Complex regulations, security requirements, and business continuity challenges are transforming the enterprise backup and recovery process and setting new standards for data encryption and archiving. Many organizations are revising their strategy for information life cycle management to comply with legislative mandates that dictate how information must be stored and how long it must be retained. Addressing today’s diverse service-level agreements (SLAs) requires organizations to establish secure ways for customers, end users, and even litigators to access vital enterprise records. At the same time, they must ensure that the overall storage infrastructure has the capacity to grow quickly, flexibly, and cost-effectively.

While disk is clearly the ideal approach for online storage, tape remains a critical component of the overall information life cycle management strategy—particularly for long-term data retention, regulatory compliance, and business continuance. Linear Tape-Open Ultrium 4 (LTO-4) tape technology advances security with drive-level data encryption that helps organizations prevent tampering with stored data. The encryption is performed at line speed in the tape device hardware so it does not affect throughput performance—enabling LTO-4 devices to reduce backup windows with native data transfer rates of up to 120 MB/sec, which is 50 percent faster than the specified throughput performance for previous-generation LTO-3 devices. Plus, double-density LTO-4 tape media offers up to 800 GB of native physical capacity, which is twice the specified capacity of previous-generation LTO-3 tape media.

Understanding the role of tape in the data center
Figure 1 compares typical characteristics of disk and tape technology and how they factor into the overall storage infrastructure. Although each has particular strengths—and neither replaces the other—continuing developments in both allow administrators to combine tape and disk technology to best advantage for specific enterprise backup and archiving solutions.

Long-term archiving requirements for data storage and in some cases paper records have IT departments clamoring for low-cost, high-capacity tape media. However, compliance with strict data retention regulations may require fixed-content authenticity—for example, assurance that media files and e-mails remain in their original state while stored. Before selecting appropriate media for any given backup and storage strategy, best practices advise administrators to thoroughly understand architectural approaches and technology capabilities.

Often considered a front-runner for long-term storage, tape enables low-cost, offline backups at a remote site. Importantly, this data portability allows businesses to restore files after a disaster on whatever hardware platform is available—allowing the data to be restored by other tape
Device-level encryption enables Dell PowerVault LTO-4 tape media to protect stored data even if the machine is lost, stolen, or misplaced in a remote location.

Exploring LTO-4 technology enhancements

The fourth generation of LTO Ultrium technology, LTO-4 is designed to deliver outstanding performance and security. With a native physical capacity of up to 800 GB, a single LTO-4 tape cartridge offers double the specified capacity of LTO-3—allowing administrators to store twice as much data in the same amount of space for about the same price point. In addition, LTO-4 provides a native data transfer rate of up to 120 MB/sec, which is 50 percent faster than the specified rate for LTO-3. To ease the upgrade path, LTO-4 enables data interchangeability so that LTO-4 tape devices can read and write LTO-3 tapes (non-encrypted) and read LTO-2 tapes. Figure 2 describes LTO Ultrium technology specifications, including current plans for developing the next two generations.

Digital video, data mining, and supply chain management are just a few of the data-intensive business activities entering mainstream storage environments. Such usage scenarios necessitate high-capacity storage and high-performance streaming backup. The significant leap in storage capacity and data transfer speeds afforded by LTO-4 tape media eases the strain on managing data-intensive storage volumes and helps lower total cost of ownership (TCO). Moreover, LTO-4 devices are designed for low power consumption and enhanced energy efficiency, which helps lower overall TCO in busy data center environments (see the “Powering down consumption, powering up savings” sidebar in this article).

Benefiting from Dell PowerVault LTO-4 tape drives and libraries

Dell PowerVault LTO-4 tape drives—as external stand-alone peripherals or integrated into Dell PowerVault TL2000, TL4000, and ML6000 tape libraries—offer storage administrators a top-flight approach for backing up and archiving critical data in their environment at mid-range price points. The PowerVault LTO-4 family supports 4 Gbps native Fibre Channel and 3 Gbps Serial Attached SCSI (SAS).

Device-level encryption enables Dell PowerVault LTO-4 tape media to protect stored data even if the machine is lost, stolen, or misplaced in a remote location. Providing this enhanced protection in hardware along with up to 800 GB of native physical storage capacity per cartridge and native data transfer rates of up to 120 MB/sec helps relieve administrative overhead and shorten backup windows compared with LTO-3 devices. These advances make PowerVault LTO-4 tape drives and libraries suitable for data-rich applications requiring high performance and superior protection.

The PowerVault LTO-4-120 tape drive is a double-density version of the PowerVault 110T LTO-3 tape device, and has approximately the same form factor as its predecessor. In addition, the PowerVault LTO-4-120 drive has a 256 MB internal data buffer that helps improve data access rates and helps reduce cartridge fill and rewinder times.

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**Figure 1. Key considerations for disk and tape technology in enterprise storage solutions**

<table>
<thead>
<tr>
<th>Fast</th>
<th>Short</th>
<th>High</th>
<th>Low</th>
<th>High</th>
<th>Online applications</th>
<th>Synchronous mirroring or replication</th>
<th>Disk-to-disk-to-tape (D2D2T)</th>
<th>Backup</th>
<th>Archiving</th>
<th>Primary disk (Direct attach storage, SAN, or NAS)</th>
<th>Tape</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slow</td>
<td>Long</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**Figure 2. LTO Ultrium capacity and performance specifications**

<table>
<thead>
<tr>
<th>WORM</th>
<th>WORM</th>
<th>WORM</th>
<th>WORM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native capacity</td>
<td>Generation 1</td>
<td>Generation 2</td>
<td>Generation 3</td>
</tr>
<tr>
<td>100 GB</td>
<td>200 GB</td>
<td>400 GB</td>
<td>800 GB</td>
</tr>
<tr>
<td>Native transfer rate</td>
<td>Up to 20 MB/sec</td>
<td>Up to 40 MB/sec</td>
<td>Up to 80 MB/sec</td>
</tr>
</tbody>
</table>

Note: Current specifications are subject to change; products based on future specifications may not become available.
PowerVault LTO-4 tape libraries enhance scalability for a broad range of secure enterprise storage options, with automation features designed to streamline operations and reduce administrative overhead. The PowerVault TL2000 offers up to 19.2 TB of native capacity; the PowerVault TL4000, up to 38.4 TB of native capacity; and the PowerVault ML6000 family of tape libraries, up to 321 TB of native capacity. Besides supporting drive-level encryption, these PowerVault LTO-4 tape devices employ built-in data protection features such as on-site backup copies to avoid data loss and write-once, read-many (WORM) capabilities designed to create unalterable records. Key features for simplified, automated tape storage operations include a user-friendly interface, bar-code inventorying, and connectivity for 4 Gbps native Fibre Channel and 3 Gbps SAS interfaces.

The PowerVault TL2000 tape library is a suitable entry point for organizations requiring cost-effective yet powerful storage, while the PowerVault TL4000 tape library is an expandable version for growing mid-range businesses. For world-class scalability, the PowerVault ML6000 modular tape library family facilitates nondisruptive on-demand expansion with modules that allow easy customization. Intelligent diagnostics and intuitive wizards help predict and isolate failures while speeding resolution times. To help optimize data throughput, tape longevity, and resource productivity, LTO-4 data transfers are facilitated by the Digital Speed Matching feature and accelerated load/unload cycle times designed to synchronize with the data rate of the server.

Encrypting data to help protect archived information assets

Data is the most important business asset for many organizations. As archived data consumes an increasing percentage of the overall storage environment, it is essential to implement secure, efficient, and cost-effective backup and retrieval systems. To comply with exacting legislative mandates and rigorous SLAs, storage organizations must protect enterprise data regardless of where it is located, even during transit. Lost or unrecoverable records are very costly for organizations—whether the loss is measured in time, expense, or public image. However, determining the most suitable approach for preserving data and validating document authenticity can be tricky. Sophisticated proprietary encryption software tends to be expensive and to add...
complexity to an already multifaceted archiving and retrieval process.

Businesses are being called upon to ensure an unbroken “chain of custody,” which involves proving that long-term fixed content—such as e-mails, scanned contracts, and point-in-time images—remains in its original state throughout the time it is stored. If this type of keep-forever data is compromised, serious consequences can include theft or exposure of personal and business records, or the loss of private information such as medical images. The ramifications of such security breaches can be far more expensive than re-creating lost data or paying regulatory penalties if negative publicity leads to a loss in customer confidence, ultimately leading to a loss in business.

Dell PowerVault LTO-4 tape drives and libraries are designed to prevent these scenarios. Introduced in the previous-generation LTO-3 technology, the WORM feature is one way to bolster security for archiving and compliance requirements. WORM technology stores data cost-effectively the first time it is written to the tape cartridge. Because no further modification of the data is allowed once it is written, records cannot be modified or altered. This added level of security and control is accomplished with an encoding formula that is mastered on the tape media at the time of manufacture to help prevent tampering.

Device-level data encryption is another enhancement introduced with PowerVault LTO-4 devices that helps further increase data security for long-term storage. This approach is designed to render information unreadable by anyone except the key manager. Device-level encryption also helps improve performance, streamline archive management, and lower TCO because integrated hardware performs the encryption at line speed in the tape drive, avoiding the need for added encryption hardware or costly and complex proprietary encryption software—and the associated drain on server resources. Because the drive encrypts information internally once received, the data is protected in transit to help ensure integrity during the enciphering and deciphering processes.

“Dell PowerVault LTO-4 tape libraries enhance scalability for a broad range of secure enterprise storage options, with automation features designed to streamline operations and reduce administrative overhead.”

The hardware encryption feature is based on the Advanced Encryption Standard (AES), which is the industry standard for computer cryptographic security. AES specifies the use of a cryptographic algorithm with a symmetric block cipher mode of operation that encrypts and decrypts information using binary fields and then authenticates the encryption process to protect electronic data. Encryption converts information into a garbled form of text, known as cipher text, rendering the encrypted data unintelligible. Once the information is ready to be deciphered, a decrypting process converts the data back into its original form, or plain text.

AES hardware is formulated for high-speed encryption with low cost and low latency by using cryptographic keys that are measured in bits, to encrypt and decrypt the data in blocks. The speed of cryptographic keys is important to the rate of data transfer. The AES algorithm can use cryptographic keys of 128, 192, and 256 bits to encrypt and decrypt information in 128-bit blocks. PowerVault LTO-4 tape devices employ a secret 256-bit key to enable encryption after the host data is received. This is the fastest key rate currently available, helping to speed the execution of data conversion without affecting the tape drive’s data transfer performance, even when using high-capacity cartridges.

Providing “vault safe” archive and retrieval systems

Dell PowerVault LTO-4-120 tape drives and PowerVault TL2000, TL4000, and ML6000 tape libraries parlay state-of-the-art encryption and industry-standard LTO-4 technology to deliver outstanding data transfer rates, double-density native storage capacity, and “vault safe” data encryption. By adhering to stringent standards and compliance verification tests, the PowerVault LTO-4 lineup helps organizations measure up to exacting legislative mandates and rigorous SLAs with lots of room for growth, to safeguard valuable enterprise data wherever it resides—even during transit.

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