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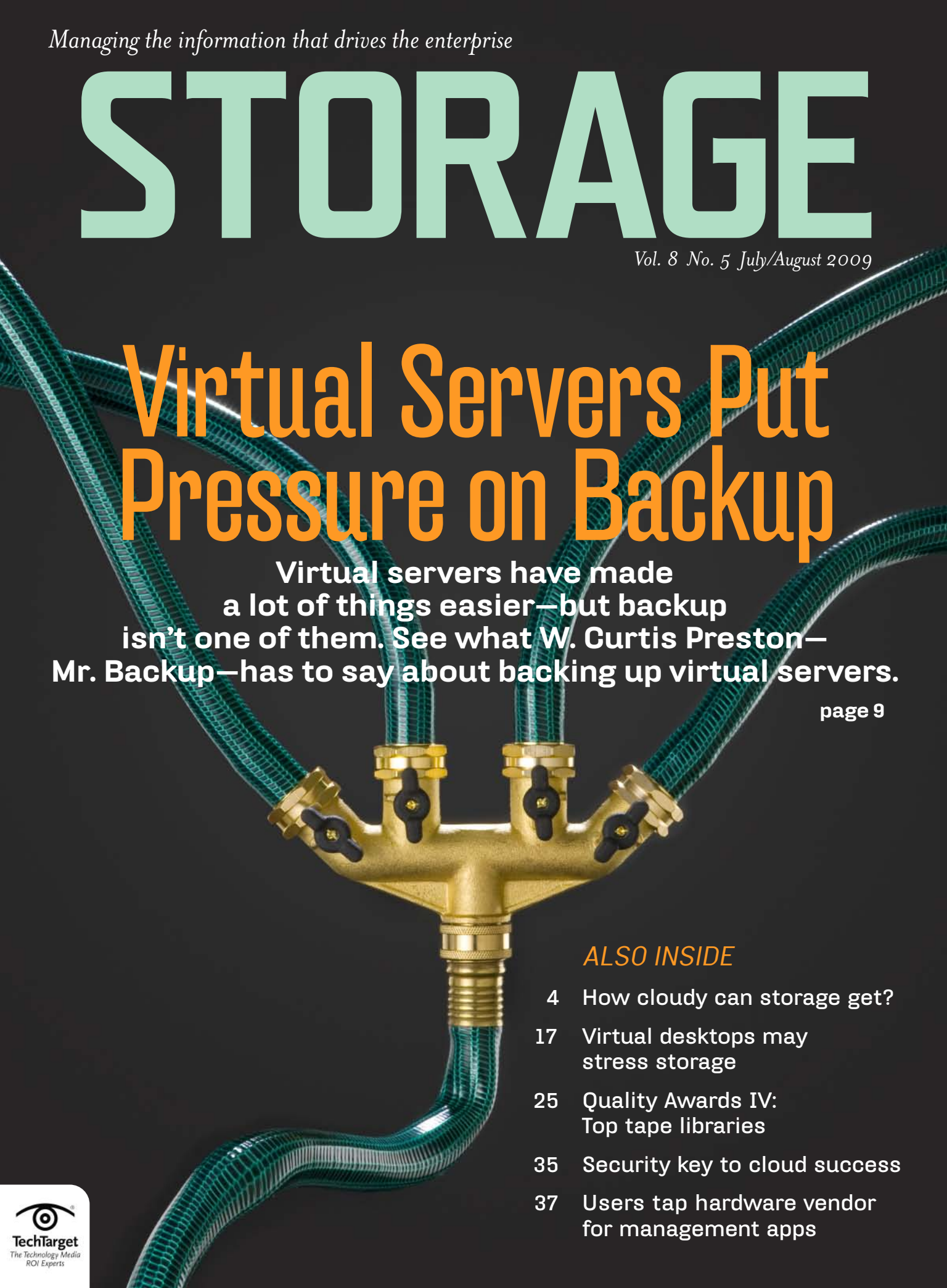

Virtual Servers Put Pressure on Backup

Virtual servers have made a lot of things easier—but backup isn't one of them. See what W. Curtis Preston—Mr. Backup—has to say about backing up virtual servers.

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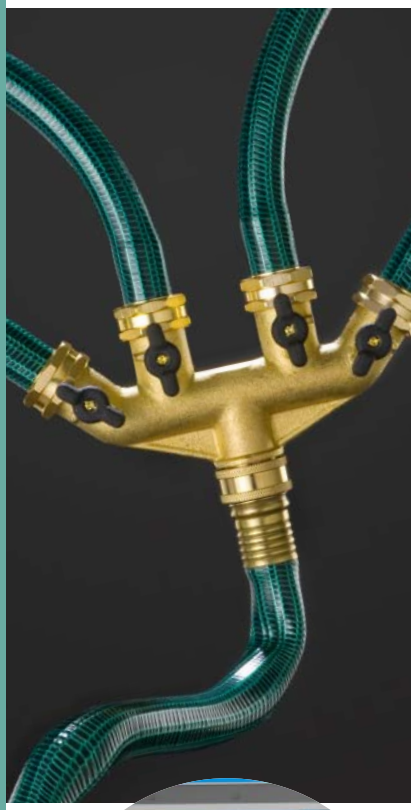

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Cloud storage gets even cloudier

The "cloud" part of cloud storage services used to mean some distant shore of the Internet beyond your data center. But vendors are now touting their "internal clouds," cloud storage that never leaves your shop.

STORAGE VENDORS HAVE done it again. They coined the term "cloud storage" and then almost immediately rendered it meaningless. It seems that storage marketers are addicted to buzzwords, and don't think they've put in a solid workday unless they've thoroughly overused, misused and abused the buzzword du jour. To this point, they've done a terrific job with "cloud storage," taking a concept that anyone could understand and then stretching the term to include almost every storage technology ever invented.

This isn't the first time this has happened. Remember the compliance wave? As Sarbanes-Oxley (SOX), HIPAA, SEC and other regulations emerged, real products that dealt with those real issues also emerged. But before you could say "Sarbanes-Oxley," every product on the shelves was labeled a "compliance edition." The same thing happened with "green." The term was once clearly interpreted as power conservation, but now vendors with arrays about as eco-friendly as Chernobyl are calling their products green. I guess it's all a matter of interpretation.

The tactic will eventually backfire because it doesn't give storage managers credit for being the smart people they are.

Now it's happening with "cloud." Cloud got its name from all of those whiteboard scrawls and flowcharts that depicted configurations that eventually went beyond the walls of the data center and into the ether or, more accurately, the Internet. With a cloud storage service, your backup or archive or whatever leaves the building, traverses the cloud and winds up on storage that may be thousands of miles away. That's simple enough to understand, right?

But now vendors are touting "internal clouds," cloud storage that never leaves your shop. Does that mean the "cloud" somehow got inside your data center? At that point, is it still really the cloud?

The answer is "No." It's not cloud storage at all, it's clustering, grid

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storage, virtualization, global namespaces or some other familiar technology that provides flexible scalability. It's all about stuff that's been around for ages with techie names that don't have that ephemeral allure of the cloud. And now some storage companies are retooling their products so they can support clustering or virtualization or whatever they couldn't do before. Rather than saying "OK, we can cluster now" and looking like the last company on earth to get wise to that technology, they call it "internal cloud storage." A not-so-new technology wrapped in the currently fashionable jargon. Oooh, feel that buzz ...

But maybe we should cut those marketing guys some slack. After all, they trotted out the same stuff a few years ago but back then they called it "utility storage." And that went over really well, right?

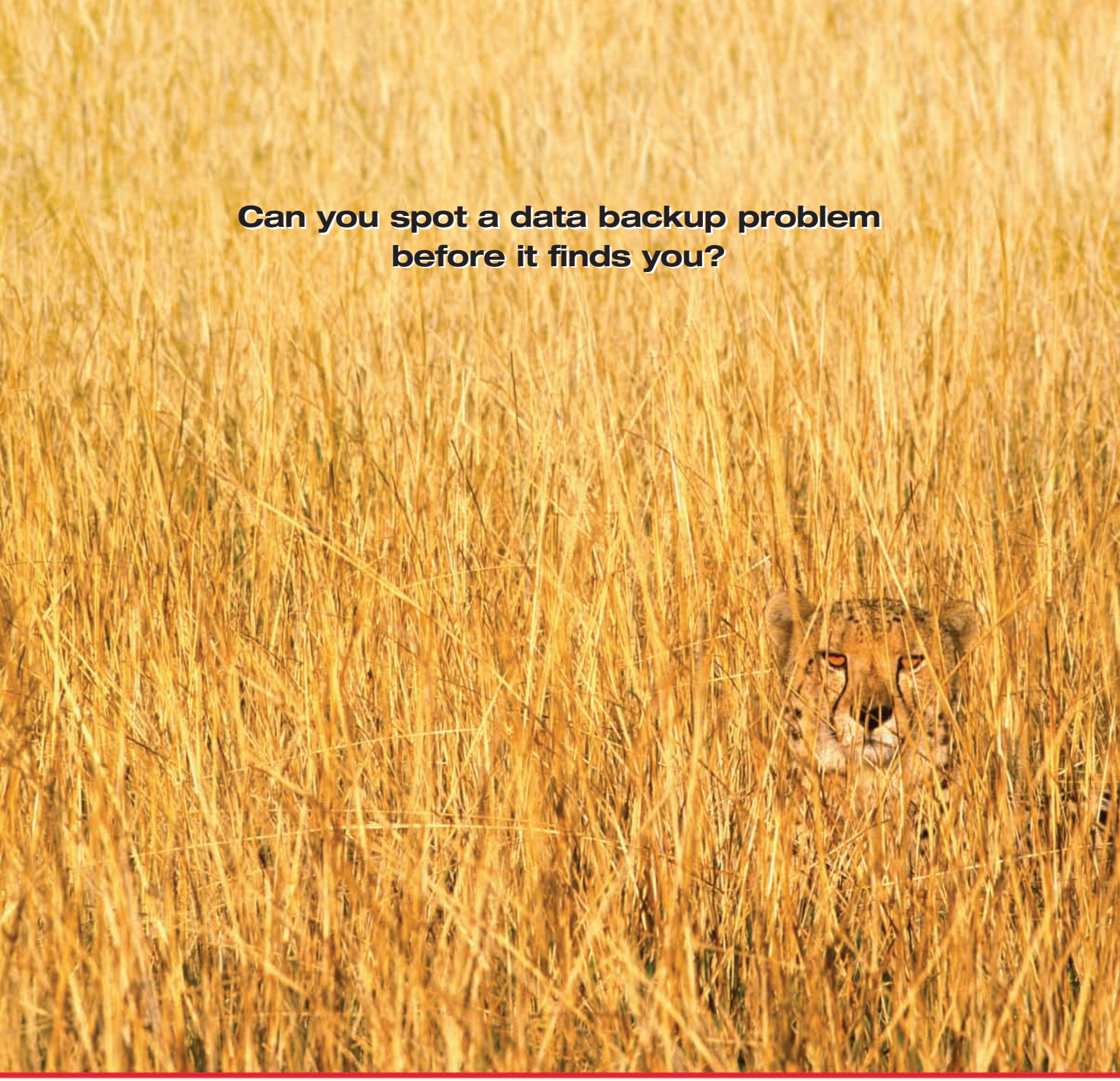
One of my least memorable summer jobs was working at a record distributor. My job was to tear the shrink-wrap off stacks of record albums (yes, I'm that old) and then bring them over to a guy named Fast Eddie who ran a machine that shrink-wrapped the albums again. The albums were leftovers that nobody wanted, so the idea was to give them new wrapping and a cut-rate price and to try and sell them again.

That's what "internal cloud" sounds like to me, except without the discount price. I think the tactic will eventually backfire because it doesn't give storage managers credit for being the smart people they are—people who can see through clouds. It does a disservice by misrepresenting a bunch of valid and useful technologies, including the cloud it's stealing its name from.

It would be nice if vendors could honestly present their products, and let them win or lose on their merits instead of just putting lipstick on a pig. Will they do it? I hope so. But in the meantime, I'm bracing myself for the tsunami of twaddle that the marketers will inevitably dish up for the "next big thing" looming on the horizon—solid-state storage. Let's see how they spin that one. ⊙

Rich Castagna (rcastagna@storagemagazine.com) is editorial director of the Storage Media Group.

** Click here for a sneak peek at what's coming up in the September issue.*



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Tools, Tips and Techniques for Managing Capacity

By most industry estimates, there's a good chance you may be wasting up to 50% of your installed disk storage. But with the right tools, you can get an accurate reading of how much disk capacity is actually being used, and how much has been orphaned or overlooked.

Dedupe: It's Not Just a Hardware Thing

Data deduplication is still the hottest topic in the world of data protection, with hardware vendors still fueling the inline vs. post-processing debate. But you don't necessarily need a new appliance, virtual tape library or specialized back-up target to implement dedupe anymore. Backup application vendors now offer dedupe options built right into their software.

And don't miss our monthly columns and commentary, or the results of our Snapshot reader survey.

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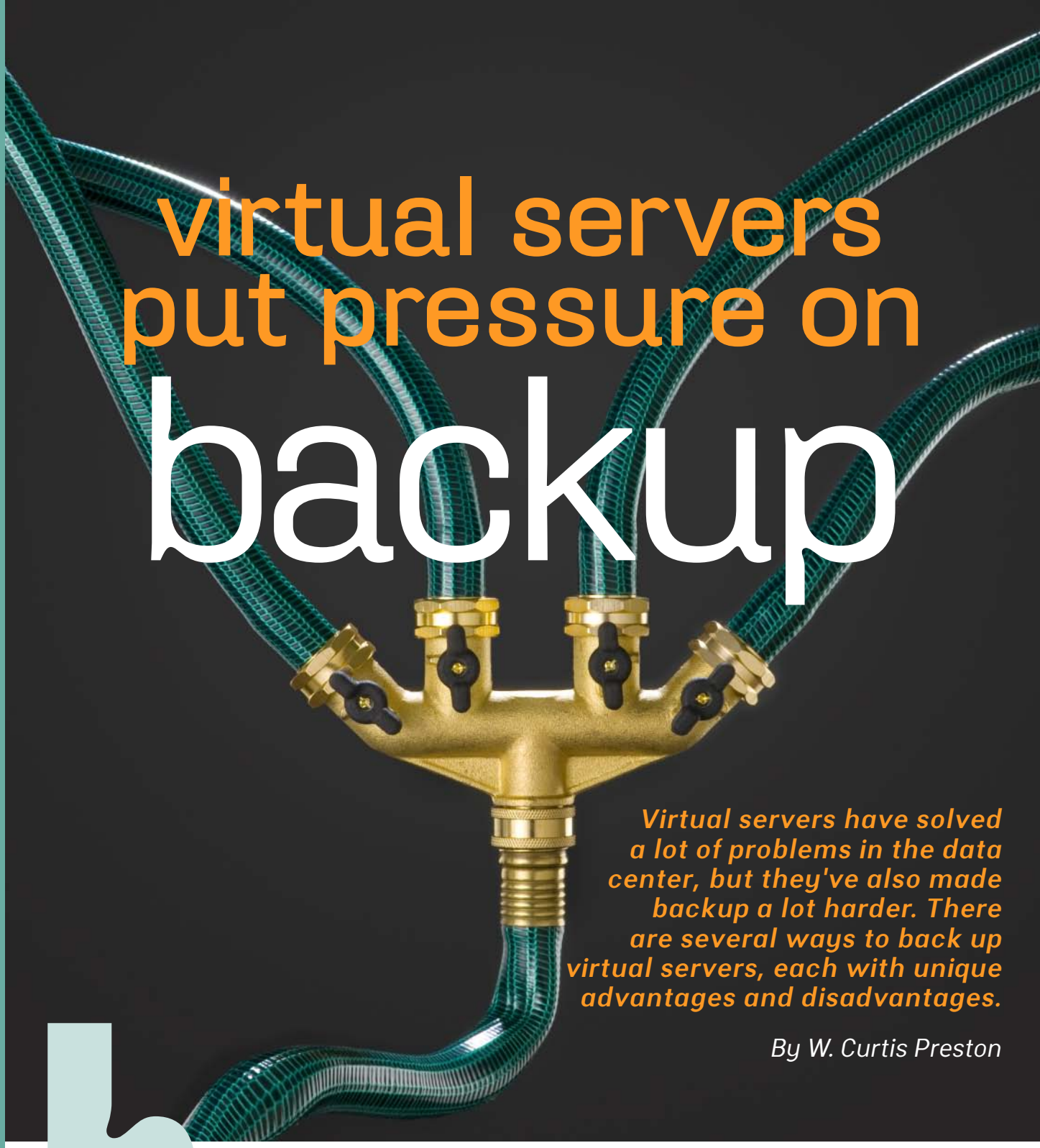

virtual servers put pressure on backup

Virtual servers have solved a lot of problems in the data center, but they've also made backup a lot harder. There are several ways to back up virtual servers, each with unique advantages and disadvantages.

By W. Curtis Preston

BACKUP IS THE SINGLE BIGGEST GOTCHA for VMware nirvana in large environments today. The usual backup methods cause many environments to limit the number of virtual machines (VMs) they place on a single ESX server, decreasing the overall value proposition of virtualizing servers. To further compound matters, one possible solution to the problem requires purchasing additional physical machines to back up the virtual machines (VMs).

However, there are existing products that can solve the problem, if you're willing to move your VMware environment to different storage. If that's not possible, there are some "Band Aid" remedies that can help until storage-independent products arrive. However you ultimately address virtual machine backup, you can at least take some comfort in knowing that you're not alone in your frustration.

THE PROBLEM IS PHYSICS

Whenever I consider VMware, I find my mind turning to the movie *The Matrix*. The millions of VMs running inside VMware are very similar to all of the virtual people living inside the movie's matrix. As with the movie, when you plug into the "matrix"—VMware, in this case—you can do all sorts of neat things. In the matrix, you can fly through the air; with VMware, VMs can "fly" from one physical machine to another without so much as a hiccup. In the matrix, you can learn Kung Fu and fly a helicopter in seconds. In VMware, a virtual machine can run on hardware it was never designed for thanks to the HyperVisor.

But when you die in the matrix, you die in real life because your body can't tell the difference between virtual pain and physical pain. Similarly, VMware can't break the connection between virtual worlds and physical worlds. Although those 20 VMs running within a single ESX system may think they're 20 physical servers, there's just one physical server with one I/O system and, typically, one storage system. So when your backup system treats them like 20 physical servers, you find out very quickly that they're running in one physical server.

USUAL SOLUTION: DENIAL

Most VMware users simply pretend their virtual machines are physical machines. In various seminar venues, I've polled approximately 5,000 users to see how they're handling VMware backups. Consistently, only a small fraction of those who have virtualized their servers with VMware are also using VMware Consolidated Backup (VCB). The majority simply use their backup software just as they would with physical servers.

Most VMware users simply pretend their virtual machines are physical machines.

There's nothing wrong with doing it that way. A lot of backup administrators suffer from a "VMware backup inferiority complex" because they think they're the only ones doing VM backups that way. They're actually part of a large majority.

If you're doing VM backups that way and they're working, don't worry. The good thing about doing conventional backups is the simplicity of the process. Virtual machine backups work the same as "real" backups; you have access to file-level recovery, database and app agents, and incremental backups (see "Improving old-style virtual machine backups," p. 11).

BACKUP FROM INSIDE ESX SERVER

Another option is to run your backup software at the physical level inside the ESX server. But things get ugly quickly and you'll find yourself doing full backups every day. You're also likely to be doing this without any support from your backup software company, which has little incentive to make this method work. (They'd much rather you use VCB or even the typical agent approach as they get more revenue that way.) The reason you end up doing full backups every day is because any change in the VM results in a modification of the timestamp of its associated VMDK files. So even an "incremental" backup will be the same as a full. This is rarely the best approach to virtual server backup.

VMWARE CONSOLIDATED BACKUP: HOPE OR HYPE?

VMware's answer to the backup dilemma is VMware Consolidated Backup. To use VCB, you must install a physical Windows server next to your ESX server and give it access to the storage that you're using for your VMFS file systems. It can access both block-based (Fibre Channel and iSCSI) and NFS-based data stores. The server then acts as a proxy server to back up the data stores without the I/O having to go through the ESX server.

There are two general ways a backup application interacts with VMware Consolidated Backup. The first method only works for Windows-based VMs. With this method, the backup application tells VMware via the VCB interface that it wants to do a backup. VMware performs a Virtual Shadow Copy Service (VSS) snapshot on Windows virtual machines and then performs a VMware-level snapshot that's exported via VCB to the proxy server as a virtual drive letter. (The "C:" drive on the VM becomes the "H:" drive on the proxy server.) Your backup software can then perform

IMPROVING OLD-STYLE VIRTUAL MACHINE BACKUPS

YOU CAN DO several things to improve backups of your virtual servers if you're using traditional software.

- Make sure you're staggering your backups and definitely staggering your full backups.
- Try decreasing the frequency of your full backups; go from weekly to monthly full backups. This is a no-brainer if you're going to disk.
- Finally, consider synthetic full backups if your backup application supports them. Perform incremental backups in the virtual machine, but create your full backups synthetically inside your backup software. This feature is available in popular backup applications, including CommVault Simpana, EMC Corp. NetWorker and Symantec Corp. Veritas NetBackup.

standard full and incremental backups of that virtual drive.

The main advantage to this method is the ability to perform incremental backups. The disadvantages are that it's Windows only, there's no official support for applications (including VSS-aware apps) and no ability to recover the VM itself, only the files within the virtual machine.

Alternatively, you can use the full-volume method. VMware performs VSS snapshots as before, but can also perform syncs for non-Windows VMs. However, with this method, the raw volumes the VMDKs represent are physically copied (i.e., staged) from the VMFS storage to storage on the proxy server. Although there's no I/O load on the ESX server itself, this approach places an I/O load on the VMFS storage that's the same as a full backup.

With standard backup products, this staged copy of the raw volume is then "backed up" to tape or disk before it's considered an actual backup. This means that each full backup actually has the I/O load of *two full backups*. And unless the backup software does a lot of extra work, there are no such things as incremental backups. That means VCB—with a few exceptions—creates the I/O load equivalent of two full backups every day.

> While VMware said VCB has been licensed fairly extensively, my experience indicates that a good number of those license holders have yet to implement it.

Symantec Corp. and CommVault have figured out ways to do incremental backups. Symantec uses the full-volume method for the full backup and the file-level method for the incremental backup, and then uses the FlashBackup technology borrowed from Veritas NetBackup to associate the two. Symantec's method significantly reduces the I/O load on the data store by doing the incremental backup this way; however, it requires a multi-step restore of first laying down the full volume and then restoring each incremental backup against that volume. This restore method is cumbersome, to say the least. CommVault's method is to perform a block-level incremental backup against the raw volume, which is a "truer" incremental backup that offers an easier (and possibly faster) restore than Symantec's approach. However, it must be understood that CommVault's method still requires copying the entire volume from the data store to the proxy server. Therefore, their incremental backup places the equivalent of the I/O load of a full backup on the data store every day.

Restoring a VM also requires two steps. Your backup software restores the appropriate data to the proxy server and then uses VMware vCenter Converter to restore that to the ESX server. If the backup software supports it, it can do individual file restores by putting an agent on the virtual machine and restoring directly to it; however, restoring the entire VM must be done

via the two-step method.

All of these issues contribute to the relatively limited adoption of VCB as a backup solution for VMs. While VMware said VCB has been licensed fairly extensively, my experience indicates that a good number of those license holders have yet to implement it. There's some hope for a better backup process, however, with VMware's vSphere (see "What about vSphere?" this page).

What about vSphere?

VMware Inc. vSphere is the next-gen architecture that's going to add some new features and resolve some backup issues. In particular, it's going to remove the "two copies" problem with VMware Consolidated Backup (which will no longer be called VCB), and it will allow true incremental backups of the VMDK files. VMware vSphere is here and available, but it will be a while (probably six months to a year) before we see these features adopted in backup software.

SOME HELP FROM POINT PRODUCTS

There are a few "point products" designed specifically to address VM backup that can be incorporated into the backup process to address some of these issues. VizionCore Inc. was early to the market with its vRanger Pro product, and has been doing VMware backups longer than anyone else. Another popular alternative is esXpress from PHD Virtual Technologies. Both products are able to do VMDK-level full and incremental backups, and file-level restores with or without VCB. The two products think and behave very differently, however, so make sure you find the best match for your environment. Note that volume-level backups with both products still require reading the entire VMDK file, even if they only write a portion of it in an incremental backup.

SOURCE DEDUPLICATION

You can also use source deduplication backup software, such as Asigra Inc.'s Asigra, EMC Corp.'s Avamar or Symantec's NetBackup PureDisk. The first way source deduplication backup software can be used is by installing it on the VM where it can perform regular backups. However, source deduplication backup requires fewer CPU cycles and is less I/O-intensive than a regular backup (even an incremental one), so it significantly reduces the impact on the ESX server. Doing backups this way also lets you use any database/application agents that the products may offer. The downside is that you're not usually able to do a "bare metal" restore of a VM if this is the only backup you do.

Some products take this approach a bit further by running a backup inside the ESX server itself, capturing the extra blocks necessary to restore the virtual machine. But this method requires the backup app to

read all the blocks in all of the VMDK files to figure out which ones have changed. That could significantly impact I/O on the CPU as it calculates and looks up all those hashes.

CDP AND NEAR-CDP APPROACHES

Continuous data protection (CDP) and near-CDP backup products are used in much the same way that deduplication software is used. They're installed on your VM and back up virtual machines as they would any other physical server. The CPU and I/O impact of such a backup is very low. Most CDP software won't allow you to recover the entire machine, so you'll need to have an alternative if your VM is damaged or deleted.

NEAR-CDP-CAPABLE STORAGE

So far, all of the methods covered have as many disadvantages as advantages—if not more. But there's a completely different solution that merits serious consideration: Use a storage system that has VMware-aware near-CDP backup already built into it. (Keep in mind that near-CDP is just a fancy name for snapshots and replication.) Dell EqualLogic, FalconStor Software Inc. and NetApp all have this ability. Other storage vendors are developing similar capabilities, so check with your storage vendor.

Continuous data protection (CDP) and near-CDP backup products are used in much the same way that deduplication software is used.

The concept is relatively simple. VMDKs are stored on their storage, and each has a tool designed for VMware that you can run to tell it to back up VMware. VMware then performs a snapshot similar to what it does for VCB, allowing your storage box to then perform its own snapshot of the VMware snapshot. Replicate that backup to another box and you have yourself a backup.

The CPU hit on the ESX server is minimal. And the I/O hit on the storage is also minimal, as all it has to do is take a snapshot and then perform a smart, block-level incremental of today's new blocks by replicating them to another system. (Note that this block-level incremental is being done by the storage that already knows which blocks need to be copied, so the I/O impact is as low as it can be.) Vendors that offer these capabilities have their own ways of providing file-level restores from these backups as well.

Dell EqualLogic systems, because they're iSCSI, can communicate directly with the virtual machines via IP to coordinate the snapshots. FalconStor has agents that run in all your VMs to coordinate snapshots and do the "right thing" for a number of applications. NetApp uses VMware tools to do snapshots; however, NetApp's truly unique trait is

that it can dedupe VMware data—even live data. Think of all of the redundant blocks of data you can get rid of by using the deduplication tool included with NetApp's Data Ontap operating system.

BOTTOM LINE FOR VM BACKUP

There are a number of technologies you can deploy today to make VMware backups better. However, many of them are still saddled with disadvantages, especially when compared to traditional backup processes. Perhaps the best current alternative is to move your VMware instances to VMware-aware near-CDP-capable storage. Or maybe VMware will solve some of these backup problems with vSphere.

W. Curtis Preston is an executive editor in TechTarget's Storage Media Group, as well as an independent backup expert.

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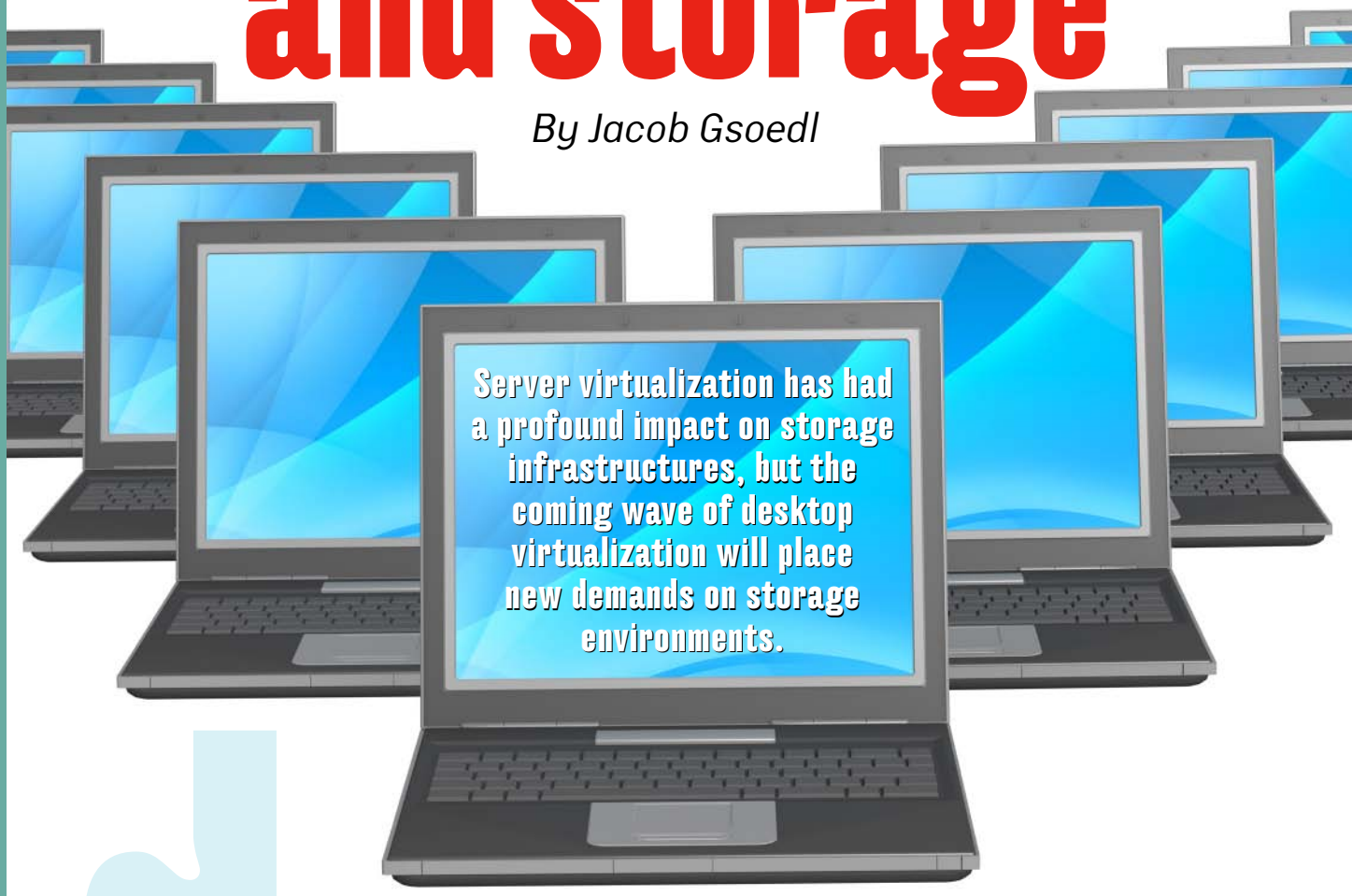
Virtual desktops and storage

By Jacob Gsoedl



DESKTOP AND LAPTOP COMPUTERS are among the most difficult IT assets to manage. Because they reside with users, and are numerous and distributed by nature, many companies simply defer critical desktop management tasks, such as data protection and patching, to users. That may seem like a practical strategy to some organizations, but it poses great risks in the areas of compliance, security and IT governance in general. Products to address these issues are plentiful—from expensive desktop management applications to client-side backup and security tools—but they're mainly point solutions and can be costly.

For storage managers, virtualizing desktops should be a real concern as all of the operating systems, applications and data currently residing on desktop and laptop PCs will need to find a new home in the data center storage environment. The required storage resources, as well as their ongoing management and administration, could be staggering.

VDI PROMISE AND CHALLENGES

Virtual desktop infrastructure (VDI)—Stamford, Conn.-based Gartner Inc. categorizes it as hosted virtual desktops—has the potential to cure this ongoing IT ailment by moving desktops into the data center. Instead of booting a local client-side operating system (OS), users connect via a browser or thin client to a virtual desktop that runs as a virtual machine (VM) on a server in the data center. Consequently, ownership of the desktop transfers from the user to IT and, by centralizing desktops, the long list of daunting desktop management tasks is greatly reduced.

Wide adoption of VDI beyond a limited number of use cases has been stifled thus far by its lack of mobility and the need to stay connected. But that's about to change. Citrix Systems Inc. and VMware Inc. have been developing offline VDI technologies that enable users to take virtualized desktops on the road while remaining secure and compliant with centrally managed policies. Offline capabilities have the potential to catapult virtual desktop infrastructure from a niche application to mainstream deployment. While Citrix Systems has partnered with Intel Corp. to develop the bare-metal Citrix Thin Client client-side hypervisor, which runs the virtual desktop on the client while disconnected from the server, VMware has released an experimental version of its Offline Desktop software, which enables users to check out their desktop and take it on the road.

"For VDI to become widely adopted in the enterprise, mobility and the ability to take desktops offline are instrumental, and we should see offline VDI production deployments by 2010," said Mark Bowker, an analyst at Milford, Mass.-based Enterprise Strategy Group (ESG).

"For VDI to become widely adopted in the enterprise, mobility and the ability to take desktops offline are instrumental, and we should see offline VDI production deployments by 2010."

—Mark Bowker,
analyst, Enterprise Strategy Group (ESG)

A second key requirement for VDI to prevail is user experience. Virtual desktops need to have the look-and-feel and flexibility of traditional thick clients. Unless audio, video and graphics capabilities, and peripheral support is comparable to (or at least close to) traditional desktops and laptops, virtual desktop infrastructure is likely to continue its niche existence and share the fate of the very thin, but relatively static, terminal server-based computing approach. But great efforts have been put into the Remote Desktop Protocol (RDP) to close the user experience gap between thick clients and VDI clients. Citrix Systems, with its Independent Computing Architecture (ICA) protocol and High Definition Experience (HDX) extensions, currently has the most comprehensive multimedia and peripheral support. Comparably, VMware has partnered with Teradici Corp. to develop a software-

only version of PC-over-IP to deliver multimedia to VDI clients beyond the rudimentary capabilities of the standard RDP protocol.

"Today VDI is ready for some users, but it'll probably take another 18 to 24 months before most of the challenges related to protocol limitations, performance and offline support get resolved," said Brian Gammage, a vice president/Gartner fellow who covers client computing.

STORAGE RESOURCES NEEDED FOR VDI

The final and probably biggest challenge for VDI to succeed is its infrastructure impact and cost. With desktop and laptop prices starting at $500, plus intangible management costs, any ROI for virtual desktop infrastructure needs to weigh the obvious benefits against the cost and effort it takes to acquire and maintain a data center infrastructure that can support hundreds and possibly thousands of virtual desktops.

To start, VDI requires servers to run the desktop virtual machines. With one CPU core able to support about five users, according to Gammage, a typical eight-core server can support approximately 40 users. VDI requires network storage for desktop virtual machine images and user data. By simply moving desktop images from clients to servers, and with the average desktop image requiring approximately 10 GB of storage, 100 virtual desktop images consume 1 TB of relatively expensive network storage vs. the low-cost disks used in contemporary desktops and laptops.

Even with offline support, VDI depends on a reliable network and sufficient bandwidth on both the local-area network (LAN) and wide-area

VDI VENDORS AND PRODUCTS

	Citrix Systems Inc.	Microsoft Corp.	Parallels	VMware Inc.
Hypervisor	XenServer	Hyper-V	Virtuozzo Containers	VMware ESX
Virtual desktop infrastructure (VDI) product	XenDesktop	Licensed from Citrix Systems	Depends on third-party session brokers: Ericom Software's PowerTerm WebConnect and Quest Software Inc.'s vWorkspace	VMware View
Offline capabilities	Via Citrix Thin Client by late 2009 or 2010	Will leverage Citrix Thin Client when available	N/A	Via VMware Offline Desktop (available as experimental release)
Application virtualization	XenApp	App-V	Via application templates	ThinApp
VM image sharing	Via Provisioning Server	Licensed from Citrix	Built into Virtuozzo Containers	Via VMware View Composer linked clone feature
Biggest benefit	Most advanced desktop and application virtualization products	Hyper-V is part of Windows Server 2008	Lowest infrastructure requirements; cost-efficient and low degree of complexity	Strongest and most widely deployed hypervisor

network (WAN), and the larger the VDI deployment the more likely network upgrades will be required. Add to that the cost of cooling, electricity and data center space, and it adds up to a significant IT infrastructure investment. On top of that infrastructure investment, there's the cost of the virtual desktop software, typically licensed by concurrent desktop (VMware View) or concurrent user (Citrix XenDesktop), OS licenses, as well as the Microsoft Corp. Vista Enterprise Centralized Desktops (VECD) add-on license Microsoft demands for each VDI client in addition to the OS license.

The cost of getting a virtual desktop infrastructure off the ground is truly staggering, and VDI software vendors have been working feverishly to minimize hardware requirements, especially those related to storage. They're also partnering with server, storage and networking vendors to maximize the number of virtualized desktops their devices can support by adding features like data deduplication and thin provisioning to storage arrays, and enhancing servers to increase the number of concurrent VDI sessions the servers can support. One example is Cisco Systems Inc.'s Unified Computing System (UCS) server platform.

"While a normal server blade can support about 40 to 60 VDI clients, UCS more than doubles that number, effectively reducing the cost per user by more than a factor of two," noted Chad Sakac, vice president of the VMware Technology Alliance.

TO VDI OR NOT TO VDI

1. Any virtual desktop infrastructure (VDI) deployment consideration needs to start with a thorough return on investment (ROI) analysis that weighs desktop management and compliance benefits against the cost of deploying and maintaining a VDI infrastructure.

2. Because IT is more likely considered a necessity rather than an asset at small- and medium-sized businesses (SMBs), VDI may not be an option for these types of firms with their limited IT teams and modest data centers. As VDI service providers mature, outsourced virtual desktop infrastructure and VDI in the cloud will become viable options for smaller firms.

3. When evaluating a VDI platform, focus on advanced features, such as offline support, linked clone-type capabilities for efficient use of storage and simplified management, as well as application virtualization capabilities. These are the areas where you get the biggest bang, but it's also where products differ the most.

4. Keep your mind open to mixing hypervisors and VDI products. While there's a small benefit to having all components from a single vendor, mixing and matching different vendors to get best-of-breed products or the most cost-efficient combinations is a valid and prudent option.

5. Start with a small number of desktops and grow your VDI footprint from there. Because it's such a radical change, a gradual rollout that includes frequently reassessing the project and making adjustments will increase your likelihood of success.

VDI ARCHITECTURE AND PLATFORMS

VDI comprises several joined components that enable clients to run their desktops remotely from within the data center. One of the key elements is a hypervisor, such as Citrix XenServer, Microsoft Hyper-V or VMware ESX Server, which runs on a server and executes the desktop virtual machines. A second ingredient is a management platform offered by the hypervisor vendors for their respective products. This manages the hypervisor servers as well as the pool of VMs used by existing connections and requested by new connections, and facilitates provisioning desktop virtual machines to VDI clients. The third element is a session broker, which is responsible for distributing sessions from clients to VMs and redirecting users of disconnected sessions back to their original virtual machines. For a VDI client to start up, these three components work hand-in-hand: On receiving a request for a new session and after successful authentication—typically via Active Directory—the session broker asks the management platform to start up a virtual machine—provisioned with the OS, applications and profiles assigned to the connecting user—that establishes a remote desktop connection between the client and desktop VM on the hypervisor server. While all VDI platforms are architected in this fashion, vendor implementations vary significantly, each with its pros and cons.

Citrix XenDesktop's Provisioning Server acts as a central proxy for all virtual desktops and is used by admins to build, configure and manage desktop virtual machine images.

Citrix XenDesktop's Provisioning Server acts as a central proxy for all virtual desktops and is used by admins to build, configure and manage desktop virtual machine images. The XenDesktop Delivery Controller (DDC) is the session broker and manages user access to desktop virtual machines. Besides being one of the most advanced VDI platforms, XenDesktop greatly benefits from the popularity and strength of Citrix XenApp (Citrix's terminal server-based platform), which allows applications to be streamed for local and offline use, and is often used to complement XenDesktop deployments.

VMware View is on par with Citrix XenDesktop in most areas, but lags in user experience, at least until VMware releases its version of PC-over-IP to match or exceed Citrix's ICA protocol and HDX extensions. VMware View includes VMware ThinApp for application virtualization, but unlike Citrix XenApp's flexible concurrent online and offline application support, its application delivery functionality is focused mostly on isolating applications from the operating system and other applications.

Microsoft has so far played a role in virtual desktop infrastructure with its Hyper-V hypervisor and System Center Virtual Machine Manager (SCVMM) management platform, but has relied on its partnership with

Citrix Systems for a session broker. Microsoft will include a session broker in Windows 7, but it's intended for smaller deployments. On the app virtualization front, Microsoft is offering Application Virtualization (App-V), formerly known as SoftGrid. Like VMware ThinApp, it's more limited than Citrix XenApp and focused primarily on isolating apps from each other and the OS.

Leadership in the VDI market is currently shared by VMware and Citrix Systems. While VMware boasts the widest deployed hypervisor platform, Citrix Systems, with a 90+% market share, according to Gartner's Gammage, dominates server-based desktop and app computing. Luckily, and mostly the result of an interoperability agreement Microsoft and Citrix Systems signed in 2006, customers can mix and match virtual desktop platforms and hypervisors. "Many of our customers run XenDesktop with Microsoft or VMware hypervisors," confirmed Calvin Hsu, director of XenDesktop product marketing at Citrix Systems.

Parallels has a VDI product that's based on its Parallels Virtuozzo Containers virtualization offering. Contrary to competing hypervisors that require a full OS image per VM, virtual containers—the equivalent of virtual machines—leverage a single OS. Instead of having resources assigned to each container, all containers share the resources of the host operating system. On the downside, Parallels VDI product doesn't have the clear-cut OS isolation, and is less flexible and more proprietary than traditional hypervisors. Similar to Microsoft, Parallels doesn't have its own session broker and relies on third-party brokers such as Quest Software Inc.'s vWorkspace and Ericom Software's PowerTerm WebConnect.

THE VDI STORAGE CHALLENGE

Unlike traditional hypervisors, Parallels' Virtuozzo Containers virtualization product is architected to minimize storage requirements. Any newly created virtual container references the underlying OS, and it's only as the OS and applications within each virtual container change that changes are stored within each container's virtual disk. "We can create a 50 Gig virtual disk, but the actually used space may only be a few megabytes and [it] grows as files change," explained Jamie Moore, senior sales engineer in the enterprise group at Parallels. Because of its efficient use of storage, Virtuozzo works well with both networked and direct-attached storage (DAS), making it very attractive for smaller environments.

Both Citrix Systems and VMware realized that for their VDI offerings to succeed they had to overcome the detriment of having to store and manage full VM images for each virtualized desktop, and they did. But unlike Parallels, they implemented their solutions outside the hypervisor.

Citrix Systems has solved the problem within its Provisioning Server. It supports creating one or several golden virtual machine images, as well as VM templates that define resource configurations such as memory, disk space and I/O devices. Once a golden VM image is created, it can be used for multiple virtual desktop users. Virtual desktop changes that

occur during a user session are stored and retained in a so-called write-cache. “You can get hundreds of virtual desktops running off the same image, with literally 100% savings on disk space,” noted Citrix Systems’ Hsu. Different from Parallels, the write-cache feature doesn’t work with DAS but requires shared storage.

VMware has addressed the storage issue with its VMware View Composer, a new component in VMware View 3. View Composer uses VMware linked clone technology to create desktop images that share virtual disks with a master image to conserve disk space. Individual desktop VM images are linked to a master virtual machine image and, as a result, can simply be patched or updated by updating the shared master image, all without affecting user-specific settings, data or apps. During runtime, VMware View Composer combines the master image with changes the user made. “View Composer reduces storage needs and costs by up to 70% while simplifying desktop management,” VMware’s Sakac said.

STORAGE VENDORS FOCUS ON VDI

Besides the aforementioned virtual desktop infrastructure capabilities, VDI users are leveraging advanced array features, such as data deduplication and thin provisioning, to reduce the disk space required for VM images and user data. Because many NAS arrays support data dedupe, and desktop VM images and user data are file based, network-attached storage is a natural fit for VDI. A case in point is offered by Dave DePillis, manager of IT operations at Allied Cash Advance, a Miami consumer loan firm. He runs all of his clients on VMware View 3 and stores desktop images and user data on NetApp FAS2020 arrays. “We’re not using linked clones at this point because of some limitations, but instead rely on NetApp’s deduplication to preserve disk space. After deduplication, we gain back about 85% of the allocated storage,” DePillis said.

> "View Composer reduces storage needs and costs by up to 70% while simplifying desktop management."
>
> —Chad Sakac,
> VP, VMware Technology Alliance

As VDI capabilities like VMware’s linked clone and Citrix Systems’ equivalent feature in Provisioning Server mature, they’ll be the preferred method of reducing disk space for virtual images because they provide the added benefit of having fewer desktop images to manage. Rather than managing one desktop image per virtual desktop, desktop management is reduced to managing one or a few master images. Patches, upgrades and configuration changes applied to the master image will be automatically propagated to virtual desktops that are linked to the master image. The impact on desktop management is huge and only compounded as the number of virtual desktops grows. “I

hope to eventually be able to leverage VMware's linked clones to simplify patching and software upgrades; at that point the NetApp deduplication will mostly benefit user data," Allied Cash Advance's DePillis said.

VDI poses something of a storage paradox. It calls for relatively low-end storage to make the ROI work, but it also needs to be highly available. "Our customers say that they want tier 1 availability at tier 6 pricing for VDI storage," VMware's Sakac quipped. As a result, VDI deployments are likely to shy away from expensive Fibre Channel SANs and gravitate toward less expensive iSCSI SANs, a notion confirmed by Hewlett-Packard (HP) Co.'s acquisition of iSCSI pioneer LeftHand Networks Inc. in 2008. "Its built-in replication, support of thin provisioning and the simplicity of iSCSI make the HP LeftHand P4000 SAN a perfect fit for VDI," explained Lee Johns, director of marketing for HP's StorageWorks Division.

The larger the number of virtual desktop users, the higher the risk of network or storage contention. Most feared is the so-called boot-storm that occurs when a large number of users fire up their virtual desktops. With features like linked clones that cause many users to access the same virtual machine image on the same blocks and spindle, a serious performance bottleneck is inevitable unless the storage array has plenty of cache. So any storage array used for desktop VM images should have an option to add cache if needed. "All NetApp filers with PCI slots have the option of adding one or multiple Performance Acceleration Modules [PAMs]," explained Manish Goel, NetApp's senior vice president, product operations. At this time, each PAM can add 16 GB of read cache for a total of 80 GB. NetApp said future expansion will allow a maximum cache of 512 GB.

Virtual desktop infrastructure deployments are likely to shy away from expensive Fibre Channel SANs and gravitate toward less expensive iSCSI SANs.

GATHERING MOMENTUM

From maturing VDI products, impending offline capabilities, Microsoft's addition of a VDI session broker in Windows 7 and Intel's chip-side support for client-side hypervisors, to emerging VDI service providers that offer VDI as a managed service, the momentum behind VDI is gaining strength. Because of its infrastructure requirements and because it represents a radical change to managing desktops, wide adoption is all but certain. The stars are lining up behind VDI to cause a major change in how companies will manage desktops in the future.

Jacob Gsoedl is a freelance writer and a corporate director for business systems. He can be reached at jgsoedl@yahoo.com.

QUALITY AWARDS IV:

Sun shines again in tape library challenge

Sun Microsystems Inc. tape libraries took top honors in both the midrange and enterprise categories in the latest Quality Awards survey.

By Rich Castagna

When Sun Microsystems Inc. acquired Storage Technology Corp. (StorageTek) back in June 2005, it raised the eyebrows of more than a few industry analysts. Some doubted that adding a tape library vendor to its arsenal would help Sun, which was struggling to stay viable in the storage market at the time. But the Sun/StorageTek combo has once again teamed up to snare top honors in *Storage* magazine's fourth annual Quality Awards for tape libraries with a resounding sweep of both the

midrange and enterprise product categories.

This is the third time Sun has finished first in the enterprise grouping in our service and reliability survey, to go along with two wins among its midrange competition. With all of those wins under its belt, it's still the first time that Sun came out on top in both product groupings in the same survey. And it was only a slim 0.02-point loss to IBM in the enterprise field last year that kept Sun from winning the category in every tape library Quality Awards installment to date.

This edition of the Quality Awards survey for tape libraries had 694 valid responses, accounting for a total of 811 product ratings (see "About the Quality Awards," this page). Seventeen product lines were included in the midrange and enterprise library categories; 13 received enough responses to be included in the final results (see "Products in the survey," p. 27).

TAPE LIBRARIES HIGHLY RATED

In our modern data centers, tape libraries loom like leftovers from the Industrial Revolution, with more moving parts that are likely to wear down, wear out and break. But judging from the results of various tape library surveys, these devices just seem to keep chugging along. "They have been running for 10 years," noted one survey respondent of his company's tape libraries. A number of respondents offered similar comments, and it's clear that library vendors deserve some kudos for refining their wares to achieve a level of reliability that rivals other storage devices.

But with the emergence of disk in the backup process, not all is happiness in tape library land. Disk has, in some cases, diminished tape's role, with some storage managers looking to eliminate tape entirely. "Tape sucks," commented two respondents, both of whom are moving toward disk-only backups. Another called tape "yester-

ABOUT THE QUALITY AWARDS

The *Storage* magazine Quality Awards are designed to identify and recognize products that have proven their quality and reliability in actual use. Results are derived from a survey of qualified *Storage* readers who assessed products in five main evaluation categories: sales-force competence, initial product quality, product features, product reliability and technical support. Our methodology incorporates statistically valid polling that eliminates market share as a factor. Our objective is to identify the most reliable product on the market regardless of vendor name, reputation or size. Products are rated on a scale of 1.00 to 8.00, where 8.00 is the most favorable score.

day's technology" and indicated that he's "moving away from tape." Still another said unambiguously, "I hate tape—we use external [hard disk] storage wherever possible."

But for most of our survey respondents, tape is still an integral part of their operations, and not an unwelcome part at all. "Regardless of what people say, tape is not dead," noted one such user, who added, "The cost to keep disk spinning that long is just too high."

PRODUCTS IN THE SURVEY

MIDRANGE TAPE LIBRARIES

- Dell Inc. PowerVault 136T/132T/TL4000/TL2000/ML6000 Series
- Hewlett-Packard StorageWorks MSL Series
- IBM Corp. System Storage TS3100/TS3200/TS3310
- Overland Storage Inc. NEO 2000/4100/4200/E-series or ARCvault 24
- Qualstar Corp. RLS Series*
- Quantum Corp. M Series/PX502 or Scalar 24/50
- Sony (All models)
- Spectra Logic Corp. 10K/20K/T24/T50*
- Sun StorageTek SL48/C4 Tape Library
- Tandberg Data StorageLibrary T24/T40/T80 or Magnum 224 LTO Library/448 LTO Library

ENTERPRISE TAPE LIBRARIES

- Hewlett-Packard ESL/EML Series
- IBM TS3400/TS3500
- Overland Storage NEO 8000*
- Qualstar TLS Series or XLS enterprise library system*
- Quantum Scalar i500/i2000/10K or PX720
- Spectra Logic 64K/T120/T200/T380/T680/T950
- Sun StorageTek SL500/SL3000/SL8500 or Sun StorageTek L1400

* Did not receive enough responses to be included in final results.

SALES-FORCE COMPETENCE

The experience that most storage managers have with any piece of storage equipment starts with the sales process. For tape library buyers, this is an especially critical part of the process as the products they purchase will play a key role in data protection and are likely to become long-term fixtures in their shops. Sun came out on top in the sales-force competence category for midrange libraries with a score of 6.63 that easily surpassed second-place finisher IBM (6.37). Sun outpaced the field with the highest scores for five of the six statements in the sales-force category, with particularly high scores for the statements "My sales rep is knowledgeable about my industry" (6.82) and "The vendor's sales support team is knowledgeable" (6.76).

"They have a long history here, so they do know my environment,"

said Max Arnold, executive director for data center operations for the State of Tennessee's Office for Information Resources in Nashville. Arnold has three Sun libraries, including a large Sun StorageTek SL8500 Modular Library System. He said his sales rep is typically accompanied by a technical resource. "They come and whiteboard with us, and we go through the entire environment in maybe a half-day session to get everything designed right," he said.

Kurt Hazel, senior lead systems administrator at the Spartanburg, S.C.-based headquarters of Denny's Corp., had a similar experience during the sales process for the firm's IBM System Storage TS3310 Tape Library. "We explained our needs, and they met every one of them," Hazel said, adding that the IBM team was "very, very receptive."

Among enterprise entrants, Spectra Logic Corp. coasted to an easy win with an overall sales competence rating of 6.53, well ahead of runner-up Sun's 6.17. Spectra Logic's domination of this category was even more impressive than Sun's midrange win, with the highest scores for every statement. Spectra's highest statement score was a 6.83 for "My sales rep is easy to negotiate with."

> "They come and whiteboard with us, and we go through the entire environment in maybe a half-day session to get everything designed right."
>
> —Max Arnold, executive director for data center operations, State of Tennessee's Office for Information Resources

INITIAL PRODUCT QUALITY

Having negotiated the sales process, the next litmus test for a tape library is initial product quality—notably, how quickly it was installed and running, and the helpfulness of the professional services the vendor provided. For enterprise tape libraries, Spectra Logic repeated its sales-force competence win with a score of 6.62 over Sun's 6.47. IBM and Hewlett-Packard (HP) Co. were third and fourth with ratings of 6.39 and 6.32, respectively. Spectra Logic once again dominated the category with high scores for five of the six statements, with Sun prevailing for the sixth ("I am satisfied with the level of professional services this product requires").

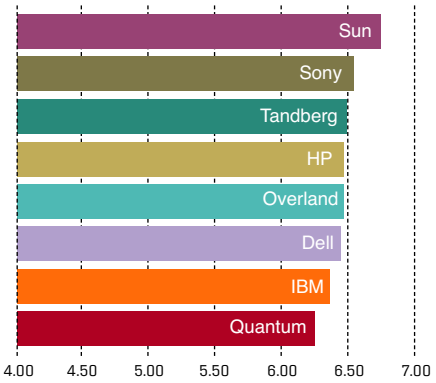
However, Sun turned the tables in the midrange library category with top scores for five statements (tying Sony for one of them); HP's 6.54 for "This product was easy to install" barely nudged Sun's score (6.50) to prevent the latter from sweeping this category. Sun also received one of only two 7.00 ratings in the entire survey for the statement "This product delivers good value for the money," which is something of a bellwether in the Quality Award surveys in helping to determine winning vendors.

Denny's Hazel is sold on the value of the company's IBM library. "It was half the cost of the previous solution, so we increased our

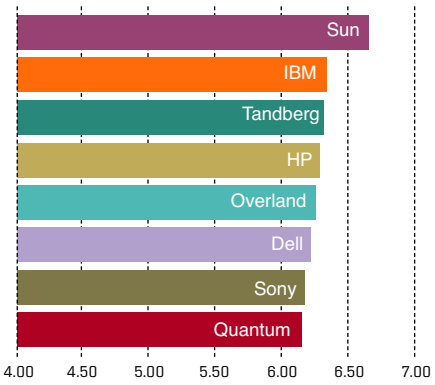
TAPE LIBRARIES

- Dell PowerVault 136T/132T/TL4000/ TL2000/ML6000 Series
- Hewlett-Packard StorageWorks MSL Series
- IBM TS3100/TS3200/TS3310
- Overland Storage NEO 2000/4100/4200/ E-series or ARCvault 24
- Quantum M Series/PX502 or Scalar 24/50
- Sony (All models)
- Sun StorageTek SL48/C4 Tape Library
- Tandberg Data StorageLibrary T24/T40/T80 or Magnum 224/448 LTO Library

INITIAL PRODUCT QUALITY



OVERALL RANKINGS



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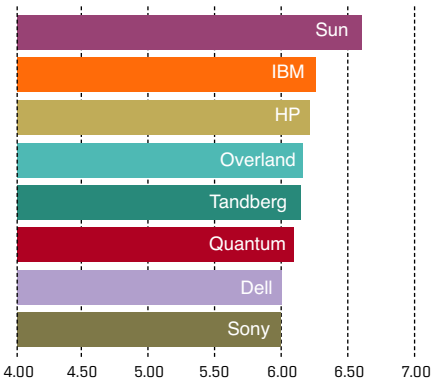
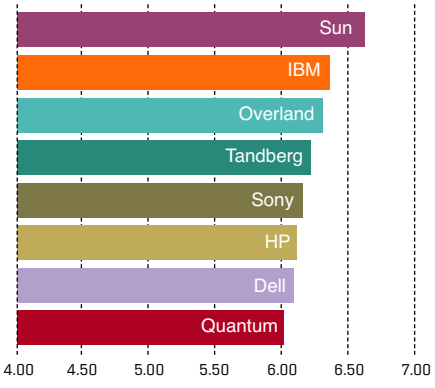
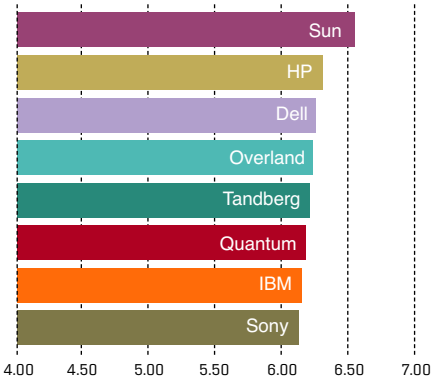


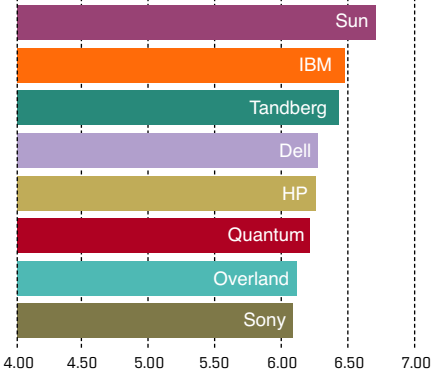
SALES-FORCE COMPETENCE



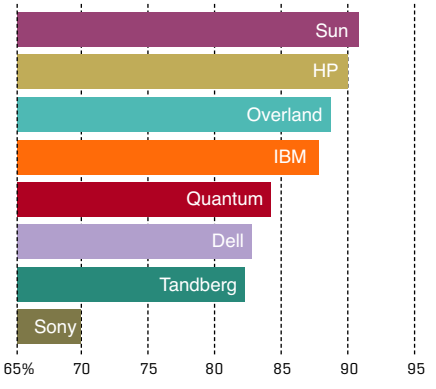
TECHNICAL SUPPORT



PRODUCT FEATURES



ALL THINGS CONSIDERED, WOULD YOU BUY THIS LIBRARY AGAIN?



Based on a 1.00-8.00 scoring scale

productivity and reduced our costs, which is an amazing thing."

Among midrange library vendors, after Sun, the field was closely bunched. Sony was second with a 6.57, but the remaining six vendors were all within 0.30 points of Sony's score.

PRODUCT FEATURES

The rubber really hits the road when a tape library is moved into production and its feature set is put to the test. In the midrange group, there was little doubt that users felt that Sun's feature set was the best. Sun topped the other vendors for every statement in this category, with a total product features score of 6.72, enough for a convincing win over runner-up IBM (6.49). Sun's impressive romp through the features category was highlighted by a very high 6.95 for "Overall, this product's features meet my needs" —a resounding endorsement of its products' capabilities.

The rubber really hits the road when a tape library is moved into production and its feature set is put to the test.

Second-place IBM was a model of consistency in the midrange-class category, with very solid scores of 6.52 to 6.59 for six of the eight statements, as well as a very respectable 6.31 for interoperability and a 6.30 for user interface. "IBM is easy," commented one survey respondent, underscoring IBM's strong showing in the features category.

In the enterprise field, Sun and Spectra Logic continued their duel, with Spectra Logic ultimately winning the features category by the slimmest possible margin (6.70 to 6.69). Reflecting the closeness of the finish, the two vendors divvied up the category with each coming out on top for four statements. Spectra Logic's win was highlighted by the other 7.00 rating in our survey, which it earned for the statement "This product loads and ejects tape efficiently." Sun Microsystems came close to garnering another 7.00, but fell slightly short with a 6.92 for "This product's operational performance meets my needs."

The Sun library purchased by the State of Tennessee's Office for Information Resources is so big that they had to ensure that the doors of their new data center were large enough to accommodate it. But as big as it is, it can still grow. "The 8500 that we have today is the maximum in a single frame, but the 8500 works where you can stack them side by side and the robot can actually go from one frame to another," State of Tennessee's Arnold said. "So it's hugely scalable."

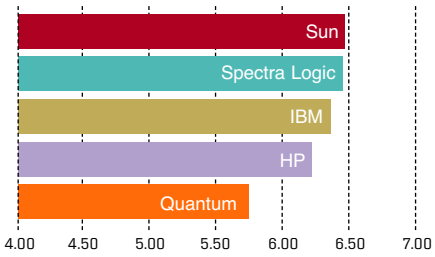
TAPE LIBRARY RELIABILITY

As noted earlier, one might assume that tape libraries, with their many mechanical components, would fall prey to reliability issues. But over the course of four Quality Award surveys, we found the opposite to be

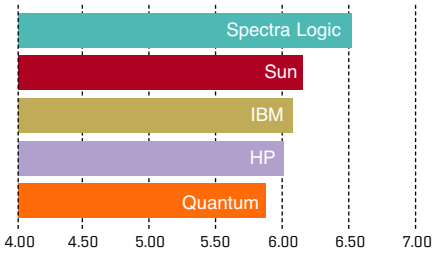
TAPE LIBRARIES

- Hewlett-Packard ESL/EML Series
- IBM TS3400/TS3500
- Quantum Scalar i500/i2000/10K or PX720
- Spectra Logic 64K/T120/T200/T380/T680/T950
- Sun StorageTek SL500/ SL3000/SL8500 or Sun StorageTek L1400

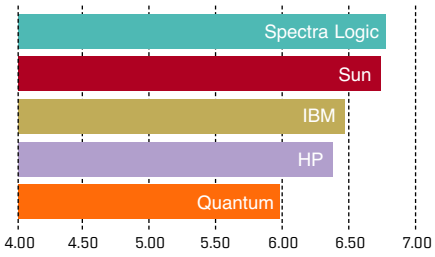
OVERALL RANKINGS



SALES-FORCE COMPETENCE

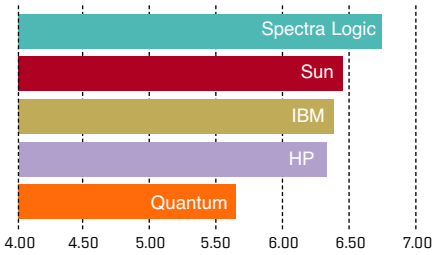


PRODUCT FEATURES

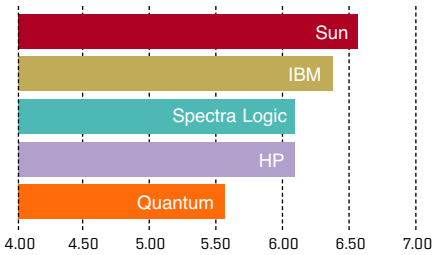


Based on a 1.00-8.00 scoring scale

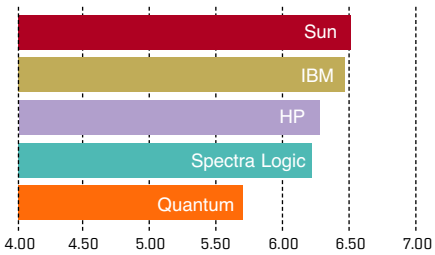
INITIAL PRODUCT QUALITY



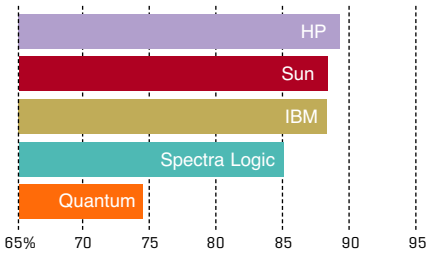
PRODUCT RELIABILITY



TECHNICAL SUPPORT



ALL THINGS CONSIDERED, WOULD YOU BUY THIS LIBRARY AGAIN?



true: tape library users tend to rate those products fairly highly for reliability concerns. In both the midrange and enterprise classes, all but one vendor pulled down scores over 6.00 for reliability, with Sun coming out on top in both the midrange and enterprise tape library groups.

Among midrange products, Sun impressed once again by taking top honors for six of the seven statements and rolling up a winning category score of 6.61, well ahead of IBM's second-place rating of 6.26. Sun again flirted with a 7.00 score by notching a 6.91 for "The product meets my service-level requirement," but the category's highest score was registered by Overland Storage Inc. with a 6.92 for "This product requires very few unplanned patches/updates."

Although most errors are detected by his backup software, Denny's Hazel still relies on IBM's user interface. "The Web interface has been helpful when a drive does go offline," he said. "It gives you a decent error code, and the error code is very simple to look up to see what the problem is."

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>
> —Kurt Hazel, senior lead systems administrator, Denny's

Sun's win in the enterprise group, with a category score of 6.53, featured another near-sweep as it came in second to IBM on a single statement ("Vendor provides comprehensive upgrade guidance") while scoring highest on all of the others. IBM again achieved a solid second-place finish with a 6.38, while HP and Spectra Logic tied for third with identical 6.11 scores. "All our HP equipment has been trouble-free," remarked one respondent, while another had similar praise for Spectra Logic, saying they're "very satisfied with this unit and the previous Spectra Logic units we have grown out of."

LIBRARY TECH SUPPORT

Ultimately, a user's final judgment on a product or vendor may come down to the technical support the vendor provides when the gear hiccups or falters. But the vendors in the survey again proved their mettle and came through with solid scores for tech support; all eight vendors in the midrange group had ratings that topped 6.00, while among enterprise vendors four of the five had scores higher than 6.00.

Sun accomplished another double win by rising to the top in both the midrange and enterprise groups. Its 6.57 score among midrange vendors was followed by some very close scores: HP was second with a 6.30, followed by Dell (6.25), Overland Storage (6.23) and Tandberg Data (6.22). Again, there wasn't much question that Sun would win this

category after topping the other vendors for seven of the eight statements with a very consistent range of scores from 6.30 ("This product is easy to service") to 6.67 ("Support issues rarely require escalation" and "Vendor's support personnel are knowledgeable").

In the enterprise library group, Sun's tech support ranked No. 1 but by a much smaller margin, 6.51 vs. IBM's 6.47. As it did in the midrange group, Sun notched its highest statement score (a 6.81) for "Vendor's support personnel are knowledgeable."

The State of Tennessee's Arnold rated Sun's support as "very good" and added, "I guess that's the main reason I've stayed with them, because I've had such good luck on response time on issues."

IBM's strong showing was the result of topping the group on three of the eight statements and rating particularly well for knowledgeable support personnel (6.66) and timely problem resolution (6.62). The battle for third place was won by Hewlett-Packard, which nosed out Spectra Logic by a score of 6.26 to 6.22.

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BUY THAT TAPE LIBRARY AGAIN?

Over the course of the nearly 20 Quality Awards surveys we've conducted, when we ask respondents if they would once again buy the product they're rating, the results sometimes contradict the other scores they volunteered. Although that may seem counterintuitive, it may simply be a case of sticking with a product that has had its intricacies and idiosyncrasies successfully deciphered. Overall, 85% of respondents said they'd buy their midrange library again; for enterprise libraries, 87% would be willing to take the plunge again.

This time, there were fewer surprises among individual vendors. Sun Microsystems backed up its midrange win with a solid 91% saying they'd buy their Sun product again. Hewlett-Packard users were nearly as enthusiastic, with 90% saying they'd buy their library again. Overland Storage was a close third with 88%, followed by IBM (87%),

In the enterprise group, Sun missed a "buy again" sweep by approximately 1 percentage point. HP topped the group with 89% saying they'd buy their enterprise library again, just beating out Sun and IBM, which both had 88%.

FIXTURES IN THE DATA CENTER

In the other surveys we've conducted, we've seen some evidence that tape libraries are playing a smaller roll in the backup process. For

example, the size of libraries, as measured by the number of slots, has been steadily decreasing due in part to higher-capacity drives but also because of the growing use of disk. But we've also seen a steady reliance on tape technology, with more than 80% of users saying they still spin off some or all backup data to tape. So tape is likely to be around for a while, and tape library vendors are apparently doing a good job of providing reliable, effective products. ⊙

Rich Castagna (rcastagna@storagemagazine.com) is editorial director of the Storage Media Group.

Service providers and subscribers benefit from cloud storage

Cloud storage can reduce the cost of IT, but service providers must prove they have the proper data security models before larger firms will adopt the model en masse.

CLOUD STORAGE, as defined by Enterprise Strategy Group, is a service delivered in one of three ways: via a subscriber, one in which the service provider is a company's internal IT group (private cloud) and when a third-party company delivers storage services.

Cloud storage must be elastic so it can quickly adapt the underlying infrastructure to changing subscriber demands. It must also be automated so that underlying infrastructure changes can be made, and content can be placed on different storage tiers or in geographic locations quickly and without human intervention. Of course, the devil is in the details. The storage cloud must also be:

- SLA-driven, automated and integrated to provide quick response times to user demands
- Policy-based, with deep levels of automation to move data to appropriate tiers
- Secure, reliable and scalable to multi-petabyte (PB) capacity with a unified management view for both block and file storage.

The current wave of public cloud storage business is mostly from small- and medium-sized enterprises (SMEs), as larger enterprises are more likely to consider private and hybrid clouds.

Cloud storage economics should enable both the service provider and the subscriber to benefit. Service providers gain economies of scale with a multi-tenant infrastructure, as well as a predictable, recurring revenue stream. Benefits for subscribers include the following:

Storage costs are shifted to an operating expense. In the current economic downturn, capital dollars are much harder to come by than operational dollars. Cloud storage is a subscription-based service that rolls into operating expenses.

Pay as you use. While some of the top IT shops have storage utilization rates in the 80%-plus range, the industry average is closer to 40% to 50%. That means IT shops are housing, powering, cooling and managing lots of "spinning rust" with zero data on it. In a cloud model, users only pay for the amount of storage actually used.

Operating expenses are reduced. The service provider absorbs storage management costs, and can manage the infrastructure more efficiently thanks to multi-tenancy and scale-out virtualized storage platforms.

Your data center footprint should shrink. Subscribers don't need to worry about finding new ways to house, power, cool and manage storage capacity, which are some of the biggest challenges facing storage managers today.

You can easily determine storage tier requirements. Moving stale, rarely accessed data off tier 1 assets allows subscribers to optimize tier 1 utilization and extend its useful life, while reducing the cost of storing stale data. Cloud service-level agreements (SLAs) can also be established for applications requiring different security levels.

Business flexibility is provided with subscriber-controlled on-demand capacity and performance. New projects can be kicked off without a long, multi-month waiting period to provision new capacity. Temporary capacity can easily be deployed if a new business opportunity arises.

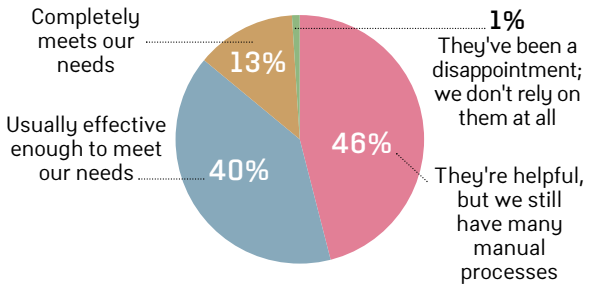
Remember, not all applications are suited for a cloud storage model. Latency is a key consideration (no matter how good the infrastructure provider is, no one has yet figured out how to beat the speed of light) and will most likely appear as a problem in hybrid and public clouds. The bulk of data stored in the data center in the foreseeable future will be file-based, long-tail content that's latency tolerant. Getting that data offsite to a cloud provider makes economic sense, especially in the current economy. The current wave of public cloud storage business is mostly from small- and medium-sized enterprises (SMEs), as larger enterprises are more likely to consider private and hybrid clouds. Cloud storage service providers in the market today still have a lot of work to do to prove they have the proper data security models in place before larger enterprises will adopt the model en masse, but there are clear opportunities to reduce the overall cost of IT for those who do. ⊙

Terri McClure is a storage analyst at Enterprise Strategy Group, Milford, Mass.

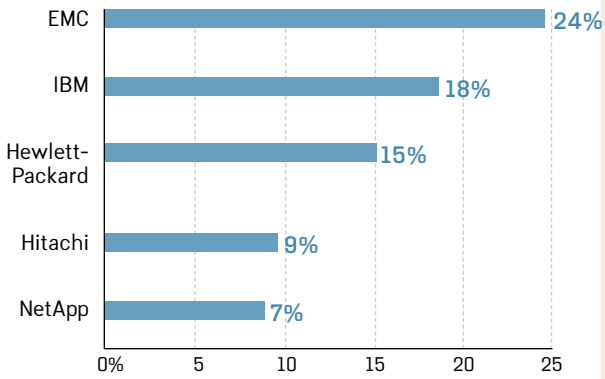
Hardware vendor still top choice for management apps

IT'S TIME FOR storage management software vendors to go back to the drawing board ... again. *Storage* readers still favor the applications and element managers they get with their hardware over storage resource management (SRM) suites by more than 2:1—45% to 21%, almost the same split we saw a year ago on our survey. Nearly one-third use some kind of point product to address specific management needs, and 26% still rely on Excel spreadsheets. Thirty-four percent cited configuration management as the area where they need the most help, similar to last year's number. But just slightly less (32%) said managing capacity was a key need, a huge turnaround from last year when only 1% said capacity management was a priority. That big swing can probably be attributed to the inexorable need for more capacity coupled with budgets that have been pared down to recessionary dimensions. Satisfaction levels with management apps are unchanged from last year, with only 13% saying that applications completely meet their needs. *—Rich Castagna*

How would you rate the effectiveness of the management tools you're using?



Who would you consider your primary storage management tool vendor?



What functionality do you require in your storage management tools?

34%	Configuration management
32%	Capacity management
26%	Operational monitoring
26%	Performance management
21%	Reporting functions
17%	Provisioning
12%	Replication

45%

Use the software that came with their storage arrays and networking equipment

> **"I have no hope for a single *uber*-tool to perform SRM. It will, for the foreseeable future, be a cobbled together assortment of tools (in-house and vendor) to do the job."**
>
> **—Survey respondent**

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