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**White
Paper**

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Storage Resource Management

An illustration of a large globe of the Earth. Two business professionals, a man and a woman, are standing on red ladders that are leaning against the globe. They are positioned on opposite sides of the globe, reaching out towards each other as if to shake hands. The background is a textured, purple and blue gradient. The globe is resting on a circular shadow on a light-colored surface.

**Developing a Road Map to Link
Global Businesses and
their Partners**


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Storage Resource Management, or SRM, has taken center stage in the high-end storage arena, and companies are discovering how this new tool can link them to their customers, partners and employees.

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At the recent Storage Networking Industry Association (SNIA) and Computerworld Storage Networking World® conference in Orlando, Fla., attendees were asked a variety of storage related questions. Their answers may surprise you.

Storage Resource Management

Developing a Road Map to Link Global Businesses and their Partners

Storage Resource Management (SRM) is evolving from a mere tool that monitors and reports on storage as an isolated entity to a set of tools and practices that help companies better serve their customers. SRM has grown to include management of the system, the fabric, the application and the storage devices (primary and secondary) and the efficient backup and recovery of data. Some refer to it as “top-to-bottom integration.”

SRM should be further defined as providing a consolidated view, monitoring and measuring the status of all of the resources and deploying active management alternatives to prevent interruption of service and ensuring that adequate plans are in place for future growth.

By Lisa Hart and Michael Peterson, industry analysts, IN_fusion

To understand where SRM fits into your storage solution, think of the storage utility as the dial tone and SRM as the telephone and service that ensures and enables the dial tone. The storage utility — the holy grail of storage — is seamless access to data, regardless

of the time or location. It is where applications are universally accessible, sharable, ubiquitous and available around-the-clock.

Users want to access data in much the same way as they do other utilities such as their telephone, water and electricity. But to do this, there must be an automated, seamless and intelligent way to manage it all. For the storage utility to truly become a reality, organizations must first implement SRM practices for operational reliability and reduce total cost of ownership and overall cost effective storage management. Resources can no longer be managed as individual components in isolation.

The overall concept of SRM must evolve to a higher level that is as inclusive and seamless as the future of the storage utility itself.

SRM - The Prelude

Although the storage utility is still a vision of the future, SRM, the enabler of this ubiquitous state, shows promise in helping companies move closer to their business goals and objectives.

“The importance of Storage Resource Management has increased exponentially as information has become more valuable, computing environments have become more complex and the cost to manage this growth continues to spiral out of control,” says Dan Stanton, senior manager of corporate information services at a world-leading biopharmaceutical firm. “With a shortage of people and resources, many companies cannot afford the time to implement SRM tools, let alone take on the whole management nirvana. Careful planning and a road map are essential elements in determining the proper strategy to accomplish overall cost-effective management.”

Stanton further states, “A vendor

might have the best tools on the market, but without an appropriate road map and strategy, it would be very difficult to implement them. We must ensure that the tools and practices we deploy match up with our overall corporate objectives. To survive in this information economy, you must have a clear understanding of where you are and where you are going. Having a well-thought-out road map, intelligent tools and adopting new philosophies about the way you manage the information will be key to the success of your business and implementing a true SRM solution.”

Explosive Data Growth

Storage is growing at a brisk pace and IT organizations are struggling to deal with the scalability and manageability issues caused by this growth (see chart).

It is estimated that the storage growth rate is between 60% and 100% per year and accelerating. This growth is spurring IT organizations to look for better alternatives to help with the challenge of managing these vast resources, the data that resides on them and the glue that integrates them all together.

Users need a way to navigate the complexities of managing hundreds, maybe hundreds of thousands of heterogeneous systems distributed across the world. Practically overnight, companies have transitioned from storing gigabytes of data to storing and managing terabytes of data that is spread across the country and around the world.

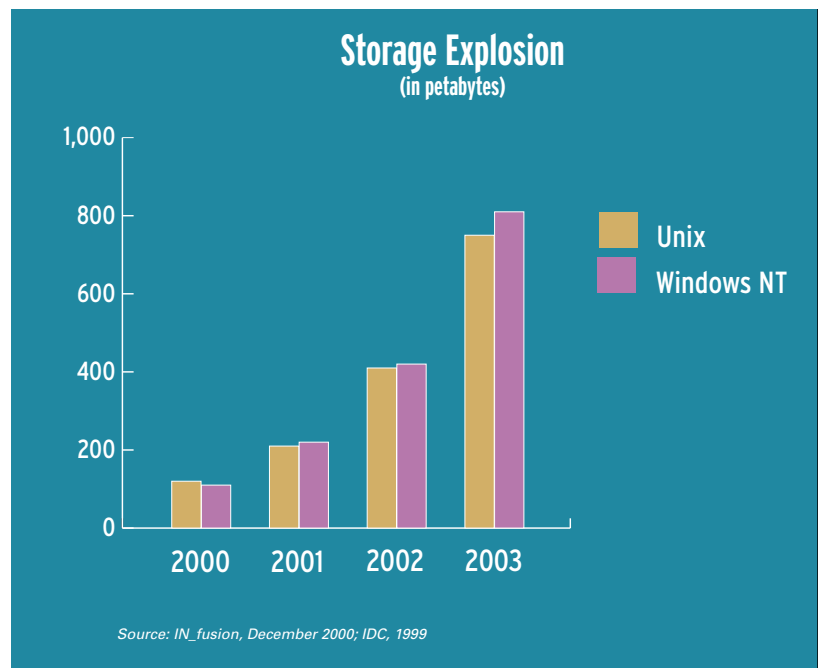
Emerging business applications have shifted to make information a

company's most important capital asset. The amount of Web content and management complexities that have emerged from Internet-based applications such as e-business and e-commerce is staggering. Terabyte-plus databases, data warehouses and electronic-voice and video-mail systems will continue to drive requirements for scalable capacity, optimized performance and global access 24 hours a day. These storage-intensive and mission-critical applications have exacerbated the management challenge and driven home the need to include all of the components, even the application, when implementing resource management strategies.

IT managers must now worry about storing vast amounts of data online, offering shared access and implementing a strategy to back it up. They must also keep lifelong

archives in case the data is needed again. New applications, such as electronic medicine, are beginning to consume large amounts of storage, and businesses that must deal with medical data are evolving their infrastructures to support different data types that are more visual in nature. These data types include graphs, charts, X-rays and even genetic DNA. Online interaction and virtual sharing of CT-scans, digital echocardiograms and lab reports can't tolerate data loss or interruptions that inhibit access to the data.

An example of electronic medicine could be a pharmaceutical company collecting clinical data from different sources about the medicines they provide to hospitals, clinics and doctors. The pharmaceutical company has a "real time" need to analyze and trend the data that has been accessed from multiterabyte databases.



Designing server, network and data storage systems for storage-intensive applications like these requires careful planning. These systems hit the limits of today's traditional file management and storage systems capabilities.

The Need for Better Alternatives

Perhaps the most complex aspect of this storage explosion is the control and management of its implementation and growth. There is a huge gap between the two. The total cost of managing storage grows substantially every year, and storage management expertise is becoming increasingly scarce. Depending on the source, it is estimated that more than 600,000 IT positions are currently unfilled and that number increases daily. In addition to a resource shortage, administrators are having to master new skills to manage these heterogeneous, complex infrastructures. Management tools are the bridge that will span this gap.

The cost of storage and bandwidth continues to decrease. But the real cost to organizations is in the management of the data: It's estimated that the cost of managing storage today is three to 10 times greater than the cost of the storage itself. As a result, businesses could be facing a management crisis, if the cost to manage these critical resources continues to spiral out of control.

"Throughout the 1970s and 1980s, storage deployment could be described as a 'many-to-one,' with all storage devices connected to the server, typically a mainframe," says Fred Moore, president of Horizon In-

formation Strategies. "During the late 1980s and 1990s, a 'one-to-one' relationship developed between the server and storage devices. Devices were dedicated to a particular server, as departmental and distributed servers became widespread," he says.

"Servers and storage were co-located. The LAN then materialized. This decentralized approach created islands of computing and storage that were costly to manage. Most often in this computing model, data was not accessible to another server in the LAN in case of failure. Applications that weren't in a clustered or a symmetrical multiprocessor designed system were unavailable until they could be restarted. The most critical and valuable element of the enterprise, the data, was too often unavailable and the costs for an un-

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scheduled outage remained severe for most every business," says Moore.

Organizations are still battling some of the same issues as in the '80s and '90s.

They still have islands of storage, and they still wrestle with the threat of running out of space to store their business-critical data. When a corporate network is close to reaching its storage capacity, the usual response from IT managers is to add more hardware. However, the luxury of just adding more storage, even though the cost has decreased significantly, is no longer feasible. Companies have millions and millions of files now to maintain, back up, archive or migrate. Some of these files contain data that is extremely valuable and critical to the success of the company while other files are unused and unnecessary — a waste of space. Reclaiming this valuable space creates a substantial cost savings.

The increase in volume and growing complexity of the data has forced administrators to begin deploying disciplines such as limiting the amount of storage and forcing users to purge old and unnecessary files. Some have even gone to the extreme of establishing quotas that prohibit users from sending or receiving e-mails, for example, until they have eliminated some of their files and created free space.

New storage topologies that encompass storage-area networks (SAN), network attached storage (NAS) and a host of other intelligent storage devices have in some ways made more complex, and in others simplified, the often demanding

management challenge.

On a SAN, storage is no longer an individual component attached to a specific server but a logically managed, centralized entity independent of any particular server or group of servers. This simplifies the management of disparate systems across an IP network.

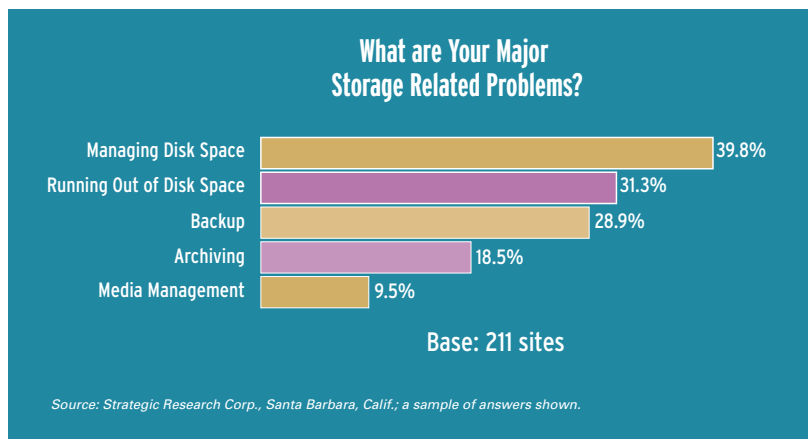
With budgets decreasing, storage requirements increasing and a continuing shortage of skilled individuals to manage these expanded infrastructures, it is easy to conclude that environments could eventually become unmanageable. For this reason, many IT managers will eventually begin to look at outsourcing storage management as a viable alternative. In the past year, numerous service providers have emerged offering the promise of seamlessly managing the storage, the application and even the network itself.

A recent Strategic Research Corp. survey estimated that databases now contain approximately 55% of all data on disk subsystems across enterprise, midrange and distributed computing platforms. Many of these databases scale to multiterabyte applications. Another 31% responded that running out of storage space has become a major problem (see chart). Backing up these huge databases and archiving the right information at the right time also surfaced as key problems that still need

to be addressed.

Today, organizations must keep an inventory of how much storage is being consumed and where it is allocated to ensure appropriate performance and availability. They also have

small, midsize and large corporate sites. By 2004, the average total corporate server capacity could exceed more than 3T bytes and a typical network administrator could be managing more than 300G bytes of net-



to keep an inventory of which applications are using the most storage and at what rate, and how often it is backed up. Administrators also have to keep track of who is using it, how much data they consume, which files should be archived and which ones should be deleted. Add to that the need to plan for future growth and ensure that the data is available day and night and it's easy to see why managing these precious resources can be tedious and costly.

Research Shows Growth

Strategic Research Corp.'s 2001 Network Demographics report projects that from 1999 to 2004, a typical company's total server capacity will grow at an annual compounded rate of 60%. Although this might seem low by comparison to other projections, the report included a sample of

work storage (more than one terabyte in the enterprise data center), in addition to overseeing the workstations that produce the data. These studies demonstrate that manual storage management practices that are no longer tenable from an operational or economical perspective.

"We implemented a three-phase approach," says Jim Coles, senior software systems specialist at auto giant DaimlerChrysler. "We use the existing system programs to help monitor our systems, we implemented SRM tools to minimize intervention and give us a more sophisticated way to look at our resources, and we established comprehensive storage policies, as our last step, to ensure that things don't spin out of control. No matter how much you automate there will always need to be some level of human intervention."

There are many commercially available SRM tools. Each product varies in the components it offers, but most provide a framework for automating the analysis of storage, capacity, utilization and availability statistics.

Most of the SRM tools now encompass heterogeneous support, centralized monitoring, alerting, trend analysis and intelligent reporting capabilities. Several of the vendors include in their offerings the ability to predict failures and then take corrective action based on policy-driven rules.

More recently, vendors have taken the view that the application is a critical part of management and should be included as part of the tool suite. Storage technologies such as SAN and NAS are making their debut, and vendors are adding support to their existing tools or developing new tool suites targeted specifically at these networked storage environments.

Implementing SRM

IT organizations that have implemented SRM tools have seen countless advantages and rewards in their ability to monitor the rate that space is being used, who is using it and how much they are using. They have been able to spot problems early and implement timely solutions. Administrators no longer spend the whole day collecting information and inserting it into a spreadsheet, which awaits another manual analysis. The sheer automation has improved the integrity of the data, not to mention the cost to manage it.

“Measuring the benefits of SRM can be difficult,” says Dennis Kelley, senior systems engineer at HCA, “but it does not take long for management to see the benefit when your production environment is brought to its knees from an undetected failure.”

Future SRM Requirements

IT managers need to respond to a request for specific information at any given time about the current state of their enterprise. They must be able to ensure that users have uninterrupted access to applications and stored information.

As organizations begin to take a more centralized approach to management and deploy such storage networking alternatives as SAN and NAS, they must be able to view their entire resource infrastructure.

“We need to be able to manage our heterogeneous environment with a common set of policies and procedures, as well as a set of tools that are all-encompassing,” says Kelley Green, computer center planning specialist for the state of Utah. Green

believes that tools need to include the necessary intelligence and support of a SAN, and the state has recently added one to its pool of managed resources. “Distributed systems have not demonstrated the same reliability as the mainframe environment, which is why we have moved to a SAN. We believe the SAN and associated tools will give us higher availability and improve the management of our resources.”

Since applications are driving many of the business decisions, organizations want to ensure that they have immediate access to information and that the application itself is being monitored as part of the overall resources.

“Management tools that give you insight into isolated storage only tell you so much,” says Dean Holland of Blue Cross/Blue Shield of Tennessee. “We need management tools that include intelligence about the applications that are utilizing the storage and begin to take proactive measures whenever possible.”

Companies continue to ask for advanced tools that automatically de-

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tect, filter, diagnose and suggest solutions, thus easing the burden for systems administrators who have increased their areas of responsibilities. The administrators want tools and policies that help remove them from the day-to-day management so that they can focus on more business-related issues.

“I need a tool that is broad enough to encompass all of our platforms. It needs to work seamlessly with other third-party products, and it needs to be flexible enough to integrate new technologies without a lot of work,” says Dick Gorman, enterprise storage manager for discount footwear retailer, Payless ShoeSource Inc.

Businesses continue to consume capacity at an incredible rate, which has caused administrators to require detailed information regarding the consumption of the storage — how quickly it is growing, how it’s being used and by whom, and in some cases how it is being misused. This type of information is critical for capacity planning, setting thresholds and establishing charge-backs for various departments within an organization.

As a result, reporting has become a critical element within the folds of SRM. Without the proper analysis, IT managers would be unable to report on the given state of their resources or identify critical trends in “real time” that could ultimately affect their business.

Recent studies showed utilization, performance, availability and quality of service as the top reporting categories that IT managers look for in an SRM tool.

“As disk utilization continues to

increase, we need reports that provide the user an analysis of all his files and the usage criteria associated with each one,” says Bill Wheeler, network systems engineer at VW Credit Inc., a subsidiary of Volkswagen of America. “We need SRM tools that automate the management and free up the administrators and engineers to work on other business issues. Tools need to have the intelligence built in to automatically archive mail messages, for example, to secondary storage, once the user has hit the threshold for capacity.”

Future Outlook

There is an increased need for global access to business-critical information. This need is forcing organizations to rethink their storage strategies and begin to recognize the importance of SRM as a key element of efficient information delivery.

As companies become more global, the infrastructure and management controls that are required will be even more challenging. Storage will continue to grow at phenomenal rates and so will the need to manage that storage and its resources. Eventually, organizations must face up to the reality that true storage resource management must be all-encompassing, comprehensive, extremely intelligent and highly automated to enable their storage utility dream.

SRM is more than a set of tools; it’s a mind set on how you drive the business, how you efficiently and effectively manage information and how you use that information to make better business decisions.

Companies shouldn’t underesti-

mate the value of developing a road map that supports their long-term business objectives and establishing a set of policies and procedures consistent with their budgetary constraints. As companies begin managing their business more from an application and business perspective, they need their valuable resources — people — focused on ensuring the timely delivery of business-critical information, rather than worrying whether or not the computing elements are functioning properly.

SRM has many different meanings, depending on whom you ask, but one thing everyone can agree on is that as we move into the 21st century, companies can’t operate efficiently without it. It is the bridge that links global businesses and their customers, suppliers, employees and partners throughout the world, 24 hours a day. What was once a prelude to the storage utility has now taken center stage and is the entry point to the future.★

Michael Peterson is president of Strategic Research Corp. in Santa Barbara, Calif., and is founder of the business development firm, IN_fusion, also in Santa Barbara.

Lisa Hart has more than 20 years’ experience in the storage and storage networking industry and is a partner at IN_fusion.

Speaking Out about SRM

Users talk about how they are initiating effective SRM practices

“Implementation of monitoring and management tools saved us when one of our primary applications hit the wall. It all started when I was meeting with an auditor from our internal audits group. While we were discussing the security aspects of our systems, my pager went off informing me that one of our file systems had reached a threshold of 96%.

This is how our monitoring and management tools alert me when there is a problem. By the time I logged in, the file system was already at 99% full. Had I not been able to intervene and solve the problem, this primary application would have crashed, bringing approximately 1,500 users with it and an hour of downtime. The cost of downtime for that one event could have been as much as \$30,000. The software paid for itself in that one incident.”

— **Dean Holland,**
AIX systems administrator,
Blue Cross/Blue Shield
of Tennessee

“The cost of storage is getting cheaper, which encourages people to store more and more data. The problem is that much of the data is stale or redundant, which is wasting valuable space. Storage Resource Management tools have provided a means to

identify which data should be deleted or archived. As a result, we have been able to free up space on the disk, reduce administrative costs in managing it and save time and money in what it would take to back it all up.”

— **David Jenkins,**
network administrator for a
worldwide manufacturer that
builds automotive components

“We have come full circle. We began with a centralized environment of mainframe storage and then added distributed storage devices to our area of responsibility. This decentralized approach added complexity, cost and fueled individualized islands of storage. To address these issues and regain some control, we brought most of our distributed systems under the umbrella of enterprise storage. In so doing, we solved one set of challenges, but introduced a few new ones.

We now needed to understand the needs of these new customers and develop the knowledge of the open environment and associated applications. Although they were under one umbrella, we still needed to manage this group of heterogeneous systems in a seamless, central manner. To help centrally manage this storage, we deployed a SAN initiative, giving us the

ability to manage multiple resources in a more controlled way. With this behind us, we are now in the process of bringing on intelligent SAN management SRM tools to move us even closer to our business objectives.”

— **Ann Ehland,**
Systems engineer,
Mellon Financial Services

“In my opinion, the best Storage Resource Management approach is to first do the ground work. Develop a blueprint so that you have everyone’s full knowledge and support from the customers to the users to upper management. Without a vision of where you want to go and an endorsement of that direction, even the best management strategies and implementations will fail. There are some very good SRM utilities that will help, but they must be coupled with policies of soft and hard quotas. Having the involvement and buy-in from everyone will make the job of implementing SRM and its components a much more manageable task.”

— **Bill Wheeler,**
network systems engineer,
VW Credit Inc.,
a subsidiary of Volkswagen of
America

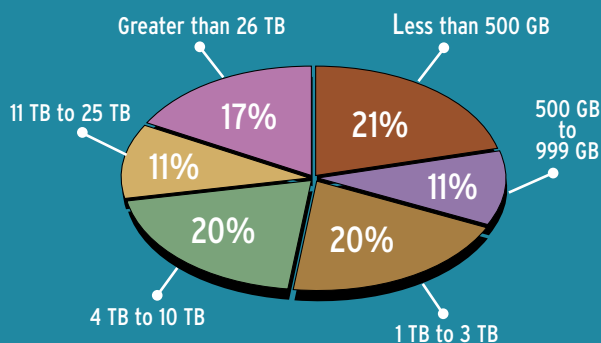
Survey Shows Storage Needs Keep Growing . . .

At the recent Computerworld Storage Networking World conference in Orlando, Fla., attendees were asked a variety of storage related questions. Here is a sample of their answers, which may surprise you.

In November 2000, more than 1,700 attendees arrived in Orlando, Fla. for the Storage Networking World® conference co-sponsored and produced by the Storage Networking Industry Association (SNIA) and Computerworld. They came from all over to hear and learn about enterprise storage. They saw real-life examples of storage deployments by users and they talked to industry analysts about the future of storage networking. They also attended technical tutorials given by storage industry experts.

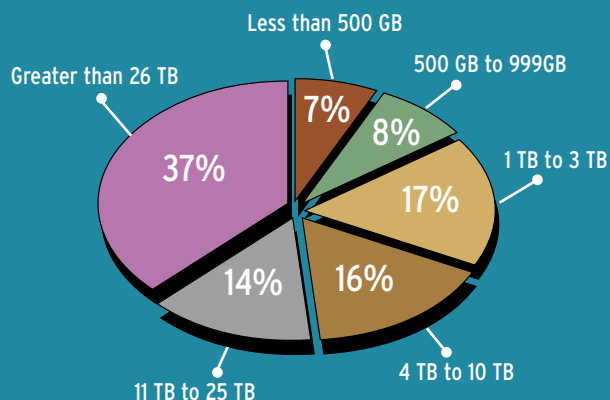
Throughout the conference attendees were given hand-held automated-response systems to record their answers to various questions. This feedback was tallied in real time so attendees could compare their thoughts on storage related issues with those of their peers.

What is the size of your managed storage capacity today?



Base: 252 Storage Networking World attendees

What do you expect will be the size of your managed storage capacity by October 2001?



Base: 278 Storage Networking World attendees

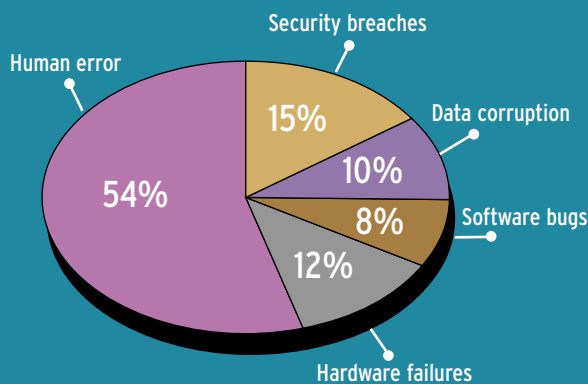
... and Needing IT Support

When attendees were asked what poses the biggest threat to their enterprise storage networks, more than half cited human error. Eighty-five percent admit that they do have staffing problems within their IT departments, which may explain the perceived threat.

The next Storage Networking World® will be held April 9 to April 11, 2001 at the Marriott Desert Springs Resort and Spa, Palm Desert, Calif.

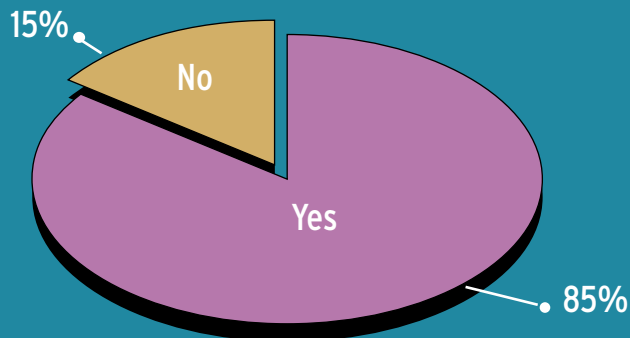
For more information on Storage Networking World®, including registration and the conference agenda go to: www.computerworld.com/snw.

Which of the following pose the most serious threat to you enterprise storage network?



Base: 190 Storage Networking World attendees

Do you have staffing problems in your IT organization?



Base: 268 Storage Networking World attendees