around the world.

TO OVERCOME SAN IMPLEMENTATION CHALLENGES, ENGAGE EXPERIENCED PROFESSIONALS

IT executives exploring migrating from a DAS to a SAN or building out their current SANs frequently have questions or concerns about the migration of their data to a new system. It can be extremely

cost-effective to have experienced industry experts help to implement a system. For example, the McDATA Professional Services team has deployed hundreds of SANs, helping businesses get the best value for their investment and balancing appropriate expenditures with the best performing solutions available. Training is also available for SAN management. (For more information about McDATA products and services, visit www.mcdata.com.)

SUMMARY

For IT executives and administrators called upon to do more with shrinking budgets, consolidation can help them cross this chasm. A holistic approach to server, disk array and tape resource consolidation and management can bring many benefits to an organization. These include:

- Higher data availability due to redundant architectures and components, helping businesses meet 24 x 7 data access needs
- A lower total costs of ownership
- Easier and faster scalability that can be accomplished non-disruptively
- Higher storage media utilization rates
- Data that is easier to manage, backup and recover
- Fewer full time equivalents needed to oversee a SAN
- More flexible support for dynamic business environments, which call upon servers to be rotated in and out of the network
- Storage capacity which can easily be dynamically assigned

IT professionals that use the concepts of availability, manageability, scalability and interoperability to guide them will be more likely to succeed in deploying a productive SAN. Choosing solid devices, like the Sphereon 4500 and first-rate management software applications will save enterprises money in the long run. Companies will also be better equipped to meet more challenging availability requirements and have room to cost-effectively grow.

