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## The ROI of Tape Consolidation

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## Executive Summary

As IT organizations attempt to do more with flat budgets, many have turned to virtualization—which can be applied to servers, storage and other components throughout the datacenter. Virtualization allows organizations to consolidate workloads onto fewer physical devices, better utilizing resources. This consolidation reduces costs by allowing organizations to purchase less hardware and fewer maintenance contracts, use less space in the datacenter, reduce energy costs, and cut the time administrators spend maintaining hardware and thereby improve their work/life balance.

Enterprise data is growing rapidly. By using tape consolidation with partitioning, deduplication and replication as well as upgrading their tape backup technology, organizations can extend the benefits of consolidation to their tape backup libraries. This white paper shows how upgrading to LTO-5 (Linear Tape Open, version 5) technology and consolidating storage onto fewer tapes enables organizations to achieve a five-year return on investment (ROI) and a 17-month payback period as well as the following savings:

- Reduce data center floor space by 90% using fewer tape backup units to store the same amount of data
- Lower power consumption by 63% and cooling costs by 64% through the use of less hardware and data center space
- Cut administrative time by more than 70% by reducing the amount of hardware to be administered and more efficient management technology
- Substantially slash media costs

## Increasing Data; Decreasing Budgets

The amount of data companies store is growing exponentially. According to IDC, worldwide disk storage systems capacity is expected to more than double every two years, growing at a compound annual rate of nearly 53% from 2007 to 2012<sup>1</sup>. Within any given company, however, data growth is unpredictable. This makes it difficult to develop the perfect capacity plan. As a result, organizations have traditionally over provisioned capacity to ensure that they have adequate disk storage resources when they need them.

At the same time, IT budgets have been virtually flat. According to Gartner, IT spending in 2010 was 1.1% greater than 2009, but this followed a reduction in IT budgets of 8.1% for 2009<sup>2</sup>. This means IT must do more with the same budget by operating more efficiently. Greater efficiency is even more important if IT staff members are to maintain a modicum of work/life balance in the face of increasing demands.

## Virtualization and Consolidation Improves Efficiency and Reduces Costs

Many IT organizations are turning to virtualization and consolidation throughout their datacenter in their efforts to make the most of their budgets. Two key initiatives have involved server and storage virtualization.

Server virtualization allows multiple virtual machines (VMs), which may each run different operating systems and applications, to operate on a single physical machine, sharing server resources. Storage virtualization adds an abstraction layer of software that hides physical storage devices from the user and allows all storage devices to be managed as a single pool. Virtualization technology can dynamically allocate server hardware or storage resources when and where they're needed so that the highest priority applications always have the resources they need without the need to provision excess capacity for use only at peak times.

Because virtualization enables IT to consolidate workloads onto fewer physical devices, it reduces hardware acquisition and maintenance costs, improves hardware utilization, and cuts energy consumption. By identifying over provisioned servers or storage devices and better taking advantage of unused resources, IT can defer investment in new resources. And by reducing the number of servers and storage devices that must be administered, virtualization allows IT organizations to devote more time to other projects and priorities.

## The Role of Tape Consolidation

Tape consolidation extends the benefits of server and storage consolidation even farther into the datacenter by enabling IT to migrate multiple tape backup systems to a single tape library. When tape consolidation is used

with partitioning capabilities, IT can define virtual tape libraries that share a single physical device. Each virtual tape library can be assigned to a specific application so that the application thinks it has its own library residing on the shared physical library.

Each logical library can be assigned to a different application or the same application, giving IT flexibility in setting up their environment. For example, one partition can be configured so that data can be transferred from primary disk straight to tape; another can be setup to transfer data from a production server to a secondary server to tape (disk to disk to tape); another can be set up tiered storage. It can even use one partition with tape-based encryption and other partitions without encryption.

As with server and storage virtualization and consolidation, tape consolidation with partitioning allows IT to use tape backup resources more efficiently and cost effectively.

When consolidating their tape backup solutions, many organizations also refresh their technology at the same time, for example, by replacing LTO-3 or LTO-4 tape technology with newly introduced LTO-5 technology. LTO-5 increases capacity by 2X over LTO-4 and 4X over LTO-3, which allows customers to reduce their library footprint, saving the costs of floor space and application licensing. Reduction in the amount of media required can add substantial additional cost savings. At the same time, migrating from LTO-4 to LTO-5 improves throughput by 17% and moving from LTO-3 to LTO-5 increases throughput by 75%. This improved throughput allows customers to consolidate their tape drives without sacrificing performance. The addition of replication allows companies to move data between sites to eliminate tape at smaller branch offices and consolidate tape in the data center.

### Growing Interest in Consolidation

The many benefits of consolidation within the data center are leading numerous enterprises to adopt this strategy. According to a recent report by the Enterprise Strategy Group<sup>3</sup>, one in three companies is aggressively consolidating data centers. In fact, the report found that data center consolidation is the third most important overall IT initiative over the next 12-18 months for enterprise class firms.

Cost cutting is a key driver for data center consolidation. Nearly half (49%) of organizations that expect their 2010 IT spending to be reduced significantly from 2009 levels are reducing or consolidating data center facilities compared to only 24% of those that would consider themselves to be in IT growth mode.

Additionally, while nearly one third (30%) of organizations surveyed are in the process of constructing new facilities, a strong correlation exists between organizations consolidating data centers and those building new ones. Nearly half (45%) of organizations that are consolidating data centers are looking to decommission older, inefficient data centers and consolidate workloads in larger new facilities capable of supporting equivalent computing power in a more efficient manner.

### Five Tape Consolidation Use Cases

Today, larger enterprises typically use tape storage for backup, archiving and low-cost Tier 2 storage for rarely accessed user tapes. Tape is also widely used for data protection and disaster recovery. When tape storage is consolidated and used with partitioning, it can provide value for a number of use cases that include the following:

- Service providers can serve multiple clients with the same tape backup system while keeping data for each client separate
- Multiple business units of a large enterprise can store their data on a consolidated tape backup system to reduce costs while keeping their data separate
- When enterprises undergo a merger or consolidation, they can use these systems to centrally manage storage while keeping the data for each company or subsidiary separate
- IT might want to use separate backup software applications because certain features, acquisitions or licensing structures fit one business line better than another, yet still consolidate storage on the same backup hardware
- IT might want to use different backup applications for email versus finance systems (or any number of other applications) yet share a single tape library for storing all of the data.

## How Tape Consolidation Delivers Cost Savings

While tape consolidation can serve many applications, its key benefit is its ability to meet IT's need to store rapidly growing quantities of data in a highly efficient manner to improve IT productivity and reduce costs.

Walking through a specific example will help demonstrate how tape consolidation delivers these cost and productivity advantages.

In this example, we will replace three StorageTek L700 tape libraries, each with 216 cartridge slots and 12 LTO-3 drives (in service 24x7 with a 2-hour service window) with one Quantum Scalar i6000 with 200 cartridge slots with nine LTO-5 drives (in service 24x7 with a 2-hour service window). Note that we performed a drive technology refresh at the same time we completed the consolidation.

By consolidating and upgrading tape libraries in this manner, IT can save on service maintenance to deliver a rapid ROI. In addition, IT can also save floor space, power and cooling, administrative time, and media costs.

### ROI

The primary costs we looked at when comparing the ROI of consolidating tape libraries and upgrading to a new LTO-5 system versus maintaining an existing LTO-3 system was the cost of purchasing the new tape library and drives plus service maintenance costs for both the L700 and i6000 systems.

Annual service maintenance agreements for tape backup systems typically run 20-25% of the cost of the hardware. Since customers often keep their tape libraries for four to five years—some even keep them for up to 10 years—maintenance usually exceeds the purchase price of the drives over their lifetime.

Because LTO-5 cartridges have 4X the capacity of LTO-3, users can consolidate data onto fewer cartridges and, therefore, smaller libraries—while the higher throughput of the LTO-5 drives (LTO-5 delivers 280MB/s throughput which is 120MB/s faster than LTO-3) means backup windows will not increase. As a result, firms can use 2/3 fewer drives, reducing service maintenance costs. Actual service maintenance cost savings will depend on the costs of the vendor's maintenance plan.

Figure 1 looks at the ROI of purchasing the new Scalar i6000 with LTO-5 drives plus service maintenance compared with the ongoing service maintenance costs of the three L700s with LTO-3 drives. In this example, the ROI for purchasing the newer technology is five years with a payback period of 17 months.

| Library (drives)    | Year 1     | Year 2   | Year 3    | Year 4    | Year 5    | 5 Year Totals | Avg Pymt |
|---------------------|------------|----------|-----------|-----------|-----------|---------------|----------|
| L700E30, LTO-3      | \$90,778   | \$90,778 | \$90,778  | \$90,778  | \$90,778  | \$453,888     | \$90,778 |
| Scalar i6000, LTO-5 | \$127,496  | \$17,371 | \$17,371  | \$17,371  | \$17,371  | \$196,981     | \$39,396 |
| HW Savings          | \$(36,719) | \$73,406 | \$73,406  | \$73,406  | \$73,406  | \$256,907     | NA       |
| Cumulative Savings  | \$(36,719) | \$36,688 | \$110,094 | \$183,501 | \$256,907 | \$256,907     | NA       |

Figure 1: ROI of upgrading and consolidating tape drive technology

### Floor Space

Figure 2 shows the floor space taken up by each example tape library and drive. Each L700 takes up 52.1 square feet of floor space. Three of these units require a total of 156.3 square feet of floor space.

In contrast, one Scalar i6000 with LTO-5 provides roughly the same amount of storage as the three L700/LTO-3 units but takes up just 14.5 square feet. Thus, floor space is reduced by 90%, which translates into a tremendous savings in data center facilities costs. With data center construction costs running as high as \$2,000 to \$3,000 per square foot, this can amount to data center construction savings of as much as \$425,400<sup>4</sup>.

This physical consolidation comes from the technology refresh, since each LTO-5 tape cartridge holds 4X the data as an LTO-3 cartridge, more efficient resource utilization from the consolidation of libraries and improved space efficiency in the design of the new system.

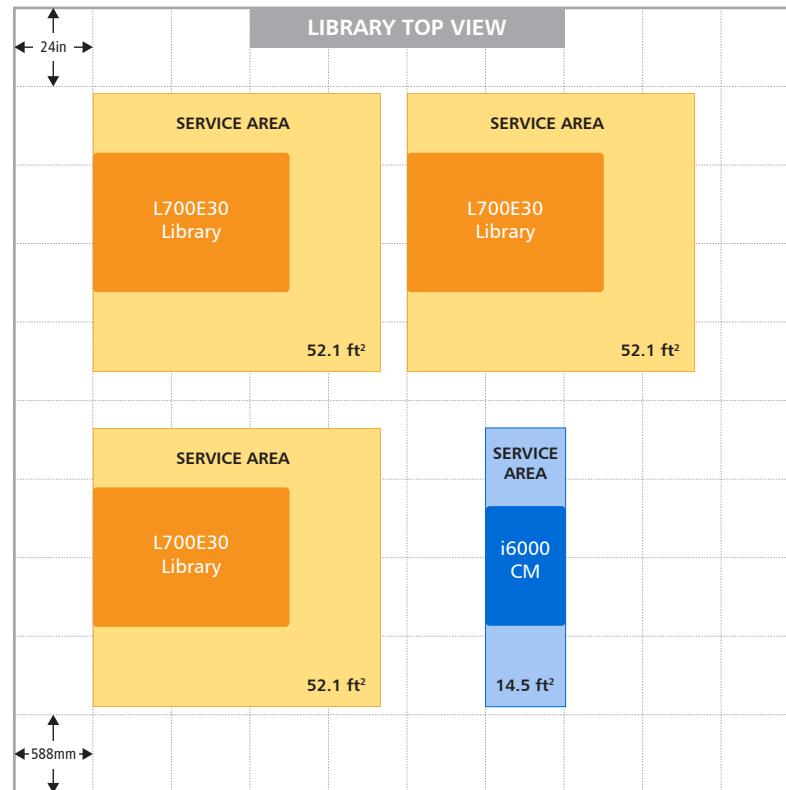


Figure 2: Three L700s take up a total of 156.3 square feet of space in the data center while the one Scalar i6000 takes up 14.5 square feet for a savings in floor space of 90%.

## Power and Cooling

According to IDC's Green Datacenter study<sup>5</sup>, power and cooling capacity are data centers' number one concern. Forty three percent of managers said that power and cooling impact the business through "increased operational costs."

One can calculate the energy costs of a tape backup unit using the following equation:

Energy Use Cost = Number of years the unit is in use × (hrs/year in use) × (energy cost/kWhr) × (Average library power consumption in KW) × PUE (1) where PUE is Power Usage Effectiveness or the Data Center Electrical load over the IT electrical load.

As the equation reveals, a number of variables impact actual energy consumption:

- The amount of time an enterprise uses the tape library. Unlike servers and disk drives that use energy even when they are not in use, tape doesn't use power when the unit is not in use. While some enterprises will use their tape backup units 24×7×365, others might use their drive only four or five hours a day during the workweek.
- Energy efficiency of the data center. In a well run data center, the PUE is usually about 2.0, which means that for every Watt of power the tape unit uses, an additional Watt is consumed by the chillers, uninterruptable power supplies, air handlers, pumps, etc. In inefficient data centers, for example, where cooling design is poor (PUE 3.0 for example), the cost of energy would be 50% higher.
- Cost of energy in a particular location. Different locales have different energy costs. For example, energy costs are twice as high in Japan as they are in the United States.
- Differences in library technology. Different libraries use different amounts of energy due to their design.

Next to the IT systems themselves, the cooling system consumes the most energy in the data center—accounting for 37% to 60% of data center electricity use depending on the efficiency of the cooling system. When fewer tape backup libraries are running due to consolidation, less heat is output, which reduces cooling costs. Additionally, when space needs are reduced, companies can cool a smaller area. By cutting down the number of tape libraries and the amount of data center space that must be cooled, companies can reduce cooling costs by 12%-72%.

Regardless of tape drive usage and the costs of power, moving from the three L700s with LTO-3 to the Scalar i6000 with LTO-5 saves considerable energy usage and costs due to consolidation and to the newer technology's greater energy efficiency. The three L700s consume 1,980 (max continuous) and generate 7,242 BTUs compared with 730 watts consumed by the i6000 and 2,626 BTUs generated for a 63% reduction in power consumption and a 64% reducing in cooling costs.

### Administrative Time Savings

Tape administrators perform a wide range of tasks. These include monitoring, managing and verifying backups, moving tapes offsite, rotating tapes, maintaining equipment (e.g., cleaning tape drives), periodically testing backup and restore procedures, and labeling and sending tapes to an offsite storage center. Additional duties include tape unit configuration, troubleshooting, service management reporting and tracking.

By reducing the number of tape libraries by two thirds, companies reduce by two thirds the amount of time it takes to administer those libraries as well as salary costs. Companies can achieve additional efficiencies by selecting a tape drive that offers modern management/administration software. Administrative time savings due to the use of modern tape management software savings average 50% and can run as high as 75%.

### Media Cost Savings

A company that migrates from LTO-3 drives to LTO-5 can save on media costs. Here's how. The LTO-5 has four times the capacity of the LTO-3. This means users would need to use 75% fewer LTO-5 cartridges than LTO-3 cartridges.

Consumption of tape cartridges varies greatly depending on cartridge rotation and data retention policies. However, as an example, assume that 100 LTO-3 cartridges (roughly half the total number of cartridges in our example) were being purchased each month for each L700 library, for a total of 300 LTO-3 cartridges. By purchasing the i6000 with its LTO-5 cartridges, the number of cartridges purchased each month is reduced by 75 (a 75% reduction) to 75 cartridges. Assuming that an LTO-3 cartridge costs \$23.45 and each LTO-5 cartridge costs \$86.20, this reduction represents an annual savings of roughly \$6,000. Those savings will only increase as LTO-5 media prices continue to decrease. For example, when LTO-5 cartridge prices reach \$60 per cartridge, the annual savings will increase to more than \$30,000.

Long-term media storage and transport costs represent additional savings. Cartridges are typically sent to DR centers or to other off-site facilities such as Iron Mountain for long-term retention. By reducing the number of cartridges, companies save not only the monthly storage costs but also the costs of sending cartridges to and retrieving them from these centers. Because LTO-5 uses 75% fewer cartridges than LTO-3, moving from an LTO-3 to an LTO-5 will reduce these costs by 75%.

### Conclusion

As companies continue to face exponential, yet unpredictable data growth and flat budgets, tape consolidation and the use of modern tape library technology can help them meet their data storage needs in a highly cost effective manner. Using tape consolidation and modern LTO-5 technology, companies can meet unpredictable storage requirements while reducing data center usage and cost, service maintenance costs, power and cooling costs, and media costs. At the same time, they can also decrease the time administrators spend managing their tape backup units, allowing them to improve their work/life balance.

## WHAT TO LOOK FOR IN A TAPE LIBRARY?

What should companies look for when choosing a tape library for use in consolidating tape backup systems? Strong management software, high reliability and availability, and media data integrity analysis to prevent data loss are key capabilities:

### Management Software

Management software directly impacts the efficiency of the IT department and their ability to manage increasing workloads. Annual operational costs (power, cooling, and management) of distributed systems and networking exceed their acquisition cost by 2-3X and continue to climb<sup>6</sup>. Tape libraries originated as simple mechanical systems to hold tape drives, and load and unload media. Most tape backup hardware systems provide few monitoring or analytical capabilities. This means that highly technical administrators are required to diagnose and resolve problems, and troubleshooting is often time consuming, expensive and uncertain. In addition, the backup system is generally managed outside the managed storage environment. Organizations need integrated tape management tools that proactively report more and better information to help them spend less hands-on time supporting their tape backup systems.

### Capabilities to Look for Include:

- **Proactive monitoring, alerts and diagnostics.** By proactively monitoring events in all key library components and logging data from them, alerting IT of abnormal events and providing diagnostics, management software can reduce service calls, increase library reliability, and shorten issue resolution time.
- **Partitioning and mixed media operation.** Partitioning, which makes a single physical library look like multiple, logical libraries to outside applications, enables consolidation of multiple backup libraries into a single library. Support for mixed technologies enables administrators to combine different drive and media generations or different connectivity options in a single library so users can leverage legacy systems while taking advantage of newer technologies and backup consolidation strategies.
- **Support for storage resource management (SRM) tools.** To simplify overall data center management, the management software should provide interfaces that allow the library to be managed centrally with users' disks. With such interfaces, central management tools can remotely discover libraries, see their configurations and view detailed information about them, reducing the time needed to maintain the SAN environment by using a single interface to manage all the elements in the backup SNA hosts, SAN fabric and library.
- **Trend analysis and reporting.** A system that tracks the read, write and mount activity associated with each drive and cartridge and uses them for both real-time performance metrics and trend reporting gives administrators the data they need to identify and resolve media problems, improve resource utilization, reduce operating expenses and increase backup reliability.
- **Integrated data security.** Data encryption protects data from access by unauthorized users. Management software should help IT manage the encryption keys necessary to unlock the data at the appropriate time.

### High Reliability and Availability

The solution should provide failover for key components so that if the primary drive fails or if connectivity issues arise, the customer can easily switch to a backup. The system should provide automated failover for the library by configuring a primary and secondary control path for every partition in the library with failover capabilities; for ports by configuring a primary and secondary port with automatic failover to work around Fibre Channel connectivity issues on the SAN, and LUN mapping to make it fast and easy for administrators to control which hosts have access to which drives on the SAN. Also, configuring data path failover for tape drives can be useful to prevent network errors from interrupting operations.

## Data Integrity Checking to Prevent Data Loss

Data is being retained for longer periods of time to meet regulatory and compliance needs. Tape is also increasingly being used for archiving. Both of these market dynamics drive the need to ensure the integrity of data in long-term storage/archive. You need a system that can check for integrity issues not only in tapes being used in production, but also for the integrity of all data on archived tapes so you can be sure you will be able to restore from archived tapes.

- 1 <http://storage.networksasia.net/content/technologies-and-trends-sustained-data-growth>
- 2 "Gartner: IT Spending Persists as CIOs Upgrade Infrastructure," CIO Magazine, By Veronica Silva, September 17, 2010
- 3 Research Report: Data Center Consolidation and Construction Trends," by Enterprise Strategy Group, June 2010
- 4 <http://cleantech.com/news/5063/putting-heat-data-center-cooling-co>
- 5 [http://uk.logicalis.com/pdf/IDC\\_White\\_paper\\_energy.pdf](http://uk.logicalis.com/pdf/IDC_White_paper_energy.pdf)
- 6 "Advantages of a Dynamic Infrastructure: A Closer Look at Private Cloud TCO" IBM, April 2009

### About Quantum

Quantum Corp. (NYSE:QTM) is the leading global storage company specializing in backup, recovery and archive. Combining focused expertise, customer-driven innovation, and platform independence, Quantum provides a comprehensive range of disk, tape, media and software solutions supported by a world-class sales and service organization. This includes the DXi®-Series, the first disk backup solutions to extend the power of data deduplication and replication across the distributed enterprise. As a long-standing and trusted partner, the company works closely with a broad network of resellers, OEMs and other suppliers to meet customers' evolving data protection needs.

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