EXECUTIVE SUMMARY

Tape solutions continue to be the preferred long-term storage choice for organizations seeking to control their data infrastructure costs in the face of explosive growth in data and digital content and increasingly demanding compliance requirements. Furthermore, tape provides reliable long-term storage with low capital and operating expenses and places minimal demands on power, cooling, and floor space. Tape is also a secure and reliable storage medium. With tape storage, critical data can be protected with multiple nearline copies for quick recovery and kept secure with encryption. In addition, tape boasts an extremely low uncorrectable bit error rate.

New enhancements further improve the manageability and reliability of tape solutions and lower the total cost of ownership (TCO). For example, Oracle has introduced software for its tape libraries that provides a proactive and predictive approach to tape storage management. Its enterprise-class StorageTek Tape Analytics software allows storage administrators to be proactive in avoiding or anticipating failures and allows executives to make informed decisions about future tape expenditures. Oracle continues to make investments in its tape automation solutions to bring new innovations to its customers. In addition, Oracle is focused on providing greater value and ease of use for its tape automation solutions with particular emphasis on:

❖ **Enterprise-Class Scale and Performance:** To bring enterprise-class performance and reliability to its midrange StorageTek SL3000 modular library system, Oracle has adapted the feature sets and enterprise technology of its StorageTek SL8500 modular library system, providing customers with non-disruptive, on-the-fly replacements of robotics, redundant library electronics, power supplies, and drives. Additionally, the StorageTek SL3000 also supports enterprise-class tape drives, such as Oracle's StorageTek T10000C, which combines native capacity of up to 5.5TB in a single cartridge with native throughput of 252MBps. The StorageTek T10000C also incorporates a number of accelerator features to boost performance and utilizes data integrity validation to ensure reliable access to data.

❖ **Lowering TCO:** The combination of the StorageTek SL3000 library coupled with the StorageTek T10000C tape drive provides a strong case for competitive cost of ownership. The drive's ultra-high throughput means that the StorageTek SL3000 modular library system can meet application throughput requirements with fewer drives. Also, the drive's maximum capacity of 5.5TB allows the library to store more data on fewer cartridges. Requiring fewer drives and tapes not only saves on acquisition costs but also reduces the library's footprint and the related
datacenter costs and simplifies media management. Archive management features save further on media purchases. In addition, backup and restore windows are considerably shorter with the drive's high throughput, avoiding the added cost of disk-to-disk backup.

IN THIS IDC WHITE PAPER

To quantify the cost benefits of the StorageTek SL3000 modular library system and StorageTek T10000C drive, IDC determined the annual costs per TB for three key acquisition and operating expenses using data supplied by Oracle. IDC then made similar calculations for other tape solutions using the average cost elements from its research projects involving over 20 organizations using tape technology.

Compared with the other tape solutions, the StorageTek SL3000 modular library system and T10000C tape drive offered greater savings in all three areas studied. The savings amounted to 19.1% in IT labor for backup, 21.8% for storage media and controllers, and 35.1% for space and power costs.

GROWTH OF TAPE DEPLOYMENTS

Tape solutions continue to find increased enterprise use because they readily handle the unprecedented growth in data and content that must be stored, organized, and archived for long periods of time to comply with exacting regulatory and business governance requirements.

In particular, enterprises value tape solutions as a critical archiving resource and an important backup and recovery solution. They also appreciate tape’s minimal demands on power, cooling, and floor space, which substantially reduce the operating costs of their storage infrastructure. As a storage medium, tape features a low $/GB cost.

In addition, tape provides enhanced security and superior reliability. Online data is susceptible to corruption and accidental erasure as well as malicious attacks. An offline copy on tape avoids such hazards. The cartridge can be stored remotely to prevent contamination, and copies can be made inexpensively and stored at different locations. Each copy is capable of restoring data without loss. With tape storage, critical data can be kept secure with encryption.

Tape — because of its low cost, true removability, and energy savings, as well as its multipurpose role in backup and long-term archiving — is also the favored storage medium for digital content, which is more than doubling every two years.

Significant innovations and enhancements to tape by industry groups have made the technology even more effective as an archive medium and a backup and recovery solution. The LTO consortium continues to develop open standards for tape storage based on the latest technology. The open LTFS format enables files stored on tape to be accessed as easily as files stored on disk. With LTFS, a file system is placed on the front end of the tape drive or library so that data can be accessed independent of application or file format. This allows users to access data stored on tape quickly and
more effectively — say for long-term retention or deep archiving — just as they would access data stored on a disk array, but at considerably less cost.

Additionally, LTFS allows the StorageTek T10000C and LTO-5 tape drives to connect directly to an operating system so that users can drag and drop files directly onto tape, just as if it were a disk, eliminating the need for third-party application software. By simplifying the sharing of larger files, LTFS provides greater data mobility in addition to enabling faster access to archived files.

IMPROVED MANAGEABILITY AND RELIABILITY

More recent advances have focused on improving the manageability and reliability of tape solutions and further lowering the total cost of ownership. Oracle StorageTek, for example, has introduced software for its tape libraries that provides a proactive and predictive approach to tape storage management.

The enterprise-class StorageTek Tape Analytics software captures more than 100 library, drive, and media health metrics in its dedicated server database on each exchange. It then runs analytical calculations on the data so that tape storage administrators can make decisions proactively to avoid or anticipate failures. Such a proactive approach not only improves the performance and reliability of the system but also helps executives make informed decisions about future tape expenditures.

The StorageTek SL3000 modular library system further simplifies tape storage management with a flexible partitioning and sharing solution that enables administrators to create up to eight partitions, assign them for mainframe and/or open systems use, and address resources down to the slot in any configuration, including non-contiguous resource assignments. Any Cartridge Any Slot technology allows any mix of supported drives and media spread throughout the library so that the drive best suited for access and storage needs can be utilized.

Using Oracle’s StorageTek Library Console software, IT staff can monitor and manage the library via a network-based operator panel or an optional local touchscreen panel. Thus the software provides convenient and consistent control for managing capacity, configuring library partitions, displaying library alerts, and running reports and diagnostics using either method.

By adapting the enterprise-class performance and reliability features of the StorageTek SL8500 modular library system, Oracle can now cost-effectively address the needs of midrange organizations with the StorageTek SL3000 system. Now a midmarket customer, with a StorageTek SL3000 library, can enjoy the same enterprise-class features, such as non-disruptive, on-the-fly replacements of robotics, library electronics, power supplies, and drives. Also, key features such as dedicated TCP/IP and/or Fibre Channel library control paths with optional dual control path technology further increase the overall availability of the fully redundant library. This allows StorageTek SL3000 customers to sustain 24 x 7 operations without interruption.
The StorageTek SL3000 system's use of redundant electronics allows for automatic failover to a standby set of control cards, transparent to host applications, if an active card should fail. Using redundant robotics with access expansion modules (AEMs) provides two benefits: the ability to insert and eject large numbers of cartridges and the capability for engineers to service a downed robot through the AEM while the system remains up and running processing active mount requests.

Customers therefore have a high availability tape solution designed for today's 7 x 24 x forever environments, with the redundant robotics, library electronics, power supplies, and control path connectivity. In addition, the library system's unique centerline architecture boosts efficiency by alleviating robotic contention. Robots travel one-third to one-half the distance required by competitive libraries, improving cartridge-to-drive performance by up to 50%.

Among its important features, the StorageTek SL3000 supports the StorageTek T10000C tape drive. The drive combines native capacity of up to 5.5TB in a single cartridge with native throughput of 252MBps. Now, a customer using the SL3000 library with T10000C drives will enjoy vastly improved storage density by having fewer drives, cartridges, and/or libraries required compared with industry-standard LTO tape drives. Thus customers will be able to consolidate and simplify management of their tape operations with higher capacity and performance tape drives and automation.

For maximum reliability, the StorageTek T10000C features two recording heads. Each head is independently servo-controlled to write and read-verify 32 tracks of data quickly and reliably. The two-head architecture offers robust read-verify performance, and simultaneous recording of 32 channels minimizes media wear. With 32 channels, the tape can move more slowly through the tape path while ensuring high throughput, and fewer passes of tape across the recording heads are needed to fill the cartridge. The StorageTek T10000C also minimizes media wear with a tape path that guides only the non-data side of the tape.

In addition to being designed to handle the most demanding datacenter environments, the StorageTek T10000C tape drive protects enterprise data from end to end with Oracle's StorageTek Data Integrity Validation feature. A major benefit of this feature comes from the tape drive's ability to immediately detect and report corrupted data to the host before it is ever written to tape. Other tape drives require the data to be written to tape, and the user must recall all of the data from the tape cartridge and perform server-based checksums to discover any corrupted data. StorageTek Data Integrity Validation also enables users to quickly and securely audit the integrity of their digital archive by performing CRC checking within the tape drive, eliminating the need to transfer massive amounts of data out of an automated tape library to servers. Other features enhance the tape drive's performance, optimizing datacenter efficiency. Starts and stops may be unavoidable in an enterprise datacenter but can be minimized with the StorageTek T10000C, which uses a 2GB buffer and a whole host of StorageTek Accelerator features to maximize streaming and the overall efficiency of the tape storage system.
MINIMIZING TCO

To contain long-term storage costs, enterprises need solutions with a low initial purchase cost and cost-effective expansion capabilities to meet future capacity and performance requirements. In addition, ongoing costs, such as those associated with datacenter floor space, energy consumption, media purchases, and tape migration, have significant impact on a tape library's TCO. The StorageTek SL3000 modular library system and StorageTek T10000C tape drive are designed with these factors in mind to minimize TCO.

With its support for mixed and multiple operating environments, the StorageTek SL3000 simplifies consolidation within mainframe or open system environments, or both, to save on space and power. Non-disruptive scalability and greater choice of design options also make growth more affordable.

The modular library system scales from 200 to just under 6,000 cartridge slots and from one tape drive to 56 tape drives in a footprint that grows linearly in a rack-like environment. Physical capacity can be installed in advance and tapped into incrementally, allowing organizations to grow at their own pace and pay for only the capacity needed.

As for the StorageTek T10000C tape drive, its high capacity and throughput substantially reduce acquisition costs and provide significant savings in power and cooling. The drive's 252MBps throughput means that the StorageTek SL3000 modular library system can meet application throughput requirements with fewer drives. Also, the drive's maximum capacity of 5.5TB allows the library to store more data on fewer cartridges. In addition, backup and restore windows are considerably shorter with the drive's high throughput, avoiding the added cost of disk-to-disk backup.

Requiring fewer drives and tapes not only saves on acquisition costs but also reduces the library's footprint and the related datacenter costs.

QUANTIFYING THE COST ADVANTAGE

To quantify the cost benefits of the StorageTek SL3000 modular library system and T10000C tape drive, IDC determined the annual costs per TB for key acquisition and operating expenses using data supplied by Oracle StorageTek. IDC then compared those costs with average costs from multiple tape solutions using the average cost elements from research projects involving over 20 organizations using tape technology.

For the StorageTek tape solution, the average annual cost per TB for IT labor involved with backup was $85.55. This represents a saving of 19.1% compared with the average annual cost per TB of $105.79 for other tape solutions. At $61.22, the annual cost per TB for storage media and controllers for the StorageTek solution was 21.8% lower than the average for other tape solutions. Likewise, the annual space and power costs per TB of $22.76 for the StorageTek solution was 35.1% lower than the average annual costs per TB of $35.10 for other tape solutions (see Table 1).
### TABLE 1

<table>
<thead>
<tr>
<th></th>
<th>StorageTek ($)</th>
<th>Other ($)</th>
<th>% Savings</th>
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</thead>
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<tr>
<td>IT labor for backup</td>
<td>85.55</td>
<td>105.79</td>
<td>19.1</td>
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<tr>
<td>Storage media and</td>
<td>61.22</td>
<td>78.24</td>
<td>21.8</td>
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<tr>
<td>controllers</td>
<td></td>
<td></td>
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<tr>
<td>Facilities — space and</td>
<td>22.76</td>
<td>35.10</td>
<td>35.1</td>
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<tr>
<td>power</td>
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<tr>
<td>Total</td>
<td>169.53</td>
<td>219.13</td>
<td>22.6</td>
</tr>
</tbody>
</table>

Source: IDC, 2013

### CHALLENGES

We expect other tape automation vendors will bring to market scalable, cost-effective tape systems that will vastly improve the economics of tape-based data protection and archiving in the coming years. That said, designing tape automation products takes a tremendous amount of commitment and innovation, and very few remaining competitors possess the knowledge, wherewithal, and financial health to bring new tape systems to market. However, it is not out of the question that Oracle could face stiffer competition in the market.

### CONCLUSION

Oracle continues to add new and innovative features to its tape automation and drive solutions by improving density, performance, and manageability. IDC's Business Value analysis has demonstrated the TCO benefits of the StorageTek SL3000 modular library system using the T10000C tape drive. We expect that customers looking to manage their unabated data growth in a very cost-effective manner will embrace Oracle's StorageTek SL3000 library. We believe the market potential for scalable tape automation products remains strong for the foreseeable future. Look for the T10000D tape drive, released on September 12, 2013, to reportedly increase capacity to 8.5TB (uncompressed), which is an improvement of 55% over the T10000C.

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