



LTO and LTFS - Delivering Archive Advantages with Qualstar Tape Libraries

Executive Summary: Users everywhere are struggling with relentless data growth. LTO tape based archive systems hold the key for many users to gain the upper hand in the battle to contain storage costs. This white paper describes how a Qualstar library solution incorporating LTO and the Linear Tape File System (LTFS) delivers a very cost-effective storage solution for the data center.

With new initiatives in big data, cloud, virtualization, video, social media, and entertainment, there will be no slowdown in the amount of data generated, stored, and managed by IT organizations. Storage purchases are expected to grow at a CAGR of 53% between 2011 and 2016¹. New desktop, workstation, and server solutions incorporating HDD and SSD devices with higher capacities add to an organization's total storage footprint, and users are eager and ready to fill these systems with ever more data. All of this translates into massive increases in data that needs to be stored, accessed, and protected.

Preserving this digital content is important no matter what industry you are in, so finding new ways to manage the process heads the agenda in many data centers. Data protection activities like backup, snapshot, and replication have been around for decades, but have taken on new urgency with exploding data growth. For many organizations, archive is thought of as only for "compliance", or "what we used to do in the old days" for general purpose protection. That is no longer the case, as today's archiving solutions play a key role in effective data management systems that use various tools to optimize storage capacity, performance and security.

It is increasingly difficult and very costly to store all data on disk. Tape is the most cost-effective means of storage and data transportation, while contributing to substantially lower energy, acquisition and administration costs. Archiving data is the key to maintaining control of the overwhelming quantities of new unstructured data that IT groups are confronted with. Tape based archives can substantially increase the performance of data protection processes by removing from their production systems the vast amounts of little used data that most IT organizations still need to manage. Tape is also the best method for storing important data that must be preserved for compliance and security reasons.

Why Tape is The Best Media for Long Term Storage of Data

Your organization may be one of the many who have decided that it is easier to just "preserve it all". That approach is becoming cost-prohibitive. In a recent study on backup and disaster recovery conducted by the Enterprise Strategy Group, a disk-based virtual tape library system with a 15:1 deduplication ratio was compared to a tape library using LTO-5 tape technology. Measured costs included hardware acquisition, maintenance, floor space, software, administration and energy consumption for both power and cooling. A variety of disaster

¹ April 2013 IDC studies on [Storage for Big data: Insight Into Usage Patterns](#) and [Influencers in Deployment of Storage for Big Data](#)



recovery methods and scenarios were analyzed in the comparison. The final conclusion: even with dedupe the VTL system was two to three times more costly than the tape library.

Table 5. Comparative Technology Cost Summary for Year 1

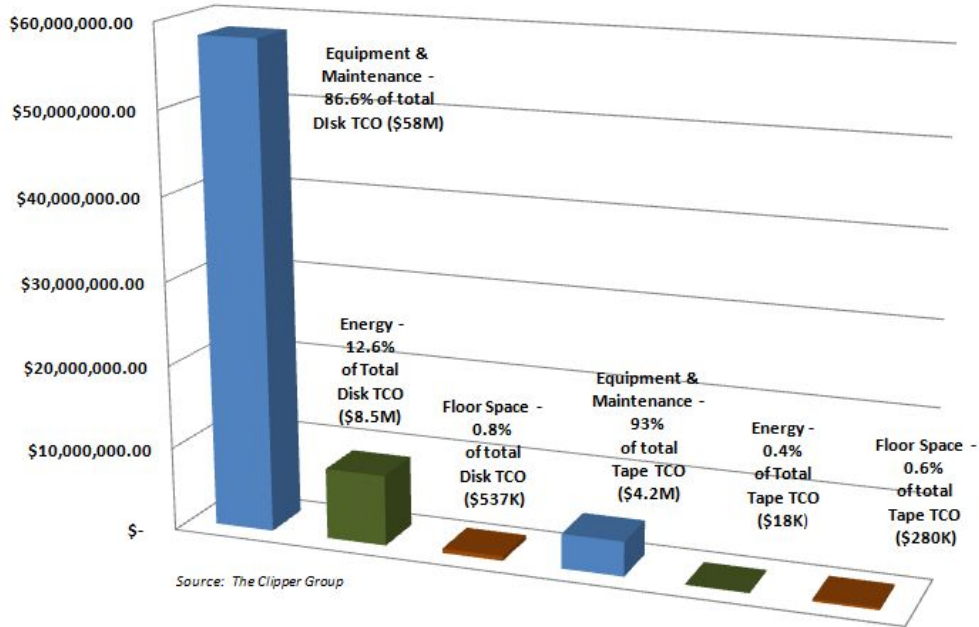
Component	LTO-5		VTL/Deduplication		LTO-5 Truck		VTL-VTL WAN	
	Annual Cost	Percent	Annual Cost	Percent	Annual Cost	Percent	Annual Cost	Percent
Hardware								
1. Product Acquisition	\$ 46,913	78.0%	\$274,217	84.0%	\$ 46,913	78.0%	\$552,432	84.1%
2. Annual Maintenance	\$ 11,098	18.4%	\$ 49,359	15.1%	\$ 11,098	18.4%	\$ 98,718	15.0%
3. Environment								
a. Floor Space	\$ 591	1.0%	\$ 554	0.2%	\$ 591	1.0%	\$ 1,108	0.2%
b. Power & Cooling	\$ 1,556	2.6%	\$ 2,156	0.7%	\$ 1,556	2.6%	\$ 4,313	0.7%
Total	\$ 60,157	31.0%	\$326,287	68.2%	\$ 60,157	30.3%	\$656,571	81.2%
Software								
1. Product Acquisition	\$ 130,924	100.0%	\$146,325	100.0%	\$130,924	100.0%	\$146,325	100.0%
2. Annual Maintenance	\$ -	0.0%	\$ -	0.0%	\$ -	0.0%	\$ -	0.0%
Total	\$ 130,924	67.4%	\$146,325	30.6%	\$130,924	65.9%	\$146,325	18.1%
Personnel								
1. Operations	\$ 3,125	100.0%	\$ -	0.0%	\$ 3,125	100.0%	\$ -	0.0%
2. Storage Management	\$ -	0.0%	\$ 6,094	100.0%	\$ -	0.0%	\$ 6,094	100.0%
2. Network Management								
	\$ -	0.0%	\$ -	0.0%	\$ -	0.0%	\$ -	0.0%
Total	\$ 3,125	1.6%	\$ 6,094	1.3%	\$ 3,125	1.6%	\$ 6,094	0.8%
One-Time-Charges								
1. Off Site Storage Fee	\$ -	0.0%	\$ -	0.0%	\$ -	0.0%	\$ -	0.0%
2. Storage Media Purchase								
	\$ -	0.0%	\$ -	0.0%	\$ -	0.0%	\$ -	0.0%
2. Other Fees	\$ -	0.0%	\$ -	0.0%	\$ 4,600	100.0%	\$ -	0.0%
Total	\$ -	0.0%	\$ -	0.0%	\$ 4,600	2.3%	\$ -	0.0%
Grand Total	\$ 194,206		\$478,705		\$198,806		\$808,990	100.0%

Source: Enterprise Strategy Group

Another study on the TCO of archive systems by The Clipper Group analyzed 12 years of hardware, maintenance, floor space, and energy costs for disk-based versus tape library-based petabyte scale systems. This exhaustive study concluded that the total cost of ownership for a disk archive storage solution was 15 times greater than using a tape library with LTO technology. The cost of energy alone to power and cool the disk-based system was more than the entire TCO for the tape library solution.



12-Year Disk TCO (\$67M) vs 12-Year Tape TCO (\$4.5M) by Category



Both of these studies underscored that tape is the media of choice for long term archiving. In today's environments, LTO is the preferred tape technology for automated tape libraries - the combination that delivers the undisputed lowest TCO for long term archival storage.

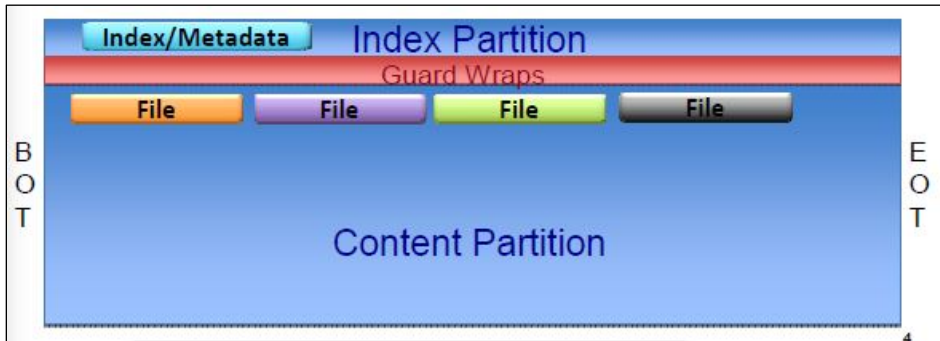
LTFS - Delivering Even More Archive Advantages

Based on an open software specification that incorporates new ways of accessing data on tape, Linear Tape File System (LTFS) directly addresses data archive requirements. LTFS presents a tape cartridge as an extension of a Windows, MAC, or Linux file system, and is compatible across each of these environments.

Now, knowing the content of an archived tape is easy using a single storage media standard. An LTO tape cartridge with LTFS appears as a drive letter, icon, or folder, just like a hard disk, CD/DVD disk, or USB stick. Files on tape can be accessed directly from any application. The contents of the tape can be simply viewed in the operating system directory tree. The tape is now a random accessible device. Using LTFS, users can easily "drag and drop", exchange, archive, and share files on tape, just as they would on any other media. Common operations like file open, write, read, append, delete, and close can also be used. No proprietary backup or archive software is needed to view the content. Users now have all the advantages of immediate data access via tape, a much less expensive and "green" storage format.



LTFs is implemented on LTO-5 and LTO-6 drives and tapes by utilizing media partitioning to create a self describing file system. The tape is logically divided "lengthwise" into two partitions. The "Index Partition" at the beginning of the tape holds the file system index, tape index, and metadata. The "Content Partition", contains the files and content bodies. When the tape is loaded, the index data is copied to the workstation or server memory for fast access and updates. The index data is also periodically backed up to the content partition².



Source:
Ultrium LTO

Taking LTFs one step further, some archiving application providers aggregate the index data from individual cartridges into a single unified data set view, like a NAS or RAID. This capability is ideal for use with tape libraries, which can deliver disk-like access at much lower cost. Note that the index information on each tape is maintained and kept up-to-date, enabling any tape to be moved to another site and read or written without the need for any proprietary software.

Advantages of Qualstar Libraries with LTO Tape

Qualstar has a 15-year track record of designing reliable, easy-to-use tape libraries. Qualstar libraries incorporating LTO technology deliver cost-effective and efficient storage for archive and data protection requirements. LTO is the worldwide tape format standard, offering an unrivaled combination of data reliability, performance and high capacity.

Qualstar RLS and XLS libraries support LTO-5 and LTO-6, housing up to 159 tape drives, up to 11,780 cartridges, and delivering native capacities from 75 terabytes to more than 29 petabytes. Each LTO 5 cartridge holds 1.5 TB native (3 TB



² Note that the tape is still a sequential device, requiring the library to move it to the correct position. It takes an average of 40-60 seconds to reach the beginning of the file. After the file is located, the transfer rate is the LTO rate of 140MB/s (LTO 5) or 160MB/s (LTO 6).



with compression), while LTO 6 offers 2.5 TB per cartridge (6.25 TB/cartridge with advanced compression). Both generations provide a 30-year data life.

Qualstar Tape Library Models					
Model	No. of Drives	LTO 5 Native Capacity	LTO 5 Compressed Capacity	LTO 6 Native Capacity	LTO 6 Compressed Capacity
XLS Enterprise Tape Libraries	up to 159	236 TB - 17 PB	Over 35 PB	400 TB - 28 PB	Over 71 PB
RLS-8350 Expandable Rack Mount Tape Library	up to 8	75 to 255 TB	Over 510 TB	125 to 425 TB	Over 1 PB
RLS-8500 Expandable Rack Mount Tape Libraries	up to 20	81- 711 TB	Over 1.4 PB	135 TB - 1 PB	Over 2.9 PB

LTO-5 and LTO-6 drives are fast, up to 160MB/s native (400MB/s with 2.5:1 compression), enabling over 1.4 TB of data transfer per hour, per drive.

LTO-5 and LTO-6 cartridges are also available in a Write Once, Read Many (WORM) format. This provides unalterable data storage while retaining the ability to append data to the cartridge.

Hardware encryption is standard in Qualstar XLS and RLS tape libraries. The process is straightforward and has virtually no impact on drive performance. An AES 256-bit encryption data key is provided to the tape drive by the library. Data is written to the cartridge in encrypted form to protect sensitive information. Encryption software and appliances are not needed.

Qualstar Libraries Meet the Needs of Media and Entertainment

In media and entertainment applications, Qualstar LTO tape solutions are ideal for saving digital original camera negatives (OCNs) and raw digital capture files. LTFS provides a common dependable exchange medium for post production files archived to tape. Qualstar solutions using LTO/LTFS tape are also a high capacity performance option allowing the movement of very large files between users and processes. Transferring master footage, editorial, and other important files to LTO tape maintains project integrity, ensures critical data will be available well into the future, and fulfills an ongoing need for lower cost offline storage, portability and interchange.



Conclusion

Long term archive will continue to grow as a strategic initiative as organizations generate, process, and store ever increasing amounts of data. LTFS in conjunction with LTO-5 and LTO-6 tape technology has enhanced tape's ease of use for data access in an archive solution. Qualstar tape libraries with LTO/LTFS play a vital role in corporate data protection strategies, and offer the most reliable, portable, cost-effective advantages to protect and preserve data created by applications as diverse as media and entertainment, digital surveillance, medical imaging, legal, architecture, big data, and the cloud.

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About Qualstar Corporation

Qualstar, founded in 1984, is a diversified electronics manufacturer specializing in data storage and power supplies. The company's products are known throughout the world for high quality and *Simply Reliable* designs that provide years of trouble-free service. More information is available at www.qualstar.com or www.n2power.com, or by phone at 805-583-7744.