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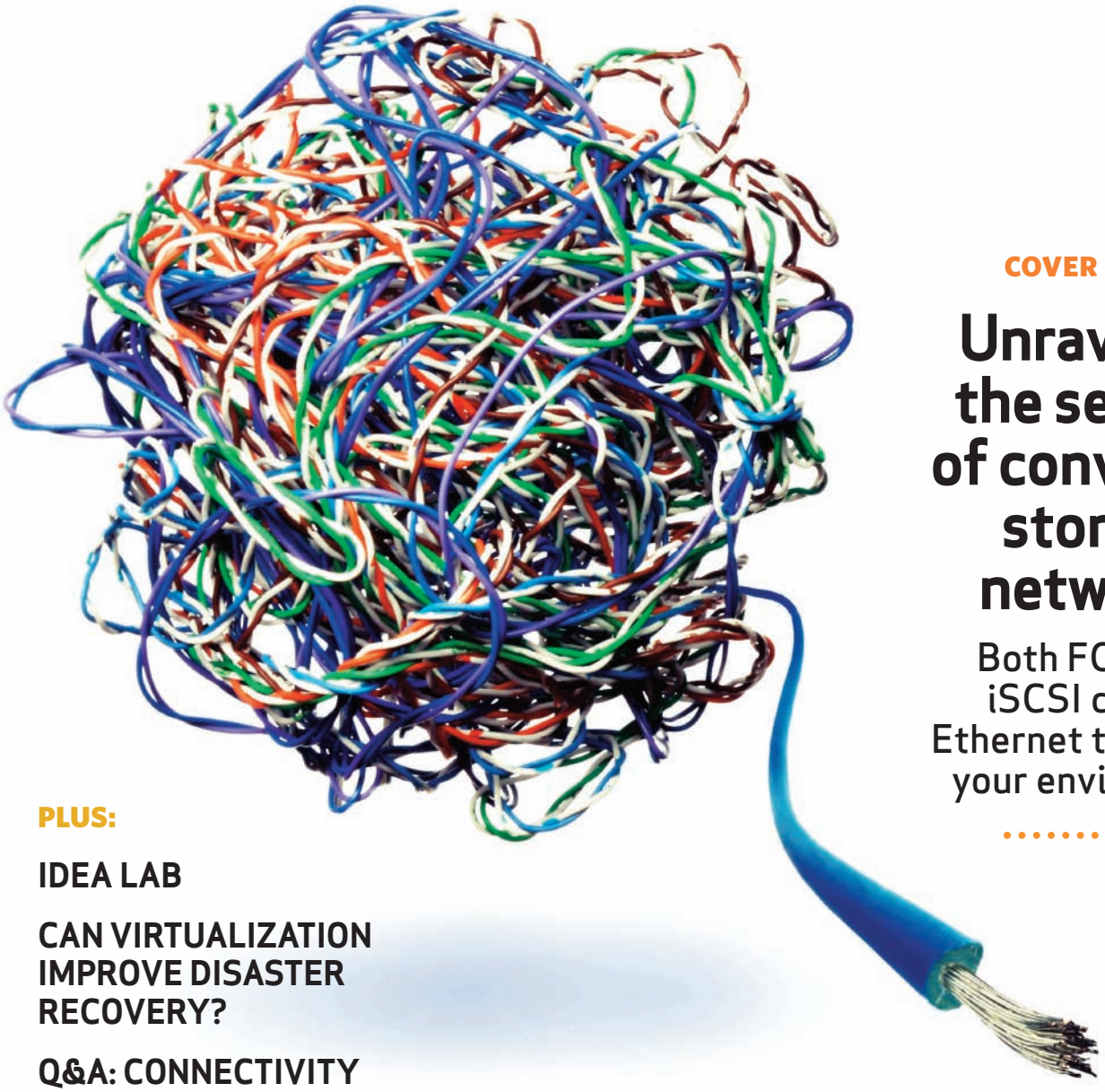
NETWORK evolution

BUILDING THE INFRASTRUCTURE TO ENABLE THE CHANGING FACE OF IT



COVER STORY

Unraveling the secrets of converged storage networks

Both FCoE and iSCSI can use Ethernet to simplify your environment

PLUS:

idealab

Where evolving network concepts come together

Network Attached Storage in a Virtualized Environment

In a virtualized environment, network attached storage appliances can serve as a swap space to move virtual machines between servers, act as a backup medium, or play the role of central repository for all virtual disk images.

NAS versus SAN for data center virtualization storage

There are two major approaches to network storage: network attached storage (NAS) and storage area network (SAN). They vary in both network architecture and how each presents itself to the network client. NAS devices leverage the existing IP network and deliver file-layer access. NAS appliances are optimized for sharing files across the network because they are nearly identical to a file server. SAN technologies, including Fibre Channel (FC) and iSCSI, deliver block-layer access, forgoing the file system abstractions and appearing to the client as essentially an unformatted hard disk. FC operates on a dedicated network, requiring its own FC switch and host bus adapters in each server. An emerging standard, Fibre Channel over Ethernet (FCoE), collapses the storage and IP network onto a single converged switch, but still requires a specialized converged networking adapter in each server. SAN solutions have an advantage over NAS devices in terms of performance, but at a cost of some contention issues. ■

SURVEY SAYS...

A survey of attendees at Gartner's recent Data Center Summit found that 27% are already converging with NAS and iSCSI, 23% are planning to use NAS and iSCSI and 32% plan to use FCoE in the next three years. No one reported using FCoE today.

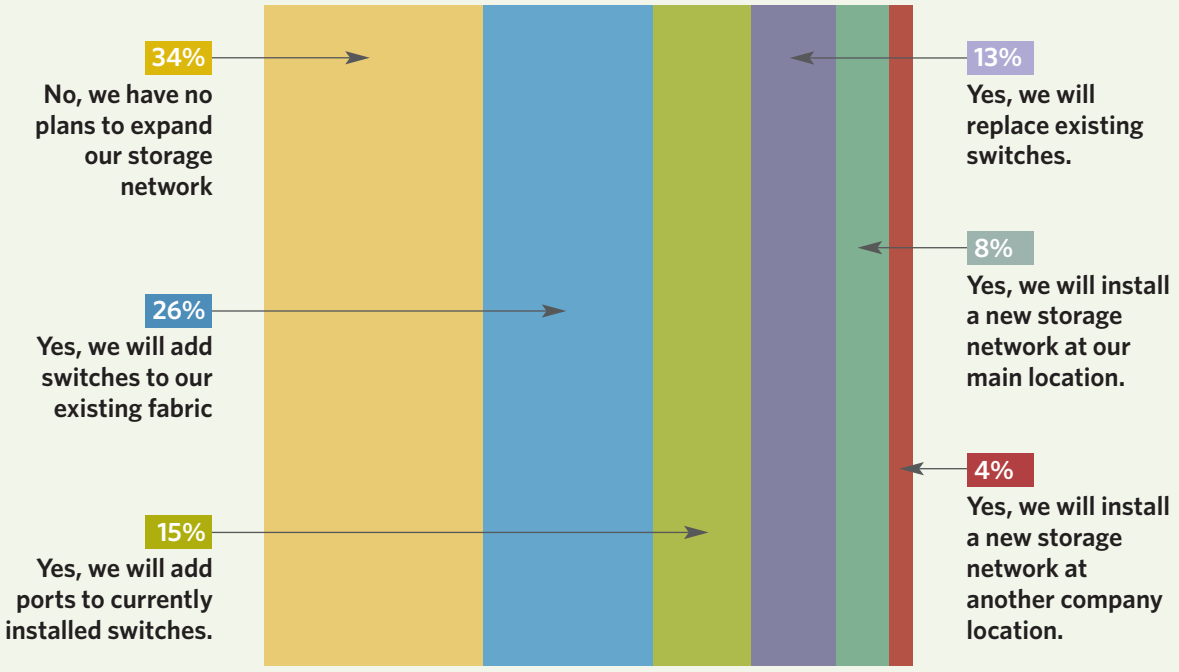
Understanding Failover and Failback

BY DEFINITION, **failover** is the capability to switch over to a redundant or standby server, system or network upon the failure or termination of an existing asset. This should occur without any kind of human intervention or warning. This contrasts with switchover, where you're dynamically making a transition from one environment to another.

Failback is the process of restoring a system or another asset that's in a failover state back to its original state. The assumption is that you're able to bring it back to the state of operation before the disruption.

With a virtualized environment, you can failover to the environment which exists in real time, and it's very easy to failback to the original mode because you can maintain images of your previous environments. What's nice about this is that it speeds up your recovery time and it's possible to do testing on an actual system without adversely affecting your actual production environment. You can then turn it on or off as quickly as you'd like, so virtualization really helps in the area of testing. ■

ARE YOU EXPANDING YOUR STORAGE NETWORK?



SOURCE: TECHTARGET STORAGE PRIORITIES SURVEY, NOV. 2010

NAS in Virtualization: Network Design Considerations

- Ensure that all connections are at least using Gigabit Ethernet.
- Verify that the network switches are at adequate subscription levels for the number of ports in use, giving enough bandwidth to the storage appliance.
- Reassess any Quality of Service (QoS) policies that may impact the links between the servers and storage and adjust if necessary to give additional priority to the increased storage traffic.
- Set network baselines before and after the NAS deployment to get a clear view of the impact of adding a NAS device to the data center network.
- Test and compare each of the network protocols available on the NAS device, typically NFS and CIFS to determine the best solution for your environment.

Moving forward

The role of network storage can quickly expand, opening the door to I/O bottlenecks and other constraints. A quick fix for the virtualized environment could rapidly snowball into a piecemeal enterprise storage solution, particularly in smaller organizations. It should be an imperative that even a small NAS deployment is followed up with a discussion about a more encompassing network storage strategy for the enterprise. Depending on the enterprise's needs, network storage could grow organically with larger scale NAS solutions or migrate to a SAN solution if higher throughput is required. ■

To learn more about NAS, click here.

DR PLANNING IN A VIRTUALIZED ENVIRONMENT

BECAUSE OF its ease of deployment and integration, server virtualization can be a highly effective tool for disaster recovery. Here's how:

→ **COST:** It allows companies to reduce the number of physical servers they deploy at production and recovery sites.

→ **PROCUREMENT DELAYS:** It eliminates most hardware dependencies.

→ **RAPID RECOVERY:** Virtualized server images can be rapidly deployed and in some cases, moved across physical systems. ■

The Benefits of Using Virtualization

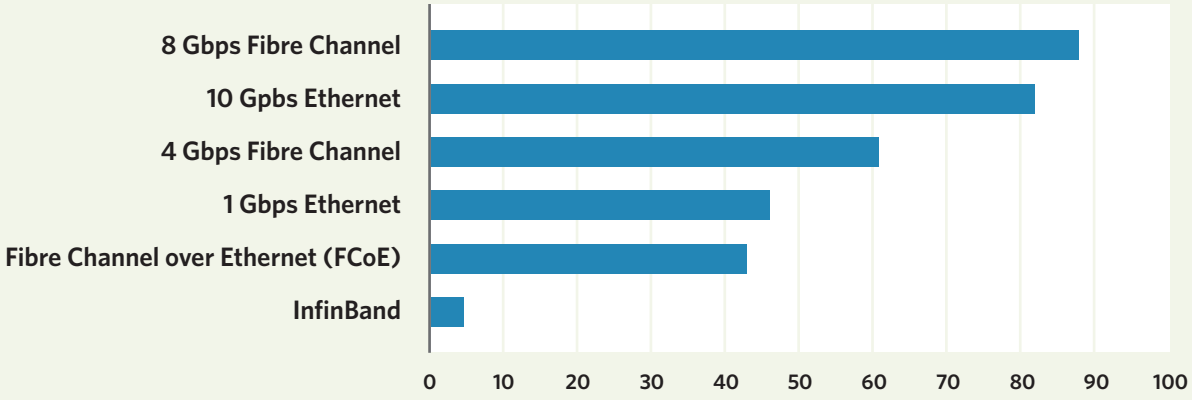
Virtualization can provide some clear benefits for disaster recovery planning; it can help save money, time and effort, and make the often daunting task of designing and implementing a disaster recovery plan easier.

Additional benefits of using virtualization as part of your disaster recovery strategy include:

- Fewer physical servers needed at a disaster recovery site reduces one-time and ongoing costs, and results in less idle hardware.
- Lower cost virtual machine (VM)-level replication is storage independent and doesn't require expensive storage arrays.
- Hardware independence allows for more hardware options without compatibility issues.
- Encapsulation turns a VM into a single portable file for easier transport and deployment.
- Snapshots provide an effective method for backup of virtual machines.
- Automated failover and easier testing.
- Easier server deployment; scripting can be used to help automate many configuration and operational tasks.■

NETWORKING EQUIPMENT PROTOCOLS IN 2011

When you purchase networking equipment in 2011, what protocols/line speeds will the equipment support?



SOURCE: TECHTARGET STORAGE PRIORITIES SURVEY, NOV. 2010

quotes

→ Can storage and network teams really get along?

"A priority is management changes to bring storage and networking groups closer together, even though it's like forcing the cat to lie down with the dog."

—STORAGE ADMINISTRATOR, *EDUCATION SECTOR*

"I've had more collaboration [with the storage and server teams] in the last two months than I have had in the last 10 years. The storage and server guys have traditionally not talked to us. Our current Nexus and FCoE project has been a catalyst with moving forward with a more unified approach between these departments. I've been at Boise for 23 years, and this is the first time in all those years that I've seen a collaborative effort between these departments."

—GREG CATALANO, *SENIOR IT STAFF SPECIALIST FOR BOISE INC.*

THE WAN MANAGERS' ROLE IN STORAGE: The WAN manager should be prepared to address additional bandwidth requests from the storage team with WAN deduplication optimization. Because of its greater opportunity to see data throughout the data lifecycle, the WAN device can provide a broader value to the organization. The storage team, though, will still benefit from the ability to replicate more data more often and to have the remote sites in closer sync with the primary site in the event of a disaster. The value is an investment that pays off for the entire organization, including the original storage request. ■

FCoE vs iSCSI? How about the one that's ready?

VENDORS CAN push Fibre Channel over Ethernet (FCoE) all they want, but the technology is simply not ready for deployment, argues **STEPHEN FOSKETT** (left), Gestalt IT community organizer. But iSCSI is another story.

"I am not a big fan of FCoE yet. The data center bridging (DCB) extensions are coming ... but we don't yet have an end-to-end FCoE solution. We don't have the DCB components standardized yet," Foskett said.

What does Foskett think it will take to make FCoE work?

"It'll take a complete end-to-end network. I understand the incremental approach is probably now what most people are going to do. It's not like they're going to forklift everything and get a new storage array and get a new greenfield system, but right now you can't do that," Foskett said.

iSCSI, on the other hand, works over 10 Gigabit Ethernet today and lends itself to a total solution. So why aren't vendors selling it?

"iSCSI doesn't give vendors a unique point of entry. They can't say we've got iSCSI, so that makes us exceptional. But with FCoE they can say, 'We are the masters of Fibre Channel' or 'We are the masters of Ethernet, so you can trust us.' iSCSI works too well for anybody to have a competitive advantage," Foskett said. ■

Before embarking on an FCoE implementation, ask:

- → **Will the storage team or the networking team own the infrastructure?** If co-managed, who has the deciding vote?
- → **Which department will pay for it?** How will chargeback be calculated and future growth determined?
- → **Will the teams be integrated?** Typically, the networking team is responsible for IP switches, while the storage team is responsible for Fibre Channel.
- → **Who will own day-to-day operational issues?** If a decision needs to be made regarding whether more bandwidth is given to local area network (LAN) or storage area network (SAN) traffic, who makes the call? Will companies have to create a single, integrated connectivity group? ■

FCOE OR ISCSI? DOESN'T MATTER! IT'S ABOUT THE ETHERNET

THE HYPE SURROUNDING data center network convergence and the battle between FCoE vs. iSCSI can obscure the core issue: At the end of the day all storage will traverse the production Ethernet network and engineers must be prepared for this transition.

Listening to vendor stories can be mind-numbing since each is choosing its own corner. Cisco Systems and Brocade lead the FCoE charge. Meanwhile, Dell tells its customers that iSCSI over Ethernet is the path to convergence. Chip vendors like Intel and network adapter vendors like QLogic and Emulex are backing all horses, ready to support whatever technology an enterprise chooses.

Enterprises must overlook the vendor hype and instead consider their existing infrastructure investments to determine which technology to choose. They also must understand that network convergence may occur in small increments, not necessarily going beyond the rack level in the short term.

"Typically [customers] have one type of convergence in mind when they come to us, and we have to open their minds a bit to the fact that there are many different options and they aren't mutually exclusive," said Joe Onisick, technical solutions architect with the data center practice of a large system integrator.

WHY MOVE FORWARD WITH DATA CENTER NETWORK CONVERGENCE?

With the proliferation of 10 Gigabit Ethernet (GbE), server virtualization and other technologies, enterprises must look seriously at network convergence to control capital and operational expenses and reduce complexity.

"If you have a rack with a lot of

servers, especially a VMware rack, you might have 10 copper Gigabit Ethernet connections and two Fibre Channel connections to each server," said Darren Ramsey, director of technology for Wellmont Health System, a Tennessee-based hospital chain. "If you have 10 servers in that rack, that's 120 cables. That's a lot to try to work around, a lot of inflexible copper, lots of heat. Switch ports aren't cheap."

In his data center, Ramsey recently introduced network convergence to eight racks of virtualized Dell servers using Cisco's Nexus line. He consolidated 10 NICSs and two host bus adapters (HBAs) on each server to two QLogic converged network adapters (CNAs) that provide dual 10 GbE FCoE links to redundant top-of-rack Nexus 2232 Fabric Extenders. All eight pairs of Nexus 2232 Fabric Extenders connect upstream to two redundant Nexus 5020 switches. Storage and data traffic is converged via FCoE up to the Nexus 5020s. From there, storage traffic returns to native Fibre Channel and connects to a pair of Cisco MDS 9506 Director switches on the storage area network (SAN). The production data traffic continues upstream to Catalyst 6509 switches.

"The FCoE streamlined and downsized the number of Fibre Channel ports we needed since all hosts now run directly into the Nexus," Ramsey said. "We no longer need to tie directly into the MDS [from the server]. And it cut down on the complexity that was in each rack. And when we went to two 10 Gigabit links on each server, that allowed us to have more virtual machines on that box."

CHOOSING A NETWORK CONVERGENCE TECHNOLOGY: ISCSI OR FCOE?

FCoE gets all the data center network convergence hype, but many industry veterans say iSCSI is another viable option. As an IP-based storage networking protocol, iSCSI can run natively over an Ethernet network. Most enterprises that use iSCSI today run the storage protocol over their own separate networks because convergence wasn't an option on Gigabit Ethernet. But with 10 GbE switches becoming more affordable, iSCSI-based convergence is becoming more of a reality.

"Certainly iSCSI is the easier transition [compared to FCoE]," said storage blogger and IT consultant Stephen Foskett. "With iSCSI you don't have to have data center bridging, new NICs, new cables or new switches."

Ultimately the existing infrastructure and the storage demands of an enterprise will govern the choice of a network convergence path.

"There are very few times where I will steer a customer down an FCoE

route if they don't all ready have a Fibre Channel investment," said Onisick. "If they have a need for very high performance and very low throughput block data, FCoE is a great way to do it. If they can sustain a little more latency, iSCSI is fantastic. And if they have no need for block data, then NAS [network-attached storage] and NFS [network file system] is a fantastic option."

For Ramsey, iSCSI was never a viable option because of Wellmont's high-performance requirements.

"We played around with iSCSI, but that was still going to run over TCP, and you're still going to contend with buffering, flow control, windowing or packet drops and queuing, so we stayed away from it. What FCoE brings to the table—It doesn't run over Layer 3. It's an encapsulation of your Fibre Channel packet inside a native Layer 2 frame, and all we're doing is transporting that between the server and up to the Nexus 2232 and the Nexus 5020."

NETWORK CONVERGENCE: NEW STRATEGIES AND CULTURAL CLASHES

With storage and data convergence, networking pros will have to think about networking in a new way.

"You have to realize you're going to have a lot more traffic and it's going to be a lot more sensitive to latency and it's going to be incredibly sensitive to availability," Foskett said. "You've got to make sure the network doesn't go down. If you lose your data center, people cry about it. If you lose your storage network, then servers fall over and that's a really big difference. "

With storage and data convergence, networking pros will have to think about networking in a new way.

What's more, networking professionals will need to familiarize themselves with the management concerns of storage professionals if they are going to have storage traffic on their production networks, according to Stuart Miniman, principal research contributor to Wikibon, an online technology research community.

"A storage person is really concerned about data availability and making sure there is never a data loss, as opposed to a networking administrator who is really concerned about making sure there is connectivity, bandwidth and resiliency," Miniman said.

These different mindsets have tra-

ditionally led to culture clashes when storage and networking professionals work together. Now they must find common ground.

"We heard that there were a lot of folks who never do [convergence] because their network folks and their SAN folks don't talk to each other," said Bob Cloud, executive director of IT infrastructure services at the University of Alabama at Birmingham. "We're unique because our network guys work for me and our SAN guys work for me."

Cloud has brought his storage and networking teams together while piloting FCoE-based network convergence in his data center. As a Brocade customer on both the Ethernet and Fibre Channel side of things, Cloud elected to pilot FCoE with Brocade's technology beginning last September.

In one server rack he has introduced two redundant Brocade 8000 top- of -rack switches. The servers in the rack connect to each switch via FCoE. The 8000 switches then use Fibre Channel connections to send storage traffic to a Brocade DCX storage director switch and Ethernet uplinks to send production data traffic to upstream Brocade FastIron SuperX switches. At first the storage and networking teams were confused about who would own the Brocade 8000 FCoE switches.

"I think there was some natural confusion over who was going to own the switch and who was going to name the switch," Cloud said. "But we got past that pretty quickly because in our data center both the networking group and the SAN group report to me. I told them to work it out because it's a trial. The purpose of the trial is to uncover the organizational issues."

DEFINING MANAGEMENT DUTIES

A common management platform will be essential to working out those organizational issues, Cloud said. Brocade has announced a new unified management product, Brocade Network Advisor, which supports management of Fibre Channel, FCoE, MPLS and IP switching and routing. Cloud is still waiting for the product.

"We may always have a route access level person in the networking group and I think the SAN folks are fine with that. The networking group will have a little more authority over management of the switch than the SAN folks, but the SAN folks will have everything they need to troubleshoot and monitor Fibre Channel," he said.

Wellmont's Ramsey also manages both the storage and networking teams in his data center, so he's been able to keep his eye on the big picture. "I'm not going to have anyone fight over a sandbox," he said.

He doesn't see convergence as being that big a change organizationally. The Fibre Channel demarcation line has been pushed back from the server to his Nexus 5020 switches, putting that into the networking team's domain, but the storage guys do everything else in managing their SAN.

"It's just that, instead of managing ports that correspond directly to a server, now they go to the connections on the 5020 and it's all kind of virtualized. Our SAN guys are more than welcome to jump in there and learn [Ethernet], but they are busy doing what they do—provisioning storage and making sure that SRDF [EMC Symmetrix Remote Data Facility] is working properly. And I think that they embraced the idea of getting that extra network burden off of them," Ramsey said.

NETWORK CONVERGENCE BEYOND THE RACK

Although Cisco and other vendors will begin delivery of end-to-end FCoE switching capabilities this year, with technologies like Shortest Path Bridging and Transparent Interconnection of Lots of Links (TRILL), Ramsey doesn't see moving beyond rack-level network convergence within the next five years.

"What you're talking about is multi-hop FCoE, and Cisco is still working on fleshing that out. The most bang for the buck right now is to simplify the rack environment. If you want to go all FCoE, all your EMC stuff is going to have to be retrofitted with FCoE 10 Gigabit.

The most bang for the buck right now is to simplify the rack environment.

And at that point you could probably get rid of your Fibre Channel. Maybe in five years we'll look at that, but that's not really going to buy us anything right now. We're just not pushing into the type of bandwidth where we would need dedicated 10 Gigabit to the storage. We don't need that much data. Where FCoE helps us is simplification inside the rack, making it faster, cheaper and smaller."

Cloud is also not ready to look past the rack until he gets a better handle on management of converged networks.

"[Brocade] just announced a lot of this stuff, and we want to test out the management system. Once we prove that out, we'll be looking to go further [with convergence]. We are trying to figure out the total cost of ownership."■

SHAMUS MCGILLICUDDY, news editor, TechTarget Networking Media

SERVER VIRTUALIZATION FOR SPEEDIER DISASTER RECOVERY?

ONE SHOP'S STORY

TECHNICAL ARCHITECT Steve Hannah originally began deploying server virtualization to reduce demand for physical servers in a data center that was running out of floor space. But Hannah and the IT team at School Specialty Inc., a Greenville, Wisconsin-based provider of supplemental learning products, realized that the agility and flexibility of virtualization could also reinvent the company's disaster recovery plan.

School Specialty's original disaster recovery strategy depended on a traditional hot site service provider that would spin up physical servers using backups of the servers in the company's primary data center.

"With a recovery of physical servers, we had to be continually aware of the exact hardware, including model types and BIOS levels, to make sure it was replicated in the hot site," Hannah said.

But getting the traditional hot site up and running required the physical transfer of backup tapes from the company's data center. Hannah estimated that it would take a week to recover School Specialty's systems with this method.

> "Virtualization gives us a boost in speed not possible with tapes and bare metal server restores."
>
> **—STEVE HANNAH**
> School Specialty Inc.

"Running to someone else's site with backup tapes is simply not going to cut it anymore," he said. "Virtualization gives us a boost in speed not possible with tapes and bare metal server restores."

Server virtualization adds an

abstraction layer to server hardware, allowing a virtual machine to move between physical servers without the need to change hardware drivers or ensure software compatibility, Hannah said.

VIRTUALIZATION BRINGS A NEW APPROACH TO DISASTER RECOVERY

School Specialty is about a third of the way through planning and implementing its new disaster recovery plan, which will entail building a new, secondary remote data center to take advantage of the mobility of server virtualization. Hannah has identified 50 of the company's 600 virtual machine images as mission-critical workloads that must be synchronized to the remote data center. School Specialty uses VMware's vCenter Site Recovery Manager to manage the virtual environment, and he uses the deployed virtualized storage solution to replicate virtual machines from the primary and remote storage networks. The remote site holds a subset of the server blades and hardware of the primary data center, and is designed to spin up the critical virtual machines in the event of a disaster.

Hannah determined that the remote site only needed to be 30 to 50 miles away from the primary data center. "We are fortunate to live in an area that is not impacted by large, regional natural disasters like hurricanes or earthquakes, so we can keep our remote site relatively close," he said.

MAKING THE HOT SITE USEFUL BEYOND DISASTERS

Unlike a traditional hot site that is only available during a disaster recovery event, School Specialty can use the infrastructure of the new remote site continuously. The company's developers and administrators use the remote data center as a staging environment for updated business applications. Performance testing, user acceptance testing and any final quality checks are done on new and updated applications in this staging environment before being pushed in the production environment of the primary data center. In the event of a disaster, the company can spin up the latest pro-

Unlike a traditional hot site that is only available during a disaster, School Specialty can use the infrastructure of the new remote site continuously.

duction virtual machines at the remote site without restoring from tape or other backup media. If necessary, both the production and staging environments could operate in parallel.

"During the spin up process in a disaster event, we can make the decision as to whether or not to shut down the staging instances to free up capacity," said Jason Seymour, Unix system administrator at School Specialty, who also noted, "We actually like the idea of our staging and disaster recovery environments sharing the same hardware. Basically, we are running a continual test on our disaster recovery hardware."

With a live environment running on their remote site, the administrators can utilize the same monitoring and management tools as the production environment to detect and troubleshoot any issues that may arise, such as failed hardware or processes. This is in a sharp contrast to relying on a third-party hot site vendor to have all its hardware ready during a disaster.

Since School Specialty has complete control over the secondary environment, it can always choose to move production workloads over to that environment during times of heavy load. In this way, the disaster recovery site becomes another component of the virtualized environment, rather than a service used for annual tests or rarely in a crisis. ■

"We like the idea of our staging and disaster recovery environments sharing the same hardware. Basically, we are running a continual test on our disaster recovery hardware."

—JASON SEYMOUR
School Specialty Inc.

MICHAEL BRANDENBURG, technical editor, TechTarget Networking Media

RETHINKING YOUR DATA CENTER NETWORK?

THINK CONNECTIVITY FIRST

WHEN JEFFREY GRAY, Liberty Mutual's director of network and communications operations, set out to interconnect three disparate data centers and begin provisioning applications on-demand from the storage area network (SAN) to remote users on the wide area network (WAN), he knew just where to begin network redesign ... from the outside connection going into the data center.

While other IT managers in Gray's position might start by grappling with server virtualization and centralization of applications, or by converging storage and data center networks, Gray decided that to make his private cloud work, he would first need to ensure speeds and feeds into the data center and make sure that each of the facilities were

JEFFREY GRAY

interconnected and functioning as one source. In order to do that, his team first worked to standardize access into each of the data centers and interconnect them through a nationwide carrier-provided Ethernet network on which capacity could be spun up and down on demand. The team also standardized the inside design of each data center so each could be mapped and managed the same way for performance optimization.

With that taken care of, his team will now move on to expand its virtualization and private cloud strategy as well as to converge storage into the data center network so applications can flow freely end-to-end with visibility along each arm of the journey. Gray sat down with SearchNetworking.com to explain the transition of his data center and storage networks.

How have you transitioned Liberty Mutual's data center network so far?

Prior to getting to this data-center-as-one strategy, Liberty Mutual had grown through acquisitions, and we picked up data centers and network infrastructure through several acquisitions. So we worked diligently to maintain the processing capabilities … and essentially go through the infrastructure and normalize it to our computing standards. For instance, from a connectivity perspective, a number of years back we made the transition from a traditional frame relay hub-and-spoke network to a fully meshed MPLS network. In addition to that, from our remote office locations we looked to standardize our connectivity in our offices from a speeds and feeds perspective. Then from a data center perspective [the back-end access network], we standardized access into the data centers. Prior to that we had multiple access methods into the data centers, looking at everything from traditional OC-48 192 technology to now operating

"In the last four or five years we've drastically transformed our infrastructure to a world-class network."

using DWDM (Dense Wavelength Division Multiplexing). So in the last four or five years we've drastically transformed our infrastructure to a world-class network.

How did you standardize access into the data centers?

There are different vendor offerings based on what part of the country you're in, but essentially, using DWDM technology allows for high-capacity, high-speed switching into our data centers. It can scale, and that's the key component for the ability to scale in short order. In a traditional build for carrier-made access to a data center, you have a huge computing environment, and adding incremental capacity sometimes takes as long as building it from scratch. To be able to standardize on DWDM technology gives

you the scalability in a much shorter period of time.

With that comes the next tier, which is looking at what computing requirements you need to push data from data center to data center, and

> "Most people in the networking industry grew up on Ethernet, so they understand the failing conditions of it. It can be monitored and it's very predictable, and the cost is right as well."

then standardizing that connectivity. This past 18 to 24 months we've had some success in standardizing connectivity across three data centers using optical mesh technology that gives you, from an industry perspective, bandwidth on demand.

Can you explain optical mesh?

Based upon where you're located geographically, you have the capability to take advantage of high-speed Ethernet connectivity [leveraging multiple carriers], in some cases across the country where it exists. Most people in the networking industry grew up on Ethernet, so they understand the failing conditions of it. It can be monitored and it's very predictable, and the cost is right as well.

At Liberty Mutual, why is it necessary to be able to provision bandwidth on demand across the data center network?

For instance, if Liberty Mutual were to run an ad campaign during the Super Bowl, and we were expecting additional demand on the network from our call center's perspective, or just transactions to be at a higher peak, now we would have the capability to provision the bandwidth on demand across the data centers to handle that increased capacity.

What kind of hardware and software do you need for this type of provisioning?

If I had to put a wrapper on it, it's in the cloud. We're leveraging service provider technology. It's an offering that AT&T and Verizon and others have today. But in some cases we've taken a different approach than some other enterprises. Where historically network managers looked at techniques like WAN optimization [to deliver application and data performance], we've built out a data center-to-data center infrastructure and also in parallel taken a look at

the remote office capabilities to access the data centers. If you start to centralize and virtualize those applications, but you haven't covered the data center connectivity to access those applications in the data center, you have a gap.

We also continue to invest in internal cloud infrastructure that is more central to our data centers, and that's the real sweet spot for us. Having uniformity across the data centers and our computing environment becomes simpler, and the more we take the complexity out of it, we gain efficiency from a processing perspective.

So we can have clones of the data center in the Northeast looking like one in the Midwest, looking like one on the West Coast. We put the hardware in the same rack on the floor so we know what the configuration looks like; we know what the speeds are from data center to data center since they are uniform. It's pretty powerful for positioning ourselves for the future.

How is the data center LAN architecture changing?

We have a traditional multi-tiered processing environment. We are in the process now of trying to look at how we want to evolve the core LAN from a lifecycle perspective. [We are considering] what the true speeds and feeds and requirements are. Also, as we continue to evolve, we're looking at server virtualization, reducing server footprint and reclaiming cooling and power in some of the footprint.

The [physical layer] is the biggest challenge. [We're considering] how to transform the environment so instead of having 1,000 servers on the floor, we'll go down to 300 or even to 100. It's kind of a two-part piece working closely with business partners and rewriting their applications to marginalize and consolidate the infrastructure while giving them on-demand computing capability across multiple environments—not just from production but test, development and performance.

The dynamic virtualized environment has made it difficult to manage the network. How do you approach that?

Traffic management is right up there with the efforts of increasing utilization for virtual servers. I say traffic management as opposed to network management because essentially with the adaptive network that we've created comes tight partnership with our application developers, with uniquely how they are developing their applications to leverage all of the benefits of QoS and classes of service on the network.

So for instance, you have VoIP and video and SharePoint on the

network. When there are a lot more collaborative applications deployed on the network, it comes down to traffic management, and that to me is more about looking end-to-end

> "In order to protect the user's experience, the network management applications need to have the capability to do one minute-or-less samples on the network in order to capture the traffic."

and having visibility of the transactions that take place on the network—not at the traditional network management where we take five minute samples of what's happening. In order to protect the user's experience, the network management applications need to evolve and have the capability to do one-minute-or-less samples on the network in order to capture the traffic.

How does storage play into all of this? Are your networks converged?

We have a hybrid solution where we have some network attached storage (NAS) and some storage area networks (SANs) deployed, and our roadmap is taking us to more convergence and more centralization of storage because of what I described earlier about the data center network and the flexibility that it gives us to essentially [use] our own storage network across multiple data centers. So, backup and recovery can ride on its own uncontested network. We are positioning ourselves to drastically reduce recovery times.

Is that storage network Fibre Channel?

We are leveraging the MPLS network. We have premier sites that have increased needs from a storage perspective. So how do you get that data from premier sites housing 200-plus people that have a particular need back to the data centers? We have some SAN [with some Fibre Channel and some traditional SAN switches] and some NAS, so from a convergence perspective, we see huge value in investing in both NAS and SAN technology. We also have host bus adapters (HBAs). We've got a little bit of everything. We even have some traditional tape hanging around.

I think you have to look at data usage patterns to see what transactions look like end-to-end, and then classify your data to make sure you are applying the right tier of storage to the right business requirement.

If you're working toward convergence and you already have Fibre, will you eventually opt for an overall FCoE strategy?

The long-term plan would be to look at the Ethernet as a long-term solution. In looking at how to get data in those remote locations back to the data center leveraging one cable—it's that Ethernet connectivity—and there's a lot of efficiency that can be gained by having that same cable to get the data from a premier office onto the Fibre Channel infrastructure, so I think that's the way to go.

As you implement convergence, are you finding a disconnect or cultural difference between networking, storage and server teams?

There's no disconnect. It's actually kind of unifying to some degree because everyone is now having the benefit and the opportunity to share information in a common language. Also, from an individual perspective, there's some career growth and some progression; and I say this about convergence of network and security, voice and data, storage and networking. There is a unique skill set to be a solid network professional, and there is more collaboration than ever before. ■

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