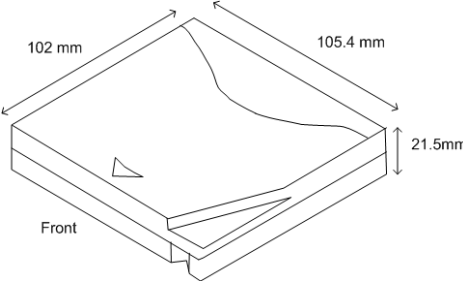


Why Tape Is Back (Although it Never Left)



LTO tape cartridge



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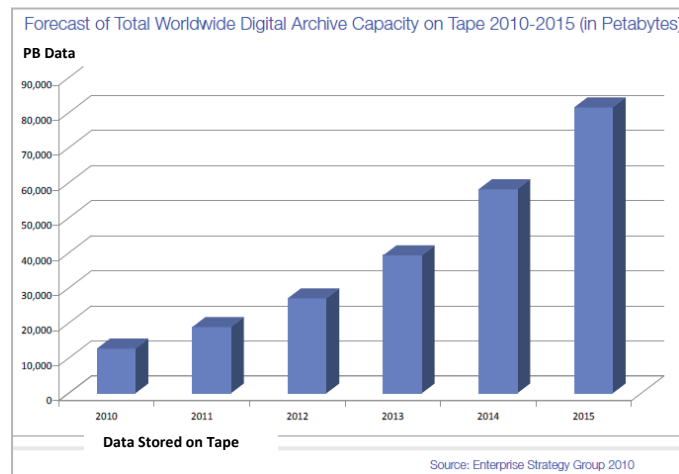
Abstract

Tape is back in the spotlight, although it never truly went away--it just kept working while attention was showered on disk. Both technologies are the senior citizens of the storage world, in that both are over 50 years old. They both are important to data centers, and tape's advantages are once again being recognized more widely as data growth continues at a furious pace. Data growth averages anywhere from 30-60 percent annually.¹ 78 percent of large data centers use tape¹, and this rate of data growth is promoting tape's important role in storing and protecting data.

Introduction

Tape technology has undergone a renaissance in the last decade or more, with advantages that surprise almost everyone who has not followed tape technology and application advancements. These advantages, coupled with the continuing data growth explosion, have brought tape full-circle, to where it is once again seen as an essential component of IT infrastructures.

The tape market is alive and well, at more than \$2.2 billion dollars for 2011.² Further, data stored on tape is growing at 45 percent compound annual growth rate, as illustrated below:³



The renewed success of tape is the result of significant advancements in tape technology and related applications. These technological leaps have given tape the following advantages:

- Lowest in cost: tape continues to be the most cost-effective storage medium, even when compared to best case use of disk with deduplication.
- Greatest reliability: Tape is orders of magnitude more reliable than disk.
- Increased capacity and performance: Tape capacity exceeds the capacity of the 2.5" disk platter.

¹ 2012 Tape Market State of the Union Memo, released 2012.

² Combined data from Santa Clara Consulting Group report *Backup Tape Technology: Global Review 2012*, for mid-range drive and media market, with data from IDC report *Worldwide Midrange and Enterprise Tape Automation*, May 2012, which reviews automated systems. *Total shown is our best interpretation of data as presented.*

³ Digital Archive Market Forecast 2010-2015," Enterprise Strategy Group Research Report, June 2010.

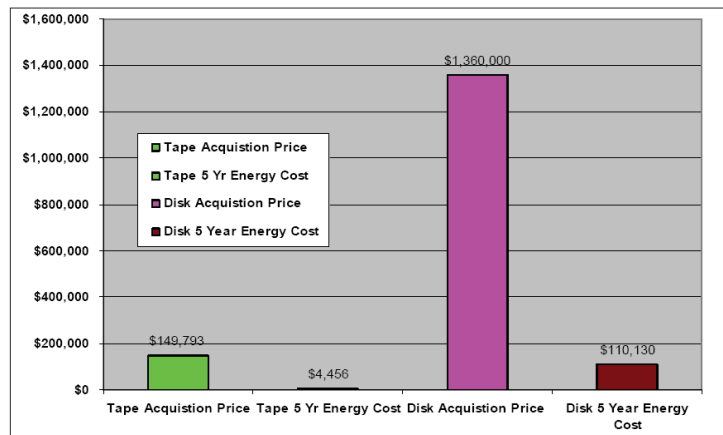
- Easiest to use: New tape technologies and software applications have profoundly improved tape’s ease of use.
- Proven longevity: With increasing retention requirements, tape’s 30+ year lifespan is increasingly attractive to enterprises.

Lowest in Cost

Although the storage industry agrees that tape is less costly to purchase and operate than the equivalent disk infrastructure, the savings can be calculated in any of several ways, such as purchase price, total cost over lifetime of the equipment, power use, and more. Chris Mellor, an industry veteran, sums up the discussion by saying, simply, “Tape’s cost/GB stored blows disk away.”⁴ The following are taken from just a few of the studies showing tape’s cost advantages.

- LTO-5 tape costs up to **15x less than SATA disk** for long-term archive of large quantities of data.⁵
- **TCO of tape solutions is approximately 2-5 times less than VTL with deduplication** for backup solutions.⁶
- “At NERSC, there is over 13 PB of data on tape...and its **\$/GB is around 5% of that of its disk storage.**”⁷

This graph⁸ contrasts the extreme cost disparity between disk and tape:



⁴ Mellor, C. “Tales from the storage frontier: What’s next for flash, disk and tape,” May 2011.

http://www.theregister.co.uk/2011/05/06/soirage_trifecta/. Accessed September 2011

⁵ Reine, D., et al. “In Search of the Long-Term Archiving Solution – Tape Delivers Significant TCO Advantage over Disk,” The Clipper Group, December 23, 2010, <http://www.clipper.com/research/TCG2010054.pdf>. Study compared a 12-year TCO for Tape to Disk for long-term archived data.

⁶ Enterprise Strategy Group, Inc. “A Comparative TCO Study: VTLs and Physical Tape,” Feb. 2011

⁷ Active Archive Alliance. “NERSC Exceeds Reliability Standards With Tape-Based Active Archive,” Case Study, 2012.7

⁸ INSIC (Information Storage Industry Consortium), *International Magnetic Tape Storage Roadmap, Part I: Applications & Systems*, November 2011. <http://www.insic.org/news/A&S%20Roadmap.pdf>

The Clipper Group analysis shows that, while the acquisition price of disk in this example is 17 times that of tape, and the five-year energy cost is 25 times that of tape, the five-year energy cost alone for disk actually exceeds the total (acquisition plus energy) cost for tape.⁹ This report also states that tape requires less administrative overhead than does disk: “Physically managing the migration of even thousands of tape cartridges is a much less demanding physical chore than installing new disk solutions and, after the data has been migrated and cleansed, removing the old disk solution.” . This reduction in administrative time in turn reduces operating costs. Although this may be counter-intuitive, given skewed coverage in industry press, it is true.

Greatest Reliability

Reliability has come to be tape’s hallmark, which may run counter to some expectations. A few facts and perspectives reinforce this point:

- Individual **tape media cartridges are 2-4 orders of magnitude more reliable than SATA disk drives.**ⁱ¹⁰
- “Tape's reliability, with today's media and pre-emptive media integrity-checking library software is far higher than disk. Tape cartridges don't crash. **Tape cartridges aren't spinning all the time, drawing electricity constantly, vibrating themselves slowly to death, generating heat that has to be chilled, and most importantly are not always online, always susceptible to lightning-quick data over-writing by dud data or file deletion.**”¹¹
- Given each medium’s bit error rate, “you are **100 times more likely to have bad data on disk than you are on an LTO-5 tape drive**, and 10,000 times more likely than if the data is stored on a T1000C or TS1130 drive!”¹²
- NERSC study shows automated **tape systems have a proven reliability of more than five 9’s (99.999%)**¹³

Contemporary tape technologies are the platform of choice for administrators requiring the highest reliability in writing and reading data.

⁹ Reine, D., et al. “In Search of the Long-Term Archiving Solution – Tape Delivers Significant TCO Advantage over Disk,” The Clipper Group, December 23, 2010, <http://www.clipper.com/research/TCG2010054.pdf>.

¹⁰ INSIC (Information Storage Industry Consortium), *International Magnetic Tape Storage Roadmap, Part I: Applications & Systems*, November 2011. <http://www.insic.org/news/A&S%20Roadmap.pdf>

¹¹ Mellor, C. “Tales from the storage frontier: what’s next for flash, disk and tape,” *The Register*, May 2011.

http://www.theregister.co.uk/2011/05/06/soirage_trifecta/. Accessed September 2011.

¹² Preston, W.C. “Have we put tape out to pasture too soon?” April 21, 2011. <http://www.backupcentral.com/mr-backup-blog-mainmenu-47/13-mr-backup-blog/376-have-we-put-tape-out-to-pasture-too-soon.html>. Accessed September 2011.

¹³ Active Archive Alliance. “NERSC Exceeds Reliability Standards With Tape-Based Active Archive,” Case Study, 2012.¹³

Alabaster, Jay. “Hitachi GST Begins Shipments of a 4TB Disk Drive,” IDG News/PC World, December 12, 2011.

Highest in Capacity and Performance

The facts are that tape is fast and high capacity, even when compared to disk:

- The largest disk drive stores 4 TB, compared with the largest tape, which stores 5 TB (10 TB compressed).¹⁴
- Tape streams data extremely quickly when restoring or writing large quantities of data, while “disk has to include a lot of complicated processes in order make it feasible as a backup solution, such as RAID for data redundancy, error checking for data integrity and deduplication to narrow the price gap with tape. But these processes can severely eat into disk performance.”¹⁵

This emphasizes a key point: disk and tape should be used together so users can take advantage of the strengths of each. Disk is without a doubt the best at accessing small files in only milliseconds. But when restoring large quantities of data, tape has some significant performance advantages. Use them both, and don't forget the tape!

Easiest to Use

One of the newest technology advancements provides a familiar directory structure interface to data stored on tape. One application that does this is the Linear Tape File System (LTFS), released in 2010. By storing descriptive information about the file's data with each file, it is easy to search and find data on tape. Additional applications, such as those for active archive applications, set disk and tape on an equal footing, with the contents of both represented using a standard directory interface.

- Active archive applications and LTFS support tape used as NAS storage.¹⁶
- A single IT administrator can manage petabytes of data on tape; alternately, one administrator can manage only up to 100 TB of data on disk.¹⁷

Proven Longevity

Tape media has a shelf life estimated conservatively at 30 years. If tape is stored in reasonable conditions, data can be retrieved from tape for even longer periods. Tapes from the 1960s have been successfully restored. The reasons underlying tape longevity are straightforward:

¹⁴ INSIC (Information Storage Industry Consortium), *International Magnetic Tape Storage Roadmap, Part I: Applications & Systems*, November 2011. <http://www.insic.org/news/A&S%20Roadmap.pdf>

Preston, Curtis. “Have we put tape out to pasture too soon?” *Backup Central*, updated 3/19/2012.

¹⁵ Crump, Georg. “Breaking the Top Four Myths of Tape vs. Disk Backup,” *Storage Switzerland*, January 27, 2011. http://www.storage-switzerland.com/Articles/Entries/2011/1/27_Breaking_The_Top_Four_Myths_Of_Tape_vs._Disk_Backup.html. Accessed July 2012.

¹⁶ INSIC. See above.

¹⁷ Moore, F. Horison Information Strategies, “Tiered Storage Takes Center Stage,” <http://www.horison.com/OracleTieredStorageTakesCenterStage.pdf>. Accessed April 2012.

Unlike a hard disk, tape storage separates the recording mechanism from the backup media. Backup tapes are designed to be very simple.... This means that they're less likely to fail when you try to recover after long-term storage. Tape is much more stable. If you scratch a tape, the entire device does not become unreadable. On the other hand, a head crash can cause an entire hard drive to become corrupted and unreadable.¹⁸

Users now also have tools that let them confirm that a tape is still in good shape, even over the course of long-term storage. Libraries, including the Spectra T-Series libraries, provide automated media health and data integrity verification that mitigates concerns about long-term data access.¹⁹

Conclusion

Tape is receiving some long-overdue recognition for advancements in tape technology and software. With tape's high reliability, longevity, affordability, and the ease of use now available through the newest software applications, tape is an excellent option. Tape will be around for decades to come---at least.

¹⁸ "Long Live Tape Storage," *Enterprise Features*, <http://enterprisefeatures.com/2010/05/long-live-tape-storage/>. Accessed July 2012.

¹⁹ Guess, Angela. "Storing Big Data on Tape," *Dataversity*, April 2011, <http://www.dataversity.net/storing-big-data-on-tape/>. Accessed July 2012.



www.SpectraLogic.com

Spectra Logic Corporation
6285 Lookout Road
Boulder Colorado 80301 USA
800.833.1132
303.449.6400

For more information, please visit www.SpectraLogic.com

ⁱ INSC (Information Storage Industry Consortium), *International Magnetic Tape Storage Roadmap, Part I: Applications & Systems*, November 2011. <http://www.insic.org/news/A&S%20Roadmap.pdf>
Preston, Curtis. "Have we put tape out to pasture too soon?" *Backup Central*, updated 3/19/2012.
<http://www.backupcentral.com/mr-backup-blog-mainmenu-47/13-mr-backup-blog/376-have-we-put-tape-out-to-pasture-too-soon.html>. "From this: "you are 100 times more likely to have bad data on disk than you are on an LTO-5 tape drive, and 10,000 times more likely than if the data is stored on a T1000C or TS1130 drive."