



## Oracle Breathes New Life into Tape Libraries by Introducing LTO-5 into StorageTek Family

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### Management Summary

Following your favorite sports team and keeping track of your favorite athletes used to be simple. In fact, many a youngster learned basic math skills figuring out the batting average of the starting lineup of the local town team. Today, following sports and, in fact, putting together your own fantasy team could not be more complicated. The Internet is awash with all kinds of statistics for every sport. Baseball is no longer simply runs, hits, and errors. Today, you need to know how each hitter does against left-handed pitchers and right-handed pitchers, how he performs during day games as well as night games, how he hits at home versus on the road, and a lot more. You can find out all of this, and more, on a website, somewhere. Furthermore, this phenomenon is not unique to baseball; more statistics are being created everyday for every sport. As another football season is upon us, try building a fantasy football team without a PC, if you dare! The growth of data in sports is rampant.

Data growth is not unique to sports. The thirst for more competitive information is evident in the datacenter of every enterprise around the world. The volume of data has been doubling every 12-to-18 months, with no end in sight, with Tier-3 storage taking center stage as enterprises create more short- and long-term copies – in an attempt to preserve and secure their business- and mission-critical applications and to meet industry and governmental standards for data protection. Recent trends to create these copies in a disk-to-disk (D2D) environment, where RTO policies are critical, have begun to return to a D2D2T (disk-to-disk-to-tape) environment when immediate recovery is not as critical, enabling the IT staff to cope with the total cost of ownership (TCO) issues associated with their disk architecture, such as data management, floor space, and energy consumption. **Archiving is another area where more information is being preserved for future use. The ability to migrate historical information off of disks onto lower cost tape, while retaining the ability to search and retrieve libraries of vital information, is becoming essential for the long-term vitality of every enterprise.** The availability of LTO devices and media with WORM and encryption architectures, and highly scalable tape libraries, enables a return to tape for long-term data protection. The arrival of LTO-5 with dual-partitioning facilitating metadata search and retrieval takes the next giant step in enabling the use of tape in archive environments.

One company has a long history of meeting the backup and archiving needs of the enterprise datacenter, one company has endured multiple acquisitions, and for the past year, a great deal of anonymity. Although every datacenter knows about StorageTek, it seems that they are just now coming out of stealth after the acquisition of Sun by Oracle. Furthermore, they are emerging in a big way, with LTO-5 being added to their entire product line to give the datacenter unprecedented scalability. To learn more about Oracle's StorageTek, please read on.

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## Data Growth in the Enterprise Datacenter

Today's enterprise has many IT issues to address, mostly revolving around the dynamic growth of enterprise storage. The IT staff needs to manage rapidly growing backup windows and new archive requirements that demand higher data accessibility and faster retrieval. The datacenter must also deal with the inexorable increase in total cost of ownership (TCO) issues involving energy consumption and datacenter floor space, along with the administration and management of an expanding storage architecture, all while trying to manage a static IT budget in support of that infrastructure.

The IT staff requires a highly scalable, economic storage deployment in order to protect the enterprise investment in IT infrastructure. It must support the highest density, with superior performance and the lowest energy consumption possible. The datacenter also needs a solution that will enable a fast and efficient search and retrieval of that growing data store, more effectively and securely, protecting the integrity of their valuable enterprise resources.

Over the past few years, datacenter storage has experienced a period of unprecedented growth in volume, with all indicators pointing to a continuation of the same. Between mergers and acquisitions, consolidation and virtualization, industry regulations and government compliance, the enterprise is storing more data, and more kinds of data: structured, semi-structured, and unstructured, along with binary objects (such as audio and video images), and more copies of data in order to mitigate risk, than ever before. Storage requirements have typically doubled every twelve to eighteen months, with a similar forecast for the decade ahead. While acquisition costs for storage may be fairly stable, TCO factors related to storage are taking a significant bite out of the IT budget. Furthermore, these overhead costs for the IT infrastructure are rising precipitously.

Primary storage continues to reside on a heterogeneous mix of spinning media: disk devices consisting of high-performance, high-availability Tier-1 Fibre Channel (FC), and high-capacity Tier-2 SATA, as well as the highest-performing Tier-0 solid-state disks (SSDs). Backup images for data with immediate recovery requirements also will continue to reside on high capacity disks, in order to satisfy the demands for business continuity. Enterprise RPO and RTO policies, however, will dictate which backup copies can

migrate to other media. **Best practices for data retention in the datacenter dictate that the long-term storage of email and other compliance documents, along with archiving environments, will continue to find a home on tape in order to protect the enterprise and its officers from failure to preserve this information and comply with internal policies and governmental regulations.**

In fact, far from being dead, tape continues to thrive in the datacenter, with 70% of enterprise datacenters using both disk and tape to store information, with many planning to increase their use of tape. Furthermore, some datacenters that may have evolved to a D2D environment now find themselves returning to tape in order to take advantage of its high capacity, portability, low-cost WORM, and encryption technologies. These are all innovations introduced on tape - *LTO Ultrium* tape - realizing the economies available in terms of energy and other environmental factors contributing to a lower TCO, as a result of a reduction in the number of cartridges required<sup>1</sup>.

Today's tape is *fast*, in fact with throughput faster than many networks can handle. It also has *high capacity*, with *LTO-5*<sup>2</sup> checking in at an impressive 3.0TB with a 2:1 compression, and a roadmap for significantly more. Most importantly in a down economy, tape is *affordable*, with a lower cost per gigabyte than disk. Furthermore, with the innovation established in *LTO-5* for dual-partitioning and new software that enables a file-system front-end for tape, *tape can act like disk for search and retrieval*. This enables the datacenter to migrate many of their archives that contain active data to tape, creating an online, active archive that is easily searchable. The availability of *LTO-5* devices and media make tape libraries perfectly positioned to ride this new wave. When discussing innovation in tape libraries, the first name that comes to mind for enterprise libraries is Oracle StorageTek, but before we take a look at StorageTek, let's look at what *LTO-5* brings to the enterprise datacenter.

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<sup>1</sup> See the issue of *Clipper Notes* dated October 21, 2008, entitled *Disk and Tape Square Off Again – Tape Remains King of the Hill with LTO-4*, and available at <http://www.clipper.com/research/TCG2008056.pdf>.

<sup>2</sup> *LTO-5* is the new generation announced in 2010. See the issue of *The Clipper Group Navigator* dated January 31, 2010, entitled *LTO Consortium Announces Next Gen Tape - LTO-5 Raises the Bar for Tier-3 Storage*, and available at <http://www.clipper.com/research/TCG2010002.pdf>.

## Introducing LTO-5 Technology

For a technology that was reportedly dead a decade ago, there appears to be a very strong heartbeat in the open system LTO tape infrastructure. With higher throughput, higher capacity, and a major reduction in power requirements, LTO-5 is breathing new life into backup and archiving applications in the enterprise datacenter. LTO-5 Ultrium introduces media partitioning to the open systems tape architecture, which enables users to logically partition an LTO-5 cartridge into two partitions, allowing the datacenter to write metadata on the thin partition and data to the broad partition. This can provide new opportunities for faster access to data on tape, especially in the area of security surveillance and video production.

With a native capacity of 1.5TB (3TB with 2:1 compression), LTO-5 has almost twice the capacity of an LTO-4 cartridge. Furthermore, LTO has a published roadmap for compressed capacities of up to 32TB with *LTO-8*<sup>3</sup>. This will enable the datacenter to improve the density of any library solution deployed, protecting the investment for IT infrastructure as the years pass. With a native throughput of 140MB/s (280MB/s compressed) per drive, LTO-5 allows the datacenter to not only shrink backup window requirements, but it also enables faster data archive searches and retrieval. Quite clearly, however, there are times when a really fast tape drive can be a detriment, especially when the network or HBA cannot match that speed and the drive is required to stop and start repeatedly. LTO-5 combats that problem with *Digital Speed Matching (DSM)*<sup>4</sup>, which can adjust the transfer rate of the drive from less than 50 MB/s up to 140MB/s, enabling the drive to match the data transfers from slower hosts. DSM utilizes a large buffer to improve overall throughput and reliability in slower environments.

In addition, LTO-5 has advanced drive technology with a simplified tape path and servo tracking systems. It has an improved reliability via read-after-write verification, error correction codes, and advances in film coating, all designed to improve the reliability of the tape environment. LTO-5 also has superior power management to help improve heat dissipation, with a 40% reduction in idle power energy, as compared

to LTO-4. There is also reduced power consumption in idle mode, consuming only 7W. As always for Ultrium, LTO-5 has two generations of backward compatibility, read compatibility with LTO-3 and read/write compatibility with LTO-4, for easy integration of historical data.

## Oracle Tape Storage Solution

Once again, speaking of dead, whatever became of *StorageTek*, THE enterprise tape library company of the past few decades? We all remember when StorageTek was acquired by Sun to complete their storage offering, don't we? Well last year Sun was acquired by Oracle and StorageTek promptly dropped off the roadmaps of enterprise datacenters around the globe while Oracle considered what to do with their new hardware and software acquisition. We did not hear much about Oracle's new server and storage line, and even less about their legacy tape offerings, until recently! Oracle may not be speaking from Delphi, but they are now bragging from their position atop the enterprise tape market and with plenty of justification. With automated tape solutions for enterprises of all sizes, Oracle has upgraded their broad offering, investing in new LTO-5 technology to take advantage of the functionality, capacity, and throughput of LTO-5. **Oracle has taken the position to accelerate performance and lower IT costs by delivering business-ready storage systems. They are offering complete business systems that integrate business application software with storage for optimum performance, efficiency, and scale.** This is a goal that includes the #1 database, #1 file system, and #1 tape offering.

With a leading position in scalability (up to 150PB), reliability, and availability (24x7 availability), StorageTek has positioned Oracle as a leading supplier of enterprise tape systems. Far from dead, StorageTek has deployed tape libraries in all ten of the leading financial institutions and telecommunications companies, as well as eight of the top ten pharmaceutical companies. In doing so, StorageTek has provided enterprise datacenters with investment protection as newer, more efficient technologies arrive, keeping StorageTek #1 in enterprise tape storage. StorageTek provides heterogeneous support to the datacenter for everything from an open systems x86 server to the largest mainframe computers. Most significantly, Oracle is also providing integration for their tape libraries with their software stack to make their libraries feature-rich for backup and archive requirements.

<sup>3</sup> See the LTO Ultrium press release dated April 14, 2010 at [http://www.ultrium.com/pdf/LTO\\_Roadmap\\_Extension\\_041410.pdf](http://www.ultrium.com/pdf/LTO_Roadmap_Extension_041410.pdf).

<sup>4</sup> A.K.A. Data Rate Matching

### **Oracle Tape Library Family**

No matter what size tape library your enterprise requires, StorageTek has a solution to fit your needs for today, tomorrow, and for years to come. From the entry-level *SL24 Autoloader* to the Enterprise-level *SL8500 Modular Library System*, StorageTek can deliver the scalability, performance, and functionality when and where you need it. With standard interfaces and library control software, StorageTek libraries can enable resource sharing across *Solaris*, *Windows*, *UNIX*, Mainframe, or *LINUX* environments. StorageTek libraries come with the *StorageTek Library Console (SLC)* as a user interface to provide partitioning as well as advanced reporting on library, drive, and media statistics.

#### **StorageTek SL24 Tape Autoloader**

The SL24 Tape Autoloader provides the datacenter with a reliable, high-capacity backup and recovery device in an easy-to-use, 2U rack-ready configuration. It delivers high-density, entry-level automation and is qualified with a wide variety of applications and operating environments. The SL24 is offered with a choice of interfaces – FC/SCSI or SAS, and can support one full-height or two half-height LTO drives<sup>5</sup>.

The SL24 comes with 24 cartridge slots in two removable 12-slot magazines, with one mail slot dedicated to the import/export of data cartridges, for a native capacity of up to 36TB with LTO-5 technology. With a 2:1 compression factor, the SL24 can hold up to 72TB of data. Furthermore, it comes with an integrated bar code reader to facilitate media management and Internet-based management to reduce dependencies on local IT resources.

#### **StorageTek SL48 Tape Library**

With up to two full-height or up to four half-height LTO-4 or LTO-5 drives, the entry-level *SL48 Tape Library* has all of the features and capabilities that you would expect from an automated library. It can meet all of the business storage demands of any rapidly expanding enterprise, workgroup, or remote office. It is highly reliable, easy to deploy, manage, and use, and is qualified with a wide variety of applications and operating environments.

The SL48 can meet the unattended backup, archiving, and disaster recovery demands of your business. It is available in a 4U, rack-ready

configuration, or in a tabletop environment with an optional kit. It delivers high-density, entry-level automation, is offered with a choice of FC, SCSI, or SAS interfaces.

The SL48 comes with 48 cartridge slots in four removable 12-slot magazines, with three mail slots dedicated to the import/export of data cartridges, for a native capacity of up to 72TB with LTO-5 technology. With a 2:1 compression factor, the SL48 can hold up to 144TB of data, sufficient to handle demanding backup and recovery operations. The SL48 also comes with an integrated bar code reader to facilitate media management and Internet-based management to reduce dependencies on local IT resources.

#### **StorageTek SL500 Modular Library System**

Designed with the same modular architecture as the enterprise-level *SL8500*, the *SL500 Modular Library System* is a midrange library with enterprise-class features to maintain reliability no matter how many expansion modules are configured. It features redundant, hot-swappable components and scales to over 850 TB with capacity-on-demand to enable a pay-as-you grow architecture, far more than other rack-mounted tape libraries. It is ideal for any rapidly growing enterprise looking to consolidate, requiring scalability, reliability, and simplicity in deployment and operation with *simplicity*.

The SL500 Modular Library System scales from 30 to 575 LTO slots with a maximum capacity of 863TB of uncompressed data with LTO-5 media. In addition, the SL500 supports up to 18 LTO-5 tape drives with a native throughput of over nine terabytes per hour. The SL500 enables the datacenter to consolidate multiple libraries and applications into a single central location to reduce the TCO of the IT infrastructure. The SL500 incorporates reliability technology from the SL8500 to ensure high availability. This includes the robotics, firmware, and redundant and hot-swappable components to help increase the stability and predictability of backups and to minimize disruptions, with two million exchange/swaps between failures. All major parts, including the robotics, can be replaced in less than 30 minutes, minimizing downtime.

#### **StorageTek SL3000 Modular Library System**

Today's business environment is constantly changing. Larger enterprises need the scalability and flexibility to change with it, or risk the penalties that failure to keep up brings. Oracle's *Stor-*

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<sup>5</sup> The SL24 is also available with two half-height LTO-4 drives with a SCSI or SAS interface (for datacenter flexibility).

ageTek SL3000 Modular Library System enables your enterprise to ride that wave, staying ahead of the curve with a solution that is easy to manage while reducing the TCO due to environmental issues. The SL3000 provides an innovative, energy-efficient solution to mid-range storage, providing the datacenter with more choice and better control in a rapidly evolving climate.

The SL3000 is a mid-range library with all of the scalability, connectivity, and choice that the datacenter needs to deploy a flexible solution for a growth enterprise. With capacity-on-demand, the datacenter can grow at its own pace, paying only for the capacity it needs, when it needs it. With slot scalability from 200 cartridges to over 3000, and with drive scalability from 1 to 56, the datacenter can access 450 TB of uncompressed data in the base module using LTO-5 technology, or 4.5PB in an expanded configuration with 3,000 slots<sup>6</sup>. In terms of throughput, using LTO-5 drives, the SL3000 can transfer up to 28.2 TB per hour with all 56 LTO-5 drives in operation. In terms of flexibility, the SL3000 also enables the datacenter to deploy StorageTek T9840D for fast access, or StorageTek T10000B drives for high performance, as well, providing a tiered storage environment within the tape library to optimize the price/performance of the SL3000, while protecting the investment in StorageTek legacy infrastructure. In addition, with Any Cartridge, Any Slot technology to meet application demands, the IT staff can mix and match between LTO-4, LTO-5, T10000, and T9840 drives and cartridges with a Fibre Channel interface plus the T10000 and T9840 also support FICON.

With an innovative Centerline architecture, the SL3000 minimizes contention. Robots need only travel one-third to one-half the distance needed by competitive solutions, improving cartridge-to drive performance by as much as 50%. Furthermore, according to StorageTek, the SL3000 requires a smaller footprint and consumes less energy than other libraries. The IT staff can partition the SL3000 into as many as eight partitions, assigning them for mainframe or open systems use, addressing resources at the cartridge slot, drive slot, and cartridge access port level. In addition, SL3000 technology minimizes datacenter risk with non-disruptive replacement of robotics, power supplies, and drives, along with dedicated TCP/IP and/or FC library control paths

via optional dual control path technology, in support of 24x7 availability. Many of the SL3000 components are the same as those in the SL8500, the industry standard for reliability, availability, and serviceability. (More details follow.)

The SL3000 also comes with the SLC, enabling the IT staff to monitor and manage the library locally or remotely, via a network-based operator panel. The SLC can display status and reports for the library, locate cartridges, perform an audit, and run diagnostics and load microcode.

### StorageTek SL8500 Modular Library System

Taking the SL3000 one step further – **one giant step further** – is the *StorageTek SL8500 Modular Library System*, by far the most scalable and most dense tape library available for the enterprise with a rapidly growing data infrastructure, but not a rapidly growing IT budget. The SL8500 can support up to 150PB of uncompressed data when used in conjunction with LTO-5 technology. With support for the same StorageTek drives (Any Cartridge, Any Slot) and operating environments as the SL3000, the SL8500 provides the enterprise with the flexibility and investment protection needed to respond to a rapidly changing business climate, with scalability from 1,000 to 100,000 slots in one library complex. Yes, I said 100,000! An entry-level<sup>7</sup> configuration for the SL8500 starts at 1000 or 1,448 customer-usable cartridge slots, up to 64 tape drives, in any mix, and a single 39- slot cartridge access port. With all LTO-5 drives deployed, this minimum configuration has a maximum throughput of 32.3TB/hour, scalable to 322.6TB/hour in the maximum configuration.

In an environment that can support 100,000 cartridges, and up to 640 drives, there is no tolerance for downtime, either unscheduled or scheduled. The largest enterprises require the highest reliability and the highest availability. Everything from robotics to power supplies is hot-swappable, and many of the components, including the robotics, have optional redundancy. The SL8500 even has an integrated service safety door to enable the replacement of a failed robot without requiring an outage. In fact, with a *RealTime Growth* capability, the SL8500 can add additional slots, drives, and robotics via pass-through while continuing to operate. In support of a consolidated environment with multiple, simultaneous mount requests, Oracle deploys

<sup>6</sup> The SL3000 can scale to 5,925 slots.

<sup>7</sup> *Entry-level* is somewhat of a misnomer, as it still is very large.

four (or eight) *HandBot* high-performance robotics in each SL8500 system to provide a multi-threaded solution. As with the SL3000, the SL8500 is configured with an SLC to simplify the management of the library environment, enabling the IT staff to monitor library status either locally or remotely.

### Oracle StorageTek Tape Drives

In addition to the industry-standard family of LTO tape drives, the StorageTek SL3000 and SL8500 also support the StorageTek enterprise drives<sup>8</sup>, the *T9840D* and the *T10000B*, enabling the datacenter to protect their investment in StorageTek infrastructure and allow the IT staff to create a tiered infrastructure within the library.

The T10000B is an enterprise-level tape drive that enables the datacenter to achieve the highest levels of capacity, reliability, performance, and data security in support of 24x7 datacenter operations. With a file access time of only 46 seconds<sup>9</sup>, not including tape loading and threading, the T10000B can provide support for the most demanding datacenter applications. In transaction-intensive IT environments, where faster access may be required, the T9840D, with a file access time of only 8 seconds, not including tape loading and threading, can provide the high-performance required.

Over the past decade, StorageTek has played leapfrog with the highest capacity commodity media. When announced in 2008, its 1TB native capacity was the highest available, only recently exceeded by the 1.5TB capacity of LTO-5. While StorageTek has not made any announcements with regard to the T10000B roadmap, it is only natural to assume that a drive with capacity greater than 1.5TB is on the horizon.

### Oracle Storage Management

It should come as no surprise to learn that Oracle has a complete storage software offering to manage enterprise data growth across multiple platforms and multiple tiers. Oracle has a superior, robust, policy-driven hierarchical storage management (HSM) solution with their *Sun Storage Archive Manager (SAM)*. SAM automates the placement of the right data to the right media in order to optimize storage hardware investments and reduce the TCO of the data-

center storage infrastructure, saving the enterprise both time and money. SAM can increase administrator productivity with policy-based storage administration, enabling storage administrators to address higher value projects.

SAM effects the automated, transparent migration of data across multiple storage tiers, including SSD, high-end disks, SATA drives, and multiple tape drive architectures, in order to reduce overall storage hardware costs without adding any overhead. This enables the datacenter to meet data growth needs within the current budget while still adhering to existing SLAs. Business- and mission-critical applications remain unaware of the physical location of the data while SAM protects the enterprise's existing storage investments.

### Conclusion

Oracle's StorageTek tape libraries have been designed to support enterprise requirements for high-performance backup and intelligent archiving in mainframe and open systems environments. No matter what size your enterprise, no matter how much data that you need to preserve and protect, Oracle has a StorageTek solution to fit your functional requirements and your budget.

With cross-platform solution to meet auto-loader requirements with as few as 24 cartridge slots, to, by far, the highest scalability in the industry with 100,000 slots in support of 150PB of capacity in one storage pool, Oracle sits atop the heap in terms of scalability, reliability, and availability. They have a complete family of enterprise-level storage products, including tape hardware and storage management tools.

With storage costs for SSDs estimated at \$40-50 per GB, \$7-\$20 per GB for high performance disk, and \$1-\$6 per GB for high capacity disk, is it any wonder why tape storage at \$0.25-\$1.00 per GB is making such a strong resurgence. If your enterprise is troubled with meeting capacity requirements and performance goals, perhaps it is time to take another look at the StorageTek tape offerings from Oracle.



<sup>8</sup> These are called *legacy* because they originally were for mainframe environments, not because they are outdated.

<sup>9</sup> Average file access time for Oracle's LTO-5 drive is 52 seconds.

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