Obtaining Maximum Return on Your Tape Investment: Accelerating Performance and Expanding Tape's Role for Lower TCO

August 2007

PREPARED FOR

The LTO Program

Introduction and Executive Summary

In today's business environment, internal and external customers alike now expect around-the-clock information services, making IT infrastructure downtime an increasingly costly proposition. Insufficient data search and recovery capabilities can impede operational efficiency and potentially jeopardize compliance audits and reporting. Hence, as tape continues to represent an essential component in today's enterprise storage infrastructures, performance now plays an even more important role in business continuity management.

With the release of the LTO Ultrium format generation 4 specification, which provides substantial increases in performance and capacity over previous generations, users now have the ability to achieve much larger storage capacities and much faster transfer rates. These latest, and fourth-generation, LTO drives are capable of storing up to 1.6 TB of data on a single cartridge with compressed data transfer rates of up to 240 MB per second. Increases in performance, seen in every generation of the LTO Ultrium format, allow the drives to accept data streams faster – in many cases, as fast as the network infrastructure can handle.

To benefit the vast number of linear-tape users, as well as encourage companies to fully take advantage of the strong performance characteristics, Ideas International (IDEAS) offers this white paper, which includes a customer case study highlighting the considerable returns one company achieved with minimal additional investment in its infrastructure to maximize performance.

REMOVABLE MEDIA

The Historical Value Proposition

» **Optimized for Long-Term Repository –** The concept of removable media has existed since the beginning of our civilization, fueled by the need to preserve some information for a long period of time. The media may not be available instantaneously, but it does hold information that can be subsequently retrieved.

» **Optimized for Affordable Storage –** The first removable media options in history were stones and sheets. Carving information on stones is more durable, but writing information on sheets affords greater mobility and storage capacity. For many centuries, paper was the preferred removable media.

The Modern, Computer-Age Choices

» **Nonvolatile Memory –** Although nonvolatile memory (NVM) has existed for decades, it has just become popular and somewhat affordable with the recently fashionable memory sticks.

» **Optical Disc –** Optical discs such as CD and DVD have been steadily developed with worldwide standards and collaborations. However, the commercial use of optical discs has been very limited due to the costliness of rewritable disc formats (while the affordable write-once discs are favored by consumers).

» **Magnetic Tape –** Magnetic tape was originally invented for storing visual data in film (movie) making and playing. Taking advantage of its outstanding affordability, portability, and data protection characteristics, magnetic tape was advanced and extended for storing computing data.

Tape and Tape Performance Are Essential to Effective Business Continuity Management

Information technology (IT) has become an imperative in the business processes of seemingly every sized company, causing an enduring impact on an organization's overall success, or even its survival, in today's hyper-competitive marketplace. Organizations must spend their IT dollars on the best-of-breed solutions currently available in order to best satisfy business demands for data storage and availability.

The Significance of Tape in the Cost-Effectiveness of Business Continuity Management

Despite recent technological advancements and price/capacity improvements in disk-based storage technologies, tape remains the most cost-effective storage media currently available for data protection and long-term archiving. Although the high-capacity disks today deliver compelling price/GB, they still cannot match the economics of removable media (see the "Removable Media" sidebar, left), especially when associated costs – such as disk enclosure costs, ongoing environmental costs, and maintenance and support service costs – are taken into consideration.

The cost savings from deploying tape over disks for long-term archiving are enormous. According to IDEAS pricing coverage [1] of major storage solution providers, the media (capacity) cost delta to tape plus other major cost factors – such as disk array controllers, network equipment, software, and services – may increase the total cost of a disk-based solution by multiple times, depending on the "class" of the disk array platform (enterprise-class products typically have a more costly pricing structure than midrange products as capacity increases.) Similarly, removable tape cartridges can provide substantial power and cooling cost savings over disk drives – savings that would be magnified in datacenter environments. Many customers have indicated that datacenters with "fever spots," or concentrated-heat areas, would incur considerably more cost for adequate cooling of online storage devices such as disk arrays.

For example, some vendor studies have shown that when companies compare the acquisition costs between tape and disk backup systems, disk-based systems cost over five times more than tape systems. When factoring in space and energy costs, LTO solution advantages increase, costing over ten times less than SATA disk systems.

---

[1] IDEAS-estimated list prices and typical discounts, as currently available within the IDEAS Competitive Profiles Storage (CPStorage) real-time product and pricing database.

IDEAS: What led your company to address the backup issue?

Mr. McNulty: Despite all the performance and budgetary issues, the most critical factor in our business case for undertaking this project that attracted company executives' attention was the lack of confidence in meeting auditors' goals for report and data backup/restore testing. If we failed once, the weakness would be included in our annual reporting and stock prices would potentially suffer, according to our own senior analysts.

IDEAS: Your total backup volume was not unusually heavy yet there were issues that demanded attention. What were the key attention getters?

Mr. McNulty: The stovepiped deployments in the past as new applications were requested resulted in a very complicated daily tape management process – not to mention the upgrade cycles and software maintenance. We needed to be able to manage our growth. When you're doing it right, it seems like no big deal.

IDEAS: How come you didn't buy into the SAN-based disk replication solutions for faster backup and restore?

Mr. McNulty: We are not one of those big guys with deep pockets. We simply cannot afford the disk-based copy and replication software licenses, or the disks even, though disks are cheaper than they used to be. As long as we can do a good job with LTO tapes, why should we waste our budget on those [SAN-based disk replication solutions]? The LTO system gives us reliable backups, speed, scalability and the means to handle our compliance needs at an affordable cost.

IDEAS: Why standardize on LTO?

Mr. McNulty: I wanted to protect my investment, so I went with the leader.

Rules and regulations on environmental elements are rapidly evolving and maturing in the U.S. IT market, and have resulted in a growing number of official (with respect to both government regulations and industry-standards mechanisms) implementation guidelines. Environmental costs and concerns – both reactive and proactive – are becoming top priorities for IT planners. Removable storage, such as tape, is remarkably environmentally friendly compared to disk-based solutions. The introduction of LTO Ultrium generation 4 and its impressive performance, capacity, encryption, and WORM functionality provides a proven, top-tier solution that addresses the "green" concerns of today's companies, while delivering a highly cost-effective approach for data protection.

Best Practices in Action – A Customer Success Case Study

Many users indicated that using tape properly resulted in fundamental improvements – not only in their IT operational efficiency and compliance, but also in their business operations and financial results. The following customer case study is featured here in particular, due to the level of success the company achieved with minimal additional investment. Mr. Matt McNulty managed the project for his company (see the "Customer Commentary" sidebar, left).

Customer Background. Mr. McNulty's firm is a global biopharmaceutical company striving to stay competitive with industry leaders that have much larger IT budgets. Due to company growth (the addition of multiple shifts during the day) and regulatory requirements (to maintain data and reporting for set periods of time), the firm's tape backup data volume had grown from 25 GB to nearly 4 TB within six years. Backup tasks were becoming increasingly challenging and drawing more and more attention from management.

The Before Picture. Based on the following indicators, IT management felt the need to address the backup challenge before it caused serious problems to the firm's core business:

» Regulatory requirements for data protection, both retention and routine testing, were becoming too costly to satisfy.

» Backup data growth was pushing the length of backup windows beyond the practical limits of application downtimes.

» Increasing application requirements to reduce overall system downtime were constrained by key backup procedures.

» Backup-related workload was about to require additional IT staffing.

The Fixes. IT management approached the issue with one dominating principle – to create scaling headroom to cost-effectively accommodate further growth.

First, McNulty standardized on the LTO format to enhance the reliability of the process and reduce the amount of physical media that needed to be managed. This change also allowed him to simplify training of IT personnel at the company.

His next step was to deploy a high performance storage management solution that automated many of his backup tasks. For this solution, McNulty chose a disk-to-tape software that is part of a leading family of disk and tape products, and is known for its ability to simplify the use of complex backup and recovery procedures. Bringing fast installation, wizard-based automation of routine tasks, and easy-to-use features, the software's centralized management allowed easy implementation of multisite changes, the ability to adapt in real time to changing business requirements, and a way to easily scale from small server environments to the largest distributed enterprise infrastructures.

McNulty used the software to automate installation of agents on all connected clients, consolidating multiple backup servers into one single management server. Using this approach, he gained an easy-to-manage solution at a much lower cost than competitive solutions, saving between 30% and 70% in licensing costs. McNulty also gained centralized multisite management capabilities, using simple wizards to easily configure software features and define role-based user rights.

Next, McNulty focused on infrastructure speed. To take advantage of LTO performance, he decided to use a Fibre Channel SAN fabric as much as possible for the backup infrastructure. With this strategy, the goal was to maximize the streaming of backup data through the company's network to fully realize the high transfer speed capabilities associated with the LTO format.

After the software and infrastructure components were complete, McNulty was able to make highly automated backups quickly and easily. Scheduling the backup and starting the operation from a single backup server, each agent was responsible for sending data from each server through the SAN fabric, consolidating backup I/O with direct, concurrent streams from each host directly into an automated LTO tape library.

Backup speeds increased dramatically, with full backups of multiterabyte data stores taking about four hours – or about one-tenth of the time needed previously. As many readers may note, the road map for LTO technology provides for higher performance speeds in successive generations; a move to LTO 4, for example, would allow users to gain additional performance and take further advantage of the infrastructure enhancements used in McNulty's implementation. A similar scenario using LTO 4 could shorten the backup window to two hours or less.

DATA SECURITY

IDEAS sat down recently with the LTO Program to further explore data encryption, included in the LTO 4 specification.

Why is encryption being offered on the LTO Ultrium generation 4 tape drive specification?

Protection of customer information is a significant business issue. Losing a consumer's information can be very expensive from an actual cost recovery and public relations perspective. Encrypting data helps protect customer's information from many types of compromise. The LTO Ultrium generation 4 tape drive encryption can help address this need.

What method of encryption will be used in LTO 4 tape drives?

LTO generation 4 uses the AES encryption algorithm, with 256-bit symmetric data keys. LTO 4 supports the T10 SSC-3 standards-based security protocol commands.

Will encryption adversely affect drive performance?

No, it should not. The impact of hardware encryption on LTO tape drive performance is expected to be typically less than 1%.

For additional FAQs,
visit **www.ultrium.com.**

Following deployment, McNulty then established company-wide best practice policies and procedures to address compliance requirements for Sarbanes-Oxley and the FDA.

The After Picture. The results were very impressive.

» Tape backup I/O targets (direct-attached and networked tape devices) were reduced from 15 separately managed devices to a single network backup server.

» The amount of tape media being managed was reduced from about 70 cartridges of various formats to 8 LTO cartridges, or as McNulty says, "going from 15 safety deposit boxes to three."

» Data and application daily backup coverage increased from about 60% to a true 100%.

» Backup operations now take four hours daily for full backups of nearly 4 TBs, compared to the eleven-hour daily incremental backup performed previously – freeing seven hours of headroom in application downtime and eliminating the more extensive full 42-hour backup on weekends.

» Data backup/restore procedures are easy to test.

» The data protection solution and backup/restore procedures passed the annual Sarbanes-Oxley audit with a level of smoothness never experienced and expected.

The Critical Role of Tape Performance in the Operational-Effectiveness of Business Continuity Management

Unlike environmental factors, the performance of data protection and recovery mechanisms has always been a critical IT focus and has been considered mandatory in business continuity management. With the increasing popularity of service-oriented IT management, where violations of service-level agreements (SLAs) carry considerable consequences, higher performance affords an additional level of protection – the ability to complete tasks more quickly translates into improved risk avoidance.

Furthermore, data search/recovery capability and speed are crucial for any business. When under investigation, the legal and public relations consequences of failing to produce information in a timely manner can cost more than the typical company can afford. In addition, the increasing length of backup windows has become a major concern among organizations with large, ever-growing volumes of data that must be backed up frequently. Greater tape performance can effectively reduce backup windows and improve the quality of service (QoS) management of the overall IT infrastructure.

OTHER MAJOR DECISION FACTORS IN TAPE DEPLOYMENTS

Key Deployment Considerations Beyond Performance

LTO tape technology brings exceptional customer value in all criteria:

» **Capacity –** An LTO 4 cartridge holds 800 GB of uncompressed data, the highest tape capacity available.

» **Reliability –** Datacenter-class reliability represents a major design point of LTO technology, achieved through multilevel protections to help ensure data integrity during I/O operations.

» **Backward Compatibility –** LTO drives have been able to read cartridges from two previous generations and write cartridges from the previous generation, helping to ease implementation and protect investments.

» **Multivendor Interoperability –** Deploying open-standard technologies can enable users to choose products from a variety of vendors while maintaining compatibility between vendor products.

» **Long-Term Viability –** When making a long-term technology commitment, organizations must consider the future competitiveness of the solution. With the vast majority of server and software vendors supporting LTO technology, LTO has become the most viable linear-tape format for the foreseeable future.

» **Tapes Expanded Role – Data Security:** LTO 4 hardware data encryption makes data security a viable option for organizations. LTO 4 encryption can help eliminate the burden on servers using software encryption and can help avoid the need for an encryption appliance.

Strategic Considerations in Tape Deployment

Choosing the right tape format for a data protection solution represents a long-term commitment to the tape technology selected, and the long-term viability and competitiveness of a tape technology stands out as a major decision driver in customers' tape product purchases. Certainly, performance should not be the only criterion customers consider when selecting a tape solution. Other key factors may be critically important for particular customers, especially with the generally high-quality tape products available today. In addition to its high performance attributes, LTO technology offers exceptional value in many other aspects.

IT professionals should be consciously aware that the LTO format advantages available to mass IT consumers today did not happen by coincidence. Rather, LTO technology defines a new era in the evolution of linear-tapes; the existence of LTO technology represents a planned and ongoing industry effort with proven-success. In 1998, facing a fragmented tape market with proprietary standards, Hewlett-Packard, IBM, and Quantum [2] – the Linear Tape-Open Technology Provider Companies (TPCs) – jointly developed an open-format solution, aimed at enabling customers to choose from multiple sources of compatible tape offerings, through the establishment of the LTO Program. To date, over 30 organizations have licensed the technology through the LTO Program, [3] creating an impressive ecosystem.

With the LTO generation 4 specifications, the LTO Program has continued to deliver on the LTO Ultrium road map with advanced data protection functionality including:

» **High capacity –** 800 GB per cartridge (uncompressed)

» **Fast data rate –** Up to 120 MB/second (uncompressed)

» **Support for tape hardware data encryption –** Uses AES 256-bit symmetric data key

» **Compliance with support for unalterable tape storage –** Uses Write Once, Read Many (WORM) technology. LTO tape cartridges can be configured with or without WORM enabled.

Additional factors brought about by tape that provide business advantage include:

» **Low archiving costs –** Tape's low TCO and low energy consumption make it the optimum storage solution for long-term data retention

---

[2] Quantum acquired Certance in 2005, which was previously owned by original TPC co-founder Seagate.

[3] For an up-to-date list of LTO licensees, visit **http://www.ultrium.com.**

Americas
Ideas International, Inc.
800 Westchester Avenue
Suite S620
Rye Brook, NY 10573-1330
USA
Tel + 1 914 937 4302
Fax +1 914 937 2485

Asia/Pacific and Worldwide Headquarters
Ideas International Limited
Level 3
20 George Street
Hornsby, NSW, 2077
Australia
Tel +61 2 9472 7777
Fax +61 2 9472 7788

Europe, Middle East, Africa
Ideas International Europe
The Courtyard
Lombard Street
Abingdon, Oxon OX14 5BJ
United Kingdom
Tel + 44 (0) 1235 462 890
Fax + 44 (0) 1235 462 891

www.ideasinternational.com

» **Portability –** Tape allows users to have affordable copies of critical data "out of region" in the event of a local disaster

The LTO Program has transformed the mature linear-tape technology into a new class of product that provides industry-leading functionality enabled by collaborative innovation. By offering an open format and a highly capable and reliable solution, LTO technology can help users and vendors mitigate the risks associated with long-term tape technology decisions.

Market trends have shown a rapid industry adoption of the LTO format, as well as a clear customer preference for LTO technology over proprietary formats. LTO shipments have been growing exponentially since the availability of LTO-1 in 2001, and achieved the 1-, 5-, 20-, 50-million cartridge shipment milestones in 2002, 2003, 2005, and 2006 respectively.

Today, many companies are already reaping rewards from their adoption of LTO technology. In light of these benefits, not deploying the LTO format could prove a serious disadvantage. Selecting the right tape technology is crucial for customers in obtaining optimal, long-term returns on investments in data protection and business continuity.

The IDEAS Bottom Line

No one can be absolutely sure about how technology will evolve in the future. When long-term technology commitments must be made – by both customers making multiyear IT investments and vendors planning multigenerational offerings – this uncertainty creates challenges as well as fears. On the other hand, organizations are voting with their limited budgets. The most effective technology implementation is also the one most likely to attract the customer attention and vendor investment needed to accelerate future development.

While past user successes have indicated that notable performance potential and business benefits may be achieved through proper implementation tactics, customers should also take the arrival of LTO generation 4 technologies into their current planning considerations, in order to best exploit the performance, capacity, encryption, and compliance attributes of the LTO format.