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PIPELINE *Managing Business Data*

>> Cover Story

MARRIAGE OF CONVENIENCE

Tape is slow but portable; disk is fast and flashy. EMC's Clariion DL300 shows how, united, they bring out the best in each other

By Howard Marks

Tapes and backups go together like wedding cake and champagne. Alternative backup media like optical, removable and WORM (write-once, read-many) disks are OK for niche markets, like home networks and stock brokerages with SEC requirements to store communications on unalterable media. But the vast majority of server admins are still faithful to their tapes.

Truth is, though, tape isn't the ideal medium for the nightly backups that protect our data from corruption, user error and server failures. Even state-of-the-art tape technologies like LTO (Linear Tape Open) and SDLT (Super Digital Linear Tape) are substantially slower than your server's RAID array. And even if your tape system is fast enough to back up your file servers in the window that's available, at restore time the difference between disk and tape becomes painfully apparent. When the CEO yells that she needs the Smitson contract she accidentally overwrote, she means now. Restoring from a tape already in your library may take as long as an hour. If the tape is on a shelf somewhere, it could take most of the day.

Of course, tape has always had two big advantages: cost and portability. The latter still holds true—a DLT tape cartridge is a lot

easier to send off to a vault for off-site or archival storage—so divorcing tape altogether is not yet an option. But the rapidly falling price and steadily improving reliability of ATA, and now SATA (Serial ATA), disk drives have changed the dynamics of the backup market. A 250-GB ATA hard drive has a lower per-gigabyte cost than the DLT IV tapes you're buying for your three-year-old tape library. Although tapes remain more portable than SATA RAID arrays, replacing tape with disk for your front-line backups can boost speed, improve reliability and eliminate the delays in loading and searching a tape for the data you need.

Thankfully, there is a happy medium. VTLs (virtual tape libraries) make a disk array appear to your backup server like a tape library, with no new software or major redesign of your backup processes needed. We invited eight VTL appliance vendors to submit their devices to our New Jersey partner labs. We were able to put seven—EMC Corp.'s Clariion DL300 Disk Library, Maxxan Systems' SVT-100 Virtual Tape System, Network Engines' Virtual Tape Library Appliance, Overland Storage's REO 4000, Quantum Corp.'s DX30, Sepaton's S2100-DS and Ultera Systems' MirageVL Fibre Virtual Tape Controller—to the test. Interestingly, three participating vendors—EMC, Maxxan and Network Engines—use FalconStor's IPStor VirtualTape Library software to power their devices. They've taken different approaches to hardware, however. ADIC declined to send us its Pathlight VX because of a looming major firmware upgrade.

Key to Domestic Harmony

Compared with physical tape, the VTL appliances we tested are blazingly fast, so features and flexibility should be more important in your purchasing decision than raw speed; this is reflected in our scoring. The most obvious difference is in the VTL storage architectures. Systems with internal storage, like the Sepaton S2100-DS and Overland REO 4000, are easy to install but also easy to out-grow. External storage means that a full library doesn't require a forklift upgrade. Other key factors to consider:

» VTL can emulate multiple libraries. Even though backup software will share a tape library among multiple media servers, they all have to be running the same backup application. With a VTL that can emulate multiple libraries, you can have your Unix systems running Networker and your Windows servers using ArcServe, both backing up to the same RAID array. EMC leads the

pack here; its DL300 can emulate 32 libraries.

» More tape drives mean more simultaneous backup streams and support for more backup media servers for better performance. EMC, Maxxan and Network Engines each support 256 drives. On the other end of the spectrum is Ultera, with one.

» Additional slots let you reduce the number of backup sets per virtual tape so you can overwrite your data in smaller chunks. Here, Sepaton shone, with a maximum of 5,000 slots.

» How and when disk space is allocated to virtual tapes is important. Ultera's MirageVL and Quantum's DX30 divide the available disk space evenly into virtual tapes at system configuration time. If you want to change the number or size of virtual tapes, you'll have to throw away all the data on the VTL. The FalconStor-based appliances and Sepaton's S2100-DS allocate disk space to virtual tapes as you write data to them, and Overland's REO 4000 takes a middle path, letting you expand a virtual device from unallocated space. Although dynamic disk allocation may appear to be a better approach, static allocation is closer to the tape paradigm. More important, because backup software overwrites a whole tape at a time, static allocation systems don't suffer performance loss from disk fragmentation.

» Finally, consider the physical tape library support the Network Engines, Maxxan and EMC appliances offer. Connect your physical tape library to the VTL, then, when your backup application finishes writing to a virtual tape, the VTL can copy the contents of the virtual tape to a tape in the physical library automatically. Without this type of support, your backup server has to copy from virtual to physical tape whenever you want to make a copy of backup data for archiving or to take off-site. This could be easy or difficult, depending on your backup application.

FalconStor Makes a Clean Sweep

After spending a few months with these VTLs, it was no surprise that three of our vendors had chosen FalconStor's IPStor Virtual-Tape Library to power their appliances. Powerful, flexible and easy to use, FalconStor has hit a home run. Setting up the IPStor-based

appliances was a breeze; once the device had an IP address, we just fired up the Windows console and either followed the wizard or just jumped in and started building virtual libraries.

The IPStor console uses a two-pane interface with a device tree in the right pane and information on the selected device on the left. As a first step, we enabled Fibre Channel and designated which ports were to be initiators connected to disks and physical libraries and which were targets to allow media servers access to the appliance. Next, we selected virtual tape libraries in the tree, clicked "new," and followed the wizard to select a library model to emulate and the number of tape drives.

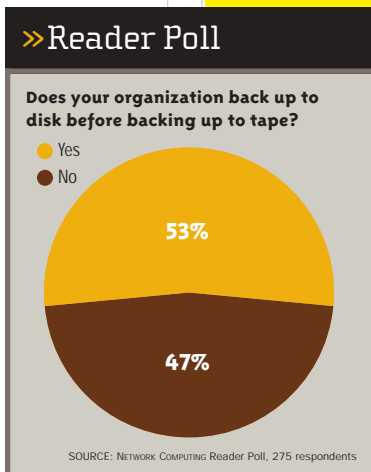
Once a library was created, we needed to make some virtual tapes. If you have a physical library attached, IPStor will read the barcodes from your tapes and create a virtual tape to correspond to each physical tape. Otherwise, give it barcode rules.

We then got to choose which disk LUN to create the tapes on and whether to use compression and static or dynamic disk allocation. The last step was to assign the library to SAN clients. We could enter the WWNs (worldwide names) of our media servers as clients and assign libraries to specific media servers or assign the library to the predefined "Everyone" client, which allows access to all.

IPStor VTL also shone when it came to virtual tape handling. In addition to keeping tapes in library slots, we could move them to a virtual vault holding area and import or export tapes to and from a physical tape library.

To test the physical library configuration, we set a virtual library on the EMC device to auto-archive. When we ran a backup and sent an export tape to mailslot command from Backup Exec, the data was copied to a physical tape and ejected from the Scalar 24's mailslot. Just to make sure it was a legit Backup Exec tape, we loaded it into an LTO drive on another media server and restored a few files, just as if it had been made there.

Although the VTLs from all three FalconStor OEMs run basically the same software, they've taken different approaches to hardware and packaging, yet all finished near the top of the pile. Their flexibility and ease of use mean we'd be pleased to have any



» Executive Summary: Virtual Tape

Because data expands to fill all available space, you're probably outgrowing the tape library you got in the go-go days before the dot-com bubble burst. You now have several options: Those still flush with cash can dump the old library and replace it with a younger, state-of-the-art trophy model. Back in the real world, a less expensive choice would be to upgrade the drives in your current library, replacing DLT8000s, for example, with

new SDLT (Super Digital Linear Tape) drives. But this would cost \$5,000 or more per drive, and you'd have to buy all new media.

A third option: Add a VTL (virtual tape library) to your backup architecture and keep your old library and media to satisfy your off-site and archival storage requirements. You'll gain the performance and reliability advantages of disk-to-disk backup, and where upgrading a six-drive tape library

might cost \$40,000 to \$50,000, the VTLs we reviewed from EMC Corp., Maxxan Systems, Network Engines, Overland Storage, Quantum Corp., Sepaton and Ultera Systems start at less than half that.

EMC's Clariion DL300, the most expensive entry, earned our Editor's Choice award. But we'd make a long-term commitment to any of our top four finishers faster than you can hum Wagner's "Lohengrin" processional.

one in our labs. Quantum's DX30 device posted a strong showing as well, thanks to the company's aggressive pricing. While we're on the subject, remember that all prices are list and as configured for this review. Installation was included only where noted. But because only one can wear the crown, we're awarding our Editor's Choice to the IPstor-based EMC Clariion DL300 Disk Library for capacity, support, and overall fit and finish.

EMC Clariion DL300 Disk Library

B+ The DL300 combines a 3U dual Xeon server with four dual-port Fibre Channel HBAs (host bus adapters) with EMC's Clariion CX300 disk array. Our test library came with a full 15-drive tray of 144-GB Fibre Channel drives and two racks of 250-GB ATA drives for almost 10 TB of raw disk space. EMC also loaned us an ADIC Scalar 24 LTO tape library so we could test the physical tape library integration.

EMC, following its full-service business model, also includes a 40U rack and installation services in the price, so installing the DL300 was just a matter of telling the engineer what IP address to use for its management port and plugging the Fibre Channel cable into the switch.

Being the 800-pound gorilla of the storage industry, EMC has made a few modifications to the standard IPstor VTL software. Beyond an additional QA pass through the code, the most significant change in the EMC version of the software is a slight reduction in the number of options. For example, the EMC version of the VTL software won't let you configure an ADIC library with STK tape drives, but that's not a great loss because ADIC never sold that configuration.

Unlike the other IPstor VTLs, the CL300 comes with a default virtual ATP P3000 tape library defined, so we had it up and running just a couple of hours after the EMC engineer arrived at the lab.

» *EMC Clariion DL300 Disk Library, starts at \$79,000; \$126,000 as tested. Pricing includes installation. EMC Corp., (800) 782-4362,*

(508) 435-1000. www.emc.com

Network Engines Virtual Tape Library Appliance

B+ Network Engines has found a market niche in packaging sophisticated software applications with standard 1U Xeon servers to create appliances for apps from firewalls to backup servers and, of course, virtual tape libraries. As expected, the VTL is a 1U Xeon server with QLogic Fibre Channel and Adaptec SCSI dual-port HBAs.

While we weren't able to overwhelm the VTL appliance with our test servers (see "How We Tested Virtual Tape Libraries, two Fibre Channel and two SCSI ports may not provide enough connections or bandwidth for larger environments. If you're looking for more scalability, Network Engines' Enterprise Edition 2U server system offers additional Fibre Channel ports.

The Network Engines VTL can be purchased configured for iSCSI instead of Fibre Channel, with connections for backup servers and SCSI disk. This version is a good bit less expensive than the FC box and offers all the flexibility of an IPstor VTL.

As for setup, a custom front panel with push buttons and an LCD panel made it easy to set the IP address. Once we racked the system, connected the provided Datamax SCSI RAID array and installed the Windows console for IPstor, we could do the rest of the configuration through the IPstor console. Piece of cake.

» *Network Engines Virtual Tape Library Appliance, \$33,995 for Fibre Channel version (as tested), \$21,000 for IP version. Network Engines, (877) 638-9323, (781) 332-1000. www.networkengines.com*

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Quantum Corp. Quantum DX30

B+ Quantum created the VTL product category with the introduction of the DX30 just two years ago. Designed when the company still made disk drives, the original DX30 was a 4-TB, 4U IDE RAID array that looked to host computers like an ATL P1000 DLT library, which is also, coincidentally, a Quantum product. Early adopters were thrilled with the DX30's high performance



» How We Tested Virtual Tape Libraries

We connected the virtual tape systems to our Brocade SilkWorm 3200 or QLogic SANbox 5200 2-Gbps Fibre Channel switches along with our four backup media servers. Regardless of the number of Fibre Channel ports available, each virtual tape appliance was connected to a single switch port.

We then ran backups with both Veritas Backup Exec 9.1 and Veritas NetBackup 5.1 to each library in turn. We recorded the backup application's reported backup rate for both a single stream backup from our fastest server and the aggregate data rate for simulta-

neous backups from four media servers.

Our test data set was just over 18 GB with an assortment of file sizes. To minimize the overhead of media servers locating each file, about half the backup data set was made up of system backup, ghost images and CD image files, including one 5-GB monster, and each server had a local copy of the backup set on a dedicated volume.

For our media servers, we used a Dell PowerEdge 1600SC with dual 2.4-GHz Xeon processors and U320 SCSI disks, a pair of white-box Pentium 4 2.4-GHz servers with IDE drives, and a

Compaq ProLiant 5500 with dual 550-MHz Xeons and a Smart Array 3200 RAID controller with U80 SCSI disks. The Compaq server has a 1-Gbps Compaq Fibre Channel host adapter and runs Windows 2000 Server; the others contain QLogic 2-Gbps HBAs and run Windows Server 2003.

To keep our experience as much like a real customer's as possible, vendors were allowed to send field engineers to install their equipment only if they always sell installation with their systems—that translates to EMC and Quantum.

but soon discovered that, just as they were outgrowing their tape libraries, they were also outgrowing their DX30s.

Today's DX30 still emulates an ATL P1000 with as many as six DLT 7000 drives, but Quantum has made it expandable. Instead of the internal RAID array of early models, current DX30s connect via Fibre Channel to as many as four 4-TB SATA disk arrays. In the default RAID-5 plus hot-spare configuration, each array provides 3.25 TB of usable space. If that's not big enough for you, the DX100, which runs basically the same software as the DX30 we reviewed, can handle up to 64 TB of disk.

Physically installing the DX30 couldn't have been easier—Quantum shipped it preinstalled in a rack and sent a field engineer out to our lab to hook it up. After plugging a PC into the controller's serial port and taking a few minutes to log in and set the IP address, then designating the number of virtual tapes to divide the disk array into and the barcode labels for the tapes, we were ready to plug the DX30 into our Fibre Channel switch. From there, NetBackup recognized the DX30 right away, and we could make backups in minutes. Backup Exec took a bit longer to get working, as we had to patch the DX30's response string into Backup Exec's SCSIchanger driver.

Compared with the Sepaton and our three FalconStor-based devices, the DX30 has a few glaring limitations: It emulates a maximum of six virtual DTL 7000 tape drives in a single tape library, limiting the number of simultaneous backup streams. Disk space is allocated when you create virtual tapes, and all the tapes on a disk array must be the same size. If you have more than one array, you can set up large tapes for full backups on one and small tapes for incremental backups on another.

On the plus side, the DX30 did a good job of alerting us to problems via SNMP or e-mail. It was the only device that provided an easy way to view how full each virtual tape was, and it made information that you would usually get from the LCD on your physical tape library, like the ID of tape in the robot arm, readily accessible.

» *Quantum DX30, \$40,000 including installation. Quantum Corp., (800) 677-6268, (949) 856-7800. www.quantum.com*

Maxxan Systems SVT-100 Virtual Tape System Maxxan's

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SVT-100 is a beefy dual Xeon 2U appliance with 10—count 'em, 10—Fiber Channel ports plus two Gigabit Ethernet ports for iSCSI connections. Although the



SVT-100 is an attractive product, at its core it's a standalone version of Maxxan's SVT-200 VTL card, which can be found in the company's MXV320 and MXV500 Intelligent Application Switches; these are aimed at moving application intelligence into the switching fabric—an interesting idea that could make a lot of sense for this kind of virtualization function.

Getting the SVT-100 up and running took a bit more work than expected because one of the 250-GB SATA drives in the Infortrend disk array Maxxan sent us died in transit. After rebuilding the array, we set the initial IP address on the management port by connecting a terminal session to the serial port and then the IPStor console to manage the appliance. In addition to the usual IPStor console interface, the SVT-100 has a Web interface where we could monitor temperature, fan and power supply status, and set the IP addresses of the Gigabit Ethernet interfaces for iSCSI, including a virtual iSCSI IP address for a bonded 2-GB connection.

» *SVT-100 Virtual Tape System, \$33,000. Maxxan Systems, (866) 462-9926, (408) 382-6500. www.maxxan.com*

Sepaton S2100-DS 1.0 Sepaton (that's "no tapes" spelled backward) is aiming at the high end of the virtual tape library market with its S2100-ES 200-TB behemoth. But for this review, it sent us the ES' little brother, the S2100-DS, with its still respectable maximum 6 TB of ATA RAID disk.

The S2100-DS is significantly more flexible than many of the

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VIRTUAL TAPE

	EMC Clarion DL300 Disk Library	Network Engines Virtual Tape Library Appliance	Quantum DX30	Maxxan Systems SVT100 Virtual Tape System	Sepaton S2100DS 1.0	Overland Storage REO 4000	Ultera Systems MirageVL
VALUE (30%)	3	3.5	4.5	3	5	5	4
FEATURES AND FLEXIBILITY (25%)	5	5	3	5	4	2	2
MANAGEMENT (20%)	4	4	4	4	2	3	1
INTEGRATION/INSTALLATION (15%)	5	4	5	4	3	4	2
BACKUP PERFORMANCE (10%)	4	4	4	4	4	4	3
TOTAL SCORE (100%)	4.10	4.10	4.05	3.95	3.75	3.60	2.30
<small>A≥4.3, B≥3.5, C≥2.5, D≥1.5, F<1.5 A-C GRADES INCLUDE + OR - IN THEIR RANGES. TOTAL SCORES AND WEIGHTED SCORES ARE BASED ON A SCALE OF 0-5.</small>	B+	B+	B+	B	B	B-	D

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other VTLs we tested, offering the ability to emulate multiple tape libraries with as many as 64 drives and dynamic disk allocation. Its biggest problem is the lack of a graphical user interface.

Although most of the VTL appliances we tested are based on PC server motherboards running Linux, the Sepaton S2100-DS exposes its roots more than most. To configure and manage the S2100-DS, we had to log in to a console session on the Linux system and either run commands with multiple command-line parameters or—even more frightening for Windows types—edit the configuration file with VI.

Because Sepaton shipped us an S2100-DS with three virtual tape libraries predefined, installation went smoothly once we found someone to help heft its 95-pound bulk into a rack. We then plugged a keyboard and monitor into the usual ports, logged on and ran the `./setup` script to set the IP address for the management port.

The next step was to create virtual tape cartridges by running the `./mkcart` command with parameters designating the RAID array to create the tapes on, the number of tapes, barcode information, file name prefix and maximum size for each tape. From that point on, we could run the VTL through our backup software; both Backup Exec and NetBackup recognized all three libraries and made speedy backups without incident.

In its current incarnation, we can recommend the 2100-DS only to readers comfortable with Linux/Unix command-line interfaces. Those who don't VI need not apply. With the addition of a management GUI, which Sepaton says should be available by the time you read this, the 2100-DS will be a formidable competitor for the rest of us at a competitive price.

» *Sepaton S2100-DS 1.0, 6-TB configuration (as tested) \$48,000; 5-TB version lists for \$21,000. Sepaton, (508) 490-7900. www.sepaton.com*

Overland Storage REO 4000 Curiously for a backup appliance from a tape library vendor, Overland Storage's REO 4000 differs from the other products we tested in that it doesn't emulate a tape library. Instead, we could use its 2 TB of internal IDE disk space to represent as many as 16 iSCSI and/or Fibre Channel disk volumes or virtual HP LTO2 tape drives. This arrangement is a lot less sophisticated than emulating multiple disk libraries and their associated tape drives, especially when it comes to allocating available disk.

Installing the REO 4000 was a simple process enhanced by Overland's use of a USB memory key to hold the REO's firmware. All we had to do was stick the USB key in a desktop machine to make a backup of the firmware and edit the configuration file to assign the REO an IP address. Once that was done, we connected the Fibre Channel and Ethernet cables and started configuring the REO through its Web interface.

The next step was picking a RAID level, 0 or 5. Note that all the products under test use RAID 5 of some sort. Quantum and EMC use hot spares. Network Engines, Maxxan and Ultera use third-party disk, so it's up to you when you set up the array. Sepa-

ton comes preconfigured for RAID 5. Only in the REO was the RAID level a setup option. We then divided the space into virtual devices. The REO can't automatically expand a virtual device as it fills with data, the way the FalconStor systems can. We recommend not allocating all its space when you initially create devices; that way, you can expand as needed.

After we created devices, we wondered why we couldn't see them from our servers. After some head scratching, we carefully entered the Fibre Channel WWNs for our server host adapters and assigned devices to each server. That solved that problem, and thereafter making backups was a cinch. The iSCSI configuration was similarly easy, and the REO gave us the same snappy performance, regardless of the connection method.

Given that backup applications don't selectively overwrite backup sets on tapes—real or virtual—we would recommend the REO 4000 as an iSCSI disk target for backup systems, a role where it would be a cost-effective solution.

» *REO 4000, \$17,500 as configured. Overland Storage, (800) 729-8725, (858) 571-5555. www.overlandstorage.com*

Ultera Systems MirageVL Fibre Virtual Tape Controller

The great modern architect Ludwig Mies van der Rohe would be

proud of Ultera's minimalist approach to product design. The Mirage's design couldn't be simpler: a 1U appliance with just a four-line LCD display and four buttons on the front, plus a pair of Fibre Channel ports for connections to an external disk array and a host or switch on the back.

Once we hooked up the MirageVL to our Fibre Channel switch and the ADTX ArrayMasStor L that Ultera provided, we realized to our chagrin that "simple" was a poor choice of adjective: The MirageVL had neither an Ethernet nor a serial port for management. All else having failed, we reached for the manual to figure out how to configure the system.

Scanning the nine-page quick start guide yielded the information that we could use the front-panel buttons to set the interface speed; choose between emulating a Sony SDX-500C AIT drive, TSL-A500C stacker or LB-81 autoloader; and choose the number of virtual tapes. Disk space was allocated when we chose the number of tapes, with each tape automatically taking an equal amount of the available space.

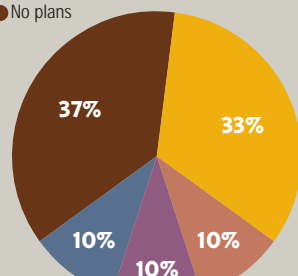
If you're planning to use the MirageVL with existing Fibre Channel disk, you'd better make sure you set up your Fibre Channel zoning and/or LUN masking before you fire it up, because the MirageVL will claim any disk it can see on its interface for use as virtual tape.

In a graphic demonstration of how far Fibre Channel interoperability still has to go, when we tried to connect the MirageVL to a server, we found tape drives and library devices appearing and disappearing from Windows Device Manager before our eyes ... like, well, a mirage. A firmware update solved the incompatibility between the MirageVL and QLogic's STORport drivers and Backup Exec, but we were never able to make the MirageVL work

» Reader Poll

Does your organization plan to set up an intermediate disk-to-disk system?

- We back up to disk before backing up to tape
- Yes, within 6 months
- Yes, within 12 months
- Yes, within 24 months
- No plans



SOURCE: NETWORK COMPUTING Reader Poll, 275 respondents

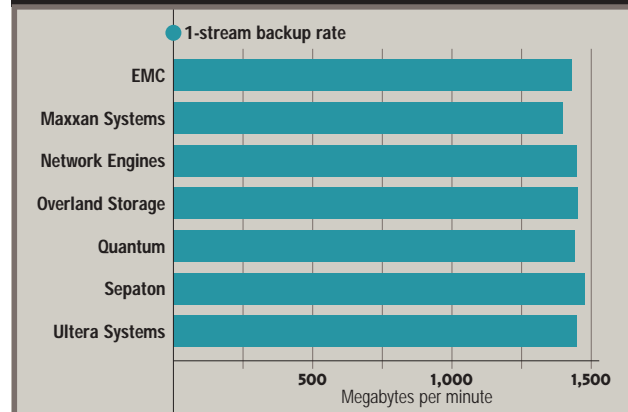
to our satisfaction with NetBackup. Because the MirageVL emulates only a single tape drive and Backup Exec doesn't support interleaving, we couldn't generate multistream backup performance data.

On the plus side, the MirageVL is the least expensive product of those we tested, and it is available in versions with SCSI interfaces for hosts and/or disk arrays, which makes it even more economical. Ultera has promised within a few months new firmware versions that support as many as eight tape drives and new models of the controller with a Web management GUI, controller clustering and support for archiving to a physical tape library. However, given its limited management capabilities, single virtual tape drive support and interoperability issues, we can't recommend the MirageVL at its current state of development.

» *MirageVL Fibre Virtual Tape Controller, Model VT2120-FV, \$9,525; ADTX RAID system, \$7,836. Ultera Systems, (949) 367-8800. www.ultera.com*

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» Virtual Tape Performance



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FEATURES

VIRTUAL TAPE

	EMC Clariion DL300 Disk Library	Maxxan Systems SVT100 Virtual Tape System	Network Engines Virtual Tape Library Appliance	Overland Storage REO 4000	Sepaton S2100DS 1.0	Quantum DX30	Ultera Systems MirageVL
Max. number of libraries emulated	32	20	20	0	16	1	1
Vendor libraries emulated	Adic Scalar; StorageTek I Series; Quantum/ATL P Series	Adic Scalar; HP ESL; StorageTek I Series; Quantum/ATL P Series	Adic Scalar; HP ESL; StorageTek I Series; Quantum/ATL P Series	N/A	Adic Scalar; HP ESL; StorageTek I Series; Quantum/ATL P Series	Quantum/ATL P1000	Sony LIB-81
Maximum number of drives	256	256	256	16	64	6	1
Drives emulated	DLT7000, DLT8000, SDLT; LTO; STK9840, STK9940	DLT7000, DLT8000, SDLT; LTO; STK9840, STK9940	DLT7000, DLT8000, SDLT; LTO; STK9840, STK9940	HP LTO	AIT2, AIT3; DLT7000, DLT8000, SDLT320; LTO-1	DLT7000	AIT2
Maximum number of slots/tapes	2,048	100 standard/ 200 optional	100 standard/ 200 optional	16	5,000	320	32
Standalone drives emulated	Y	Y	Y	Y	N	N	Y
Command-line interface	N	N	N	N	Y	Y	N
Web interface	N	N	N	Y	N	Y	N
Windows console	Y	Y	Y	N	N	N	N
Unix/Linux console	N	Y	Y	N	N	N	N
Physical tape library support	Y	Y	Y	N	N	N	N
Compression	Y	Y	Y	Y	N	N	N
Dynamic disk allocation	Y	Y	Y	N	Y	N	N
LUN masking	Optional	Optional	Optional	Y	N	N	N
Minimum/maximum disk size	6 TB/12.5 TB	Third-party unlimited	Third-party unlimited	2 TB/2 TB	3 TB/6 TB	4 TB/16 TB	0/16 TB (third-party)
Third-party disk (FC/SCSI)	N/N	Y/N	Y/Y	N/N	N/N	N/N	Y/Y
Redundant power supplies	Y	Y	N	Y	Y	Y	N
iSCSI Gigabit Ethernet ports	0	2	2	2	0	0	N/A
Fibre Channel ports (front/back)	3/4, plus dedicated tape library port	10 bidirectional	2 bidirectional	2/0	1/0	2/4	1

Y=Yes N=No