



Quantum™

Data Protection in Today's High Performance Data Center

Making the Best Use of Disk and Tape

Introducing LTO-5 Technology

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Agenda

- Today's IT Environment - Storage Issues
- Data Protection and Best Practices for Backup and Archive
- Storage Strategies to Keep Data Safe, Accessible and Cost Effective
- New LTO-5 Technology: Get ready for *Wow!*

Storage Issues: The World is Getting More Complex

● Massive Data Growth

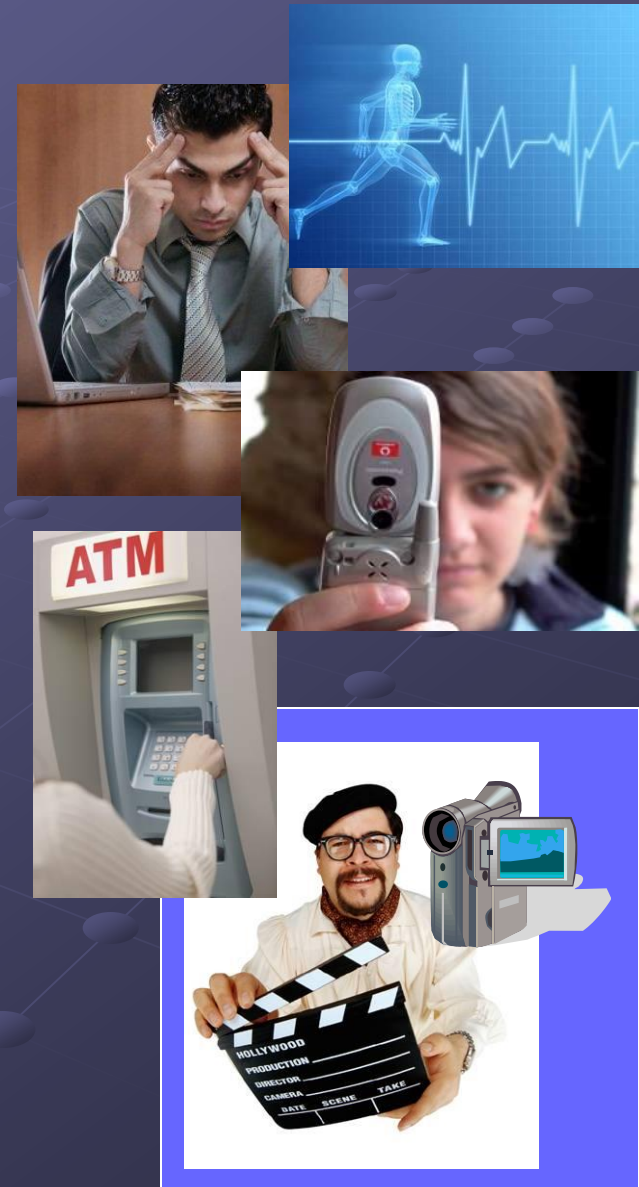
- From many sources including hand held devices
- High definition content
- Managing backup/restore windows

● Daunting Compliance and Data Security Requirements

- Disclosure laws
- Security breach can be costly

● Significant TCO and Energy Consumption Challenges

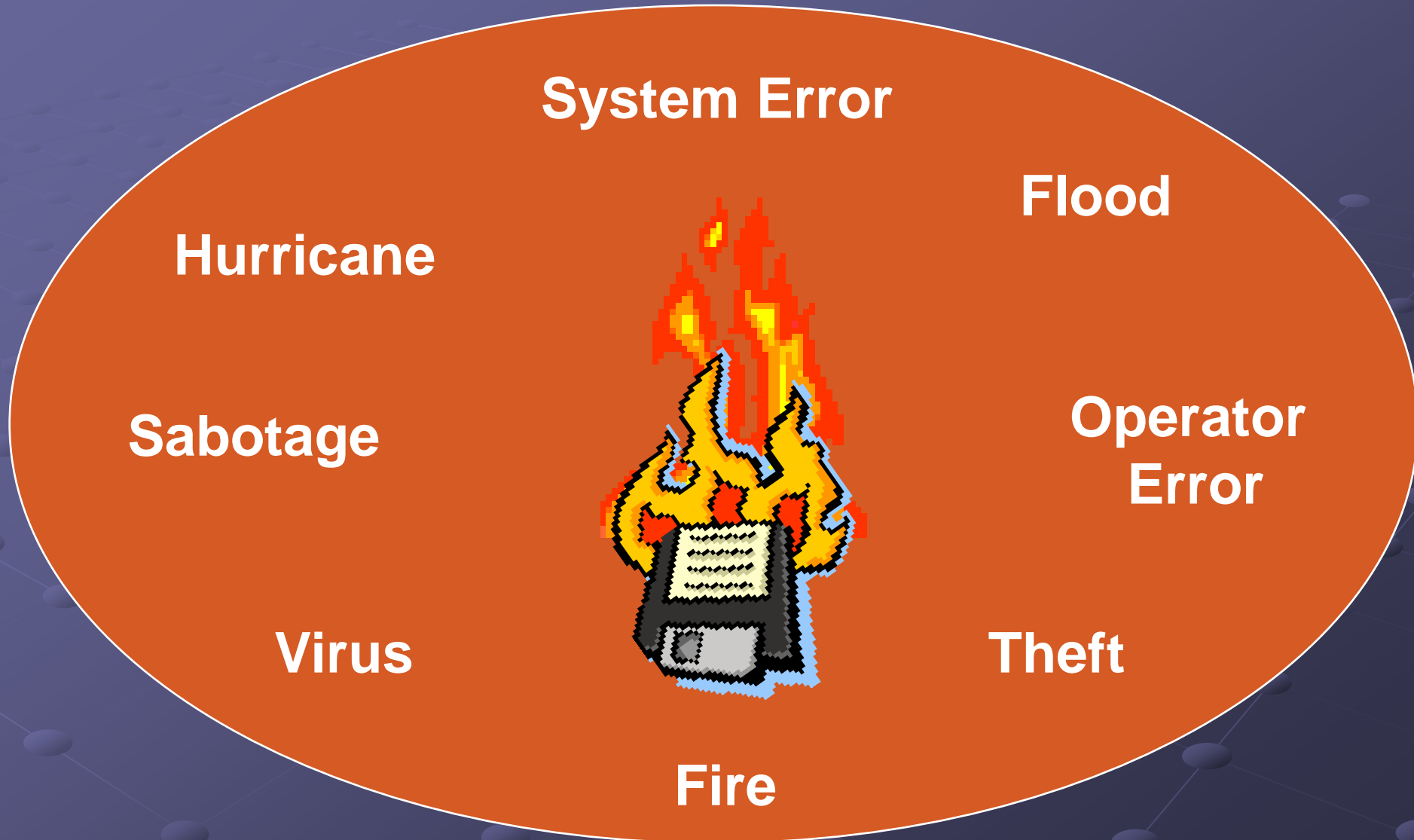
- Rising costs, insufficient power and space



Data Protection & Best Practices



Your Data Is At Risk



Hard Lessons Learned

What if you were an organization with two servers
backing each other up ...

- ...and **hackers** were able to take out both of the site's servers
- rendering **all information** culled from years of hard work **useless**
- again, if there was **no offline data** to provide recovery it would be disastrous

CAUTION



Hard Lessons Learned

What if you were providing services to thousands of bloggers and...

- ...all of their data was **completely wiped out** after the drives with the entire database were overwritten
- This could happen:
 - Especially if the **backup plan involved one disk drive replicating its data to another**
 - A **system error could erase the data** on one drive leading the other drive to erase the backup data as well
 - A big disaster if there was **no offline data to restore from**

CAUTION

If you are replicating/mirroring and the data is corrupt then your replicated system most likely will have corrupt data



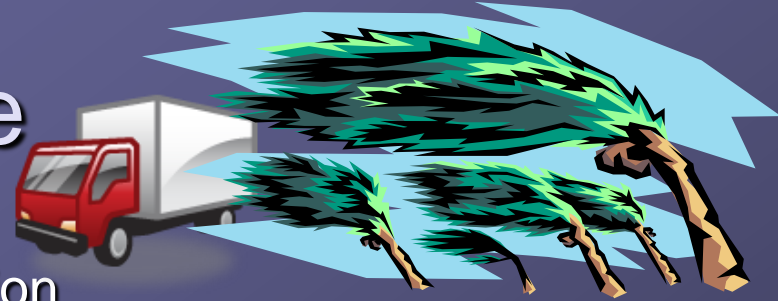
Don't Gamble With Your Data



Backup and Archive Best Practices – Protect Data

- **Have multiple levels of protection:** at least 3 copies of data in different locations and one in a remote region for DR - Use tape
- **Have technology diversification:** copies on different forms of media to avoid a media or system process disaster - Use disk and tape
- **Have system isolation:** at least one copy offline to avoid intentional or unintentional corruption that can occur with online storage - Use tape
- **Manage backup differently than archive:** multiple, point in time consistent backups provide for operational and DR recovery consistent with application specific RTO/RPO. Archive single instanced data for long term retention. – Use disk and tape
- **Protect access to data:** at rest and in transit – Use encryption

Large Truck Express Line Survives Hurricane



● Problem

- Hurricane Gastone flooded Data Center with 5 ft. of water
- Total loss of hardware, networks, phone systems, generator, utility power
- Good news: *We had a tape backup of 100% of our data made night before - off site!*

● Objective

- Protect assets and business resilience with comprehensive strategy
- Control TCO with tiered storage strategy

"We installed our new LTO-5 library at our DR site & started executing saves through a fibre fabric in LESS THAN 30 MINUTES! I can save more than 150TBs without any intervention."

Dick Cosby, Systems Mgr.

● Solution

- Create flash copy for fast retrieval and window-less backup to tape
- Backup 100% production data to LTO-4 and LTO-5 library
- Global Mirror DR site with LTO tape library – Lights out!

● Benefits

- No production System interruption
- No save window-Set it & forget it
- No production cycles, no operators, lights out operations
- Multiple tiers of protection
- Out of region protection

"You are out of your mind if you think you can live without tape."

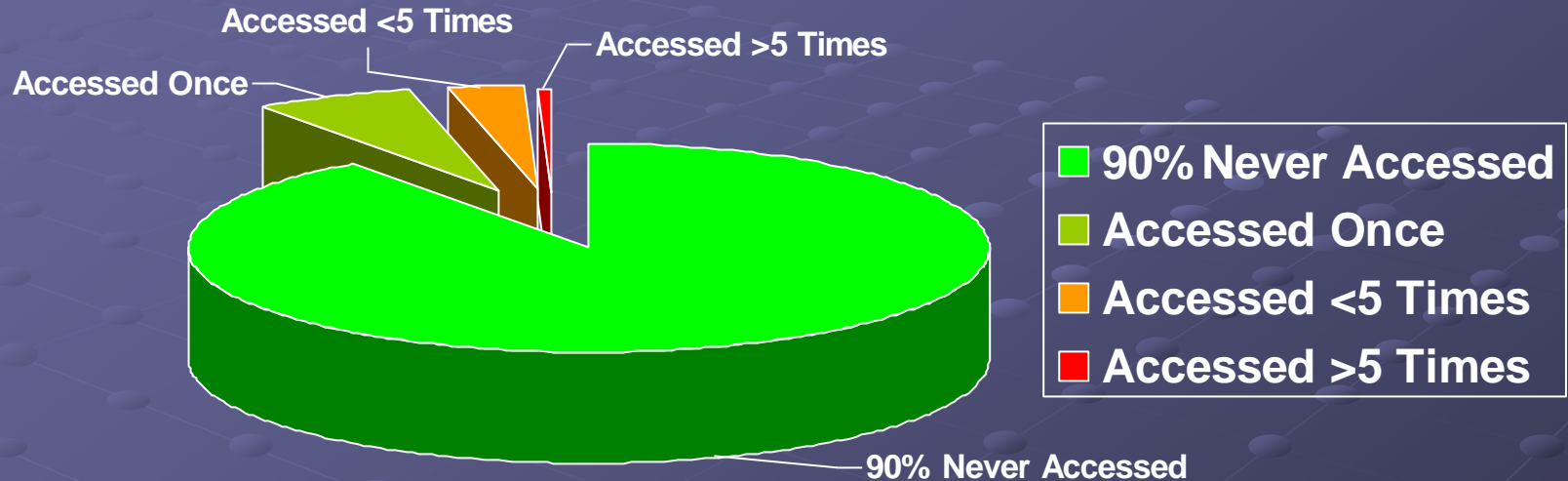
Dick Cosby, Systems Mgr.

Storage Strategies to Keep Data Safe, Accessible and Cost Effective



Most Network Data Sits Untouched

Access Patterns of Data Stored on Disk.



- Three month study of a businesses 22TB disk data access
- Conducted by University of California, Santa Cruz
- 90% of the data was never accessed after being stored on disk
- Another 6.5% of the data was accessed only once
- U of C recommendation: move data to less expensive and less energy consuming storage units

Tape is Essential to the Data Center

The InfoWorld logo, featuring the word "InfoWorld" in white sans-serif font on a red rectangular background.The header of an article titled "Information Overload" from InfoWorld, featuring a small portrait of a man on the left.

“tape is able to store a lot of data in a very small package”

JANUARY 25, 2010

Tape is dead! Long live tape!

With all the advances made in storage technology over the years,

“currently available tape drives can deliver sequential transfer speeds that rival the fastest hard disks available.”

Ultrium standard, LTO Generation 5. This may sound a little retrograde. With all of the incredible advances made in other storage technologies, can tape maintain its relevancy into the future?

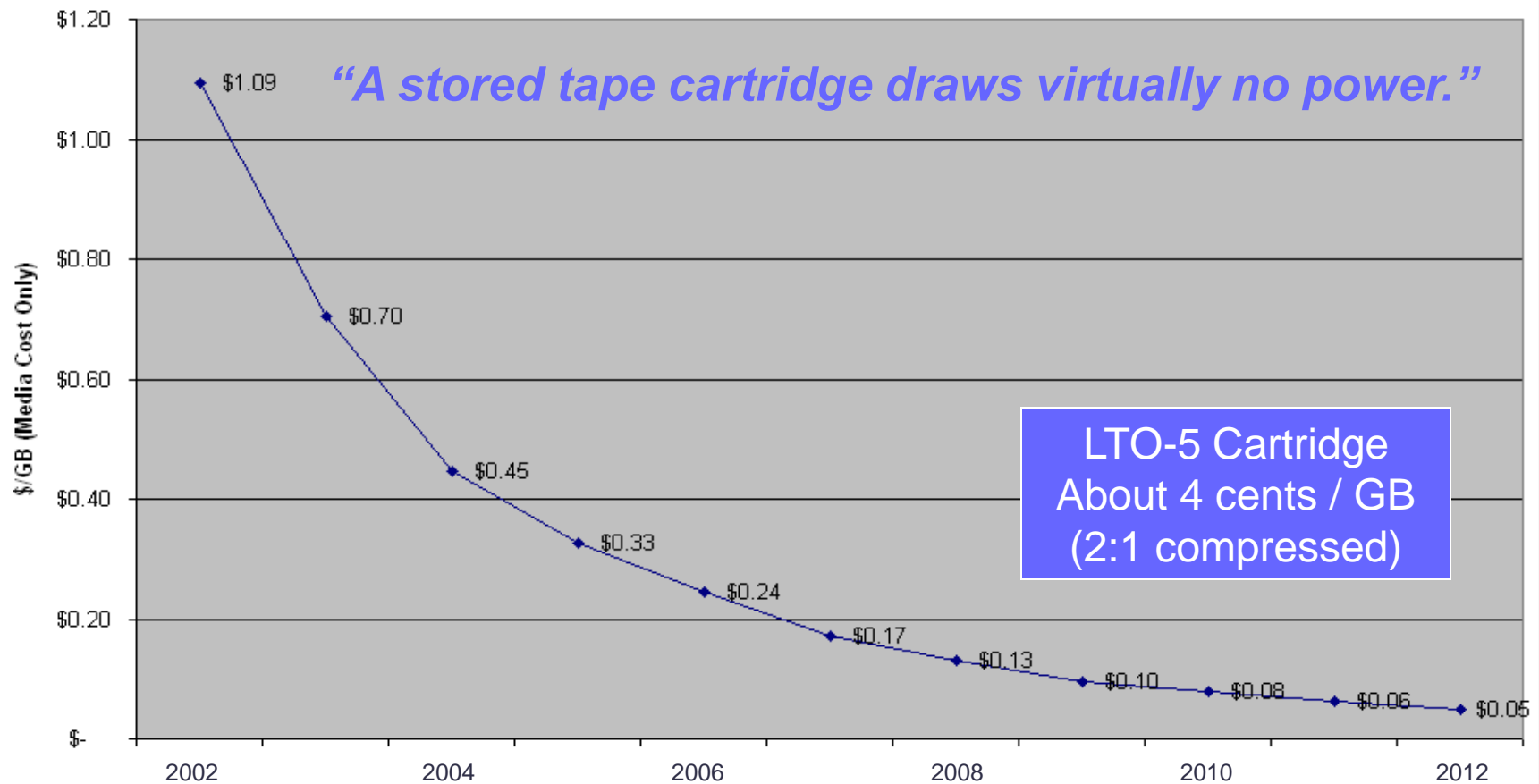
Can Virtual Tape Libraries (VTL), removable disk, or the cloud replace the need for constant

“tape media can be removed from its drive, shipped, stored, and used years later”

<http://www.infoworld.com/d/data-explosion/tape-dead-long-live-tape-090>

Tape Cartridge Price/GB Estimates

Magnetic Tape Cost Improvement Projections



Disk and Tape TCO Archive Study



Scenario

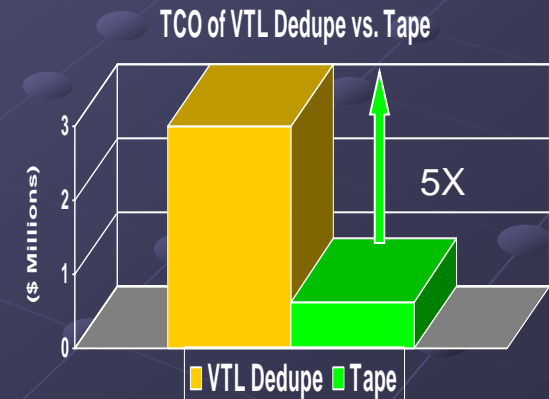
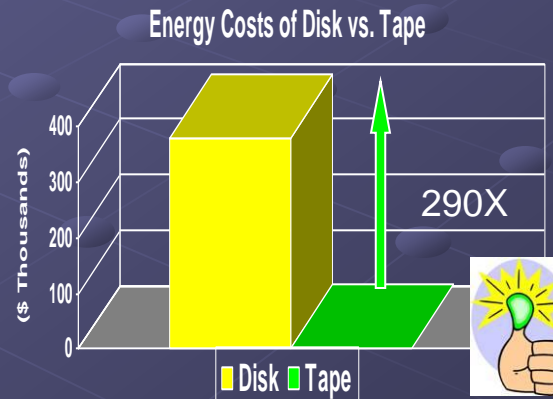
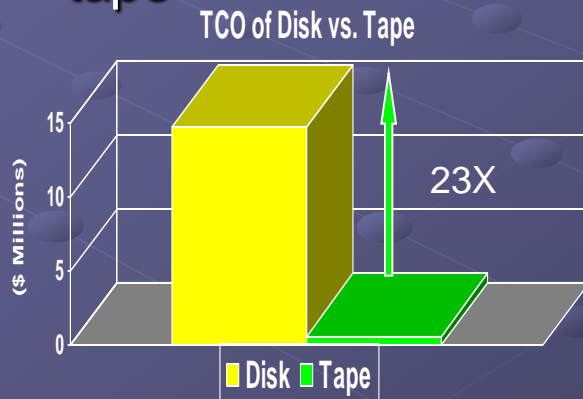
- 5 year TCO to store 2.4 PB of archive data
- Including hardware, energy, and space costs
- SATA disk system versus LTO-4 tape library

Findings

- Cost Ratio to archive data on Disk vs Tape is 23:1*
- Energy costs of disk was 290 times more than tape
- VTL with 20X data de-dupe is about 5X more costly than tape

The Cost Ratio for a Terabyte Stored Long-Term on SATA Disk versus LTO-4 Tape is about **23:1**

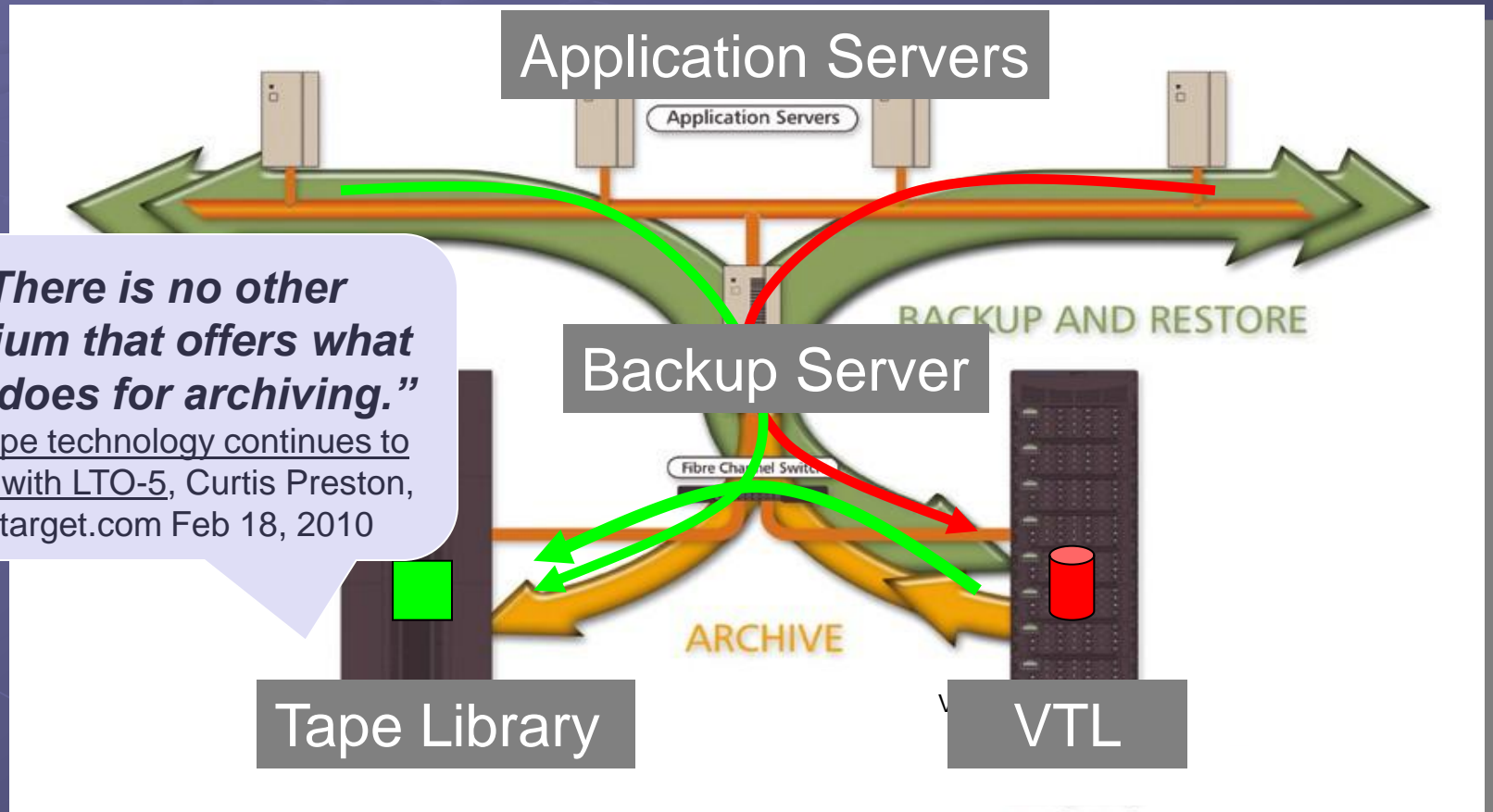
For energy cost, it is about **290:1**



"Tape continues to provide the fiscal responsibility and functional value that enterprises require in the twenty-first century." The Clipper Group

Tape and Disk are Complementary for Optimal Performance, Archive, Data Protection and TCO

Blended Tiered Storage Example



Storage Manager Survey Results*

- 61% of current disk-only users plan to start using tape

Soar to New Heights



LTO Ultrium 5 Technology Can Take You There!

LTO-5 Specs

● Fast

- Up to 140 MB per second native
- Up to 280 MB per second (2:1 compressed)
- That's > 1TB of backup data per drive / hr

● Huge

- 1.5 TB per cartridge native
- 3 TB per cartridge (2:1 compressed)
- That's over 300 DVD movies per cartridge*
- Almost 4 LTO-3 cartridges will fit on 1 LTO-5 cartridge

LTO-5 Specs

"LTO reliability is incredible, retrieves couldn't be easier, and almost zero training."

Dick Cosby, System Administrator, EDPS

● Reliable

- Read after write verification to help assure data integrity
- State of the art Servo Tracking and Heads for accurate reads and writes
- Advanced metal particle media for reliability and longevity up to 30 years
- Up to 250,000 hours mean time between failure at 100% duty cycle

● Low Cost, Portable, Off-line storage

Data Security



Compliance and Data Security

- Government Regulations
 - Sarbanes Oxley, SEC...
- Internal Requirements
- Securing Data
 - Disclosure laws
 - Penalties and Fines
 - Loss of business

A security breach can cost up to \$150 per record.*

RECENT BREACHES

Feb 2008: Bank lost unencrypted back-up tapes with sensitive data about 12 million customers

June 2008: Six laptops holding 20,000 patients' details stolen from hospital

Sept 2008: Details of thousands of criminals held on a computer memory stick are lost

Feb 2009: Hackers broke into government admin computers accessing 48K names and social security numbers of employees

Feb 2009: Large pharmacy chain pays \$2.25M in fines for improper disposal of patient data

Jan 2010: University computer infected with a virus may have exposed the personal information of 3,500

Feb 2010: Computer security breach by malware at University may have put hundreds of alumni at risk of identity theft

LTO Data Security



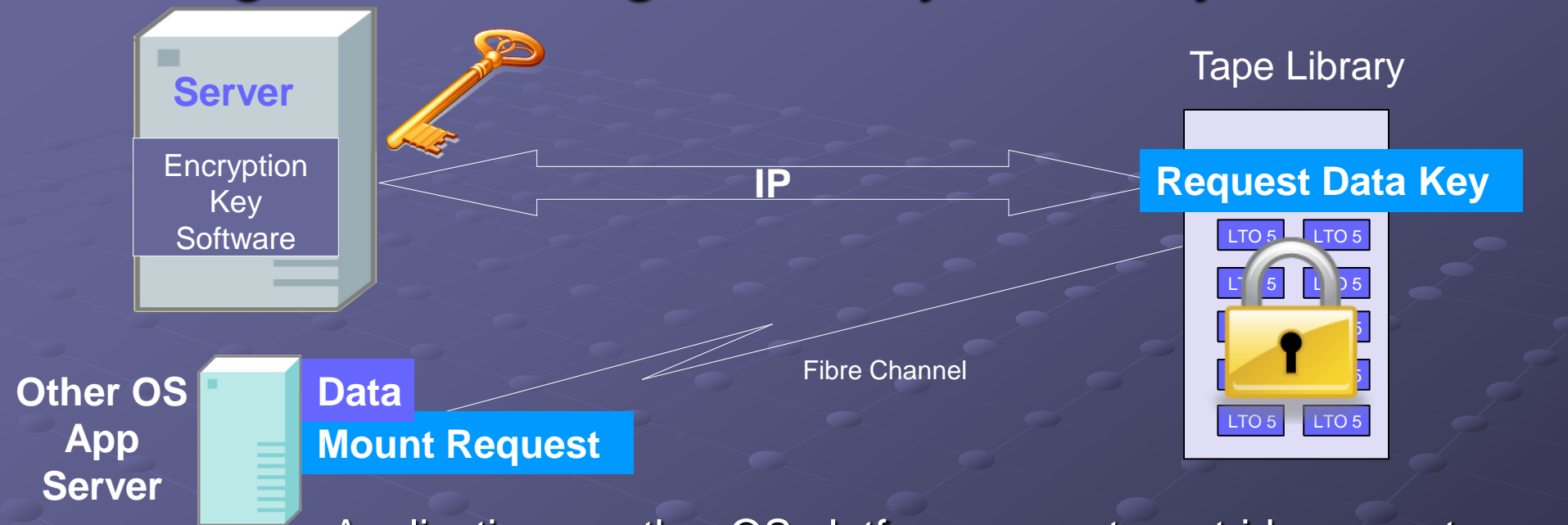
● WORM (Write Once Read Many)

- LTO 3, 4 and 5 drives and WORM cartridges
- Unalterable tape data storage
- Can append data to cartridge

● Tape Drive Encryption

- LTO 4 and 5 Tape Drive Hardware Encryption
- AES 256 bit encryption data key provided to tape drive
- Data is compressed then written to tape cartridge in encrypted form to help protect sensitive info
- Virtually no impact to drive performance
- Helps eliminate need for encryption SW or appliance
- Get encryption key management software from tape vendors

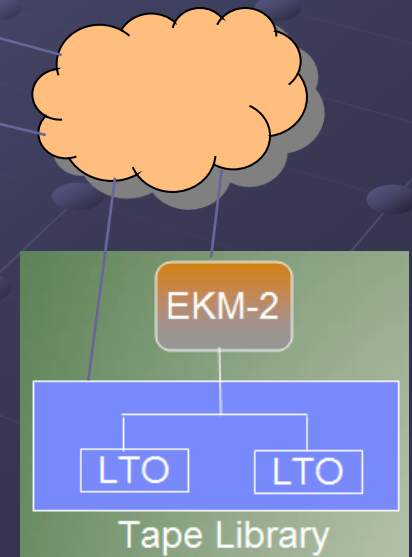
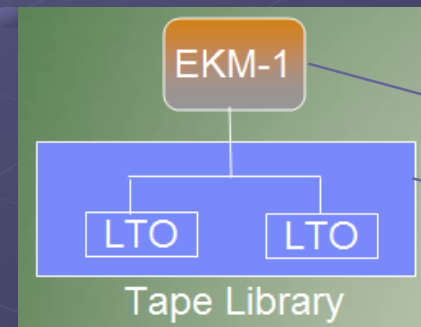
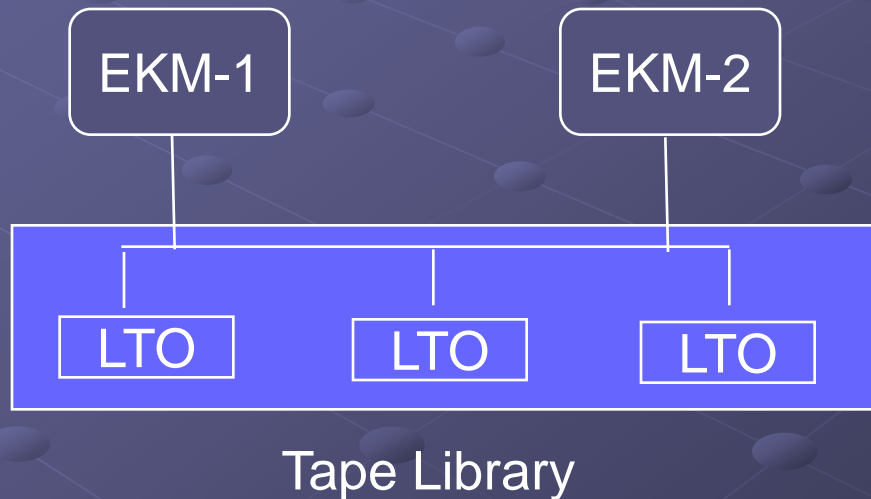
Example – Centralized Encryption Key Management Using a Library and Key Software



- Application on other OS platform requests cartridge mount on library with encryption policy “ON” for vol/ser range requested
- Library routes encryption key request to encryption key software
- Encryption key software provides key to the drive via the library and can be transparent to other OS server tape applications
- Application on other O/S begins write process
- Drive compresses data then encrypts data

Managing and Protecting Encryption Keys

- Backup key stores periodically
- Can cryptographically erase tape by deleting encryption key
- Provide DR site with copy of key store
- Have dual key management servers for high availability: local or remote



Providence Health & Services Encrypts with LTO-4 Tape Drives



- Five data centers in four states all encrypting off-site media
- Daily backups are between 1 – 8 TB per site
- Centralized, automated data protection system eliminated manual management of backups
- Effectively established a disk to disk to tape strategy
- Assured data is protected – LTO-4 addresses security and compliance requirements



***“...it took only 1 to 2 days to implement encryption.” Mack Kigada,
Data Storage Manager, Providence Health and Services***

**See white paper: Securing Sensitive Information -- with LTO-4 tape drive encryption.
by Silverton Consulting at www.ultrium.com/whitepaper*

Tape File Management



Linear Tape File System



● Linear Tape File System Specification

- Can allow viewing and access of tape files in a fashion like disk or other removable media with directory tree usage
- Enabled by dual partitioning of LTO Gen 5 technology: stores index metadata in small partition and content in large partition
- Provides file system access at the operating system level
- Non-proprietary data format independent of software applications

● Potential user benefits:

- Ability to access & update tape data faster and more easily
- Can help enhance ease of use, tape mobility, and sharing of data on tape between different platforms
- Can help address the growing needs of marketplace segments such as Rich Media, video surveillance, medical images, cloud application and many more!

Tape File System via File Browser –Example 1

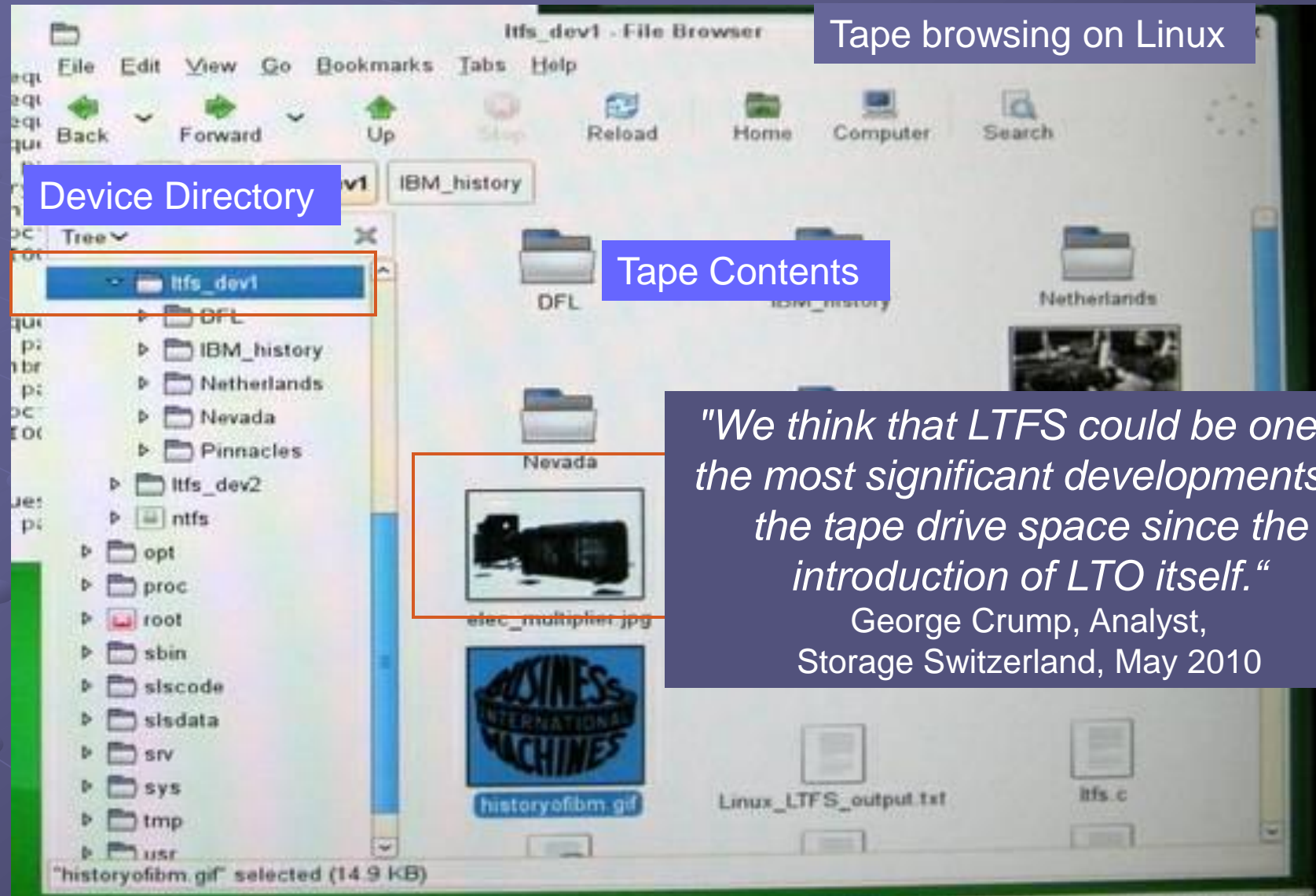
Files can be accessed on tape directly from any application

Tape browsing on Linux

Device Directory

Tape Contents

"We think that LTFS could be one of the most significant developments in the tape drive space since the introduction of LTO itself."
George Crump, Analyst,
Storage Switzerland, May 2010



The screenshot displays the 'ltfs_dev1 - File Browser' window. The left sidebar shows a 'Tree' view with a directory structure including 'ltfs_dev1', 'DFL', 'IBM_history', 'Netherlands', 'Nevada', 'Pinnacles', 'ltfs_dev2', 'ntfs', 'opt', 'proc', 'root', 'sbin', 'slscode', 'slsdata', 'srv', 'sys', 'tmp', and 'usr'. The 'ltfs_dev1' folder is highlighted. The main pane shows a grid of file thumbnails, including a folder named 'Nevada', a file named 'elec_multiplier.jpg', and a file named 'historyofibm.gif'. The status bar at the bottom indicates that 'historyofibm.gif' is selected and is 14.9 KB in size.

LTFS Gets Rave Reviews

- LTO-5 and LTFS: Shaking the Pillars of Heaven
By Mark Ferelli, Aug 17, 2010, [Computer Technology Review](#)
- LTFS: Crazy like a fox "The more I thought about this idea the more I liked it... (LTFS is) also excellent for long term storage (i.e. archiving)."
By W. Curtis Preston, Aug 12, 2010, [BackupCentral.com](#)
- "The file system allows users to drag and drop files to and from tape the way they do with disk."
By Andrew Burton, Site Editor, Aug 2, 2010, [SearchDataBackup.com](#)
- "LTFS is making tape more usable, making tape easier to search," Will 50 TB tape cartridges prove a boon for data archiving?
By Andrew Burton, Site Editor, 30 Jun 2010, [SearchDataBackup.com](#)
- LTO-5 with LTFS Gives Tape a New Lease on Life
By Jerome M. Wendt on June 4, 2010
- FOR-A Collects Two Awards For New Products At NAB 2010
Broadcast Engineering awarded one of its Pick Hits to the LTR-100HS Video Archive Recorder which uses LTO-5 tape and LTFS

Client Reactions at NAB Show – April 2010, After Viewing LTO-5 Drive and Linear Tape File System in Action

"I am shocked! This is exactly what we need!"

"You have made my dreams come true!"

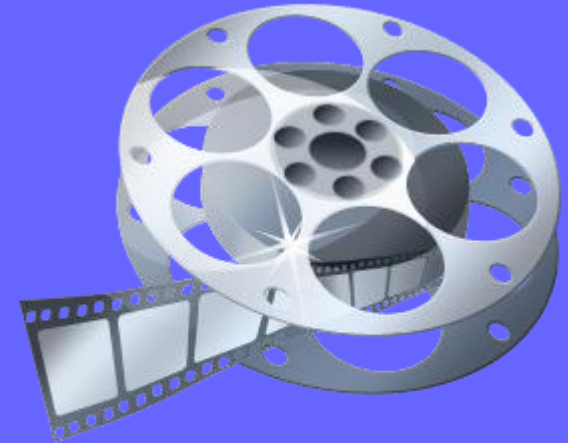
"You can't see it, but I am dancing inside!"

"LTO-5 technology gives tape-less work-flow....with tape!"

"We are going to get this (LTO-5 tape and LTFS)."

"Now I can offer an LTO-5 archiving service to my movie clients."

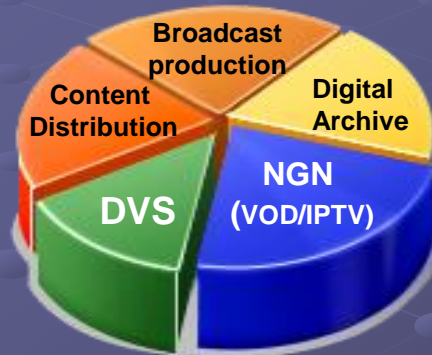
"We have LTO-3 and are now going to go to 5 with the file system"



Digital Video Storage Becomes a Must for Media Industry

Clients Require:

- Cost effective and efficient ways to capture and store digital content
- Repurpose the content and make it available for both traditional and new distribution outlets



For:

- Digital Video Surveillance (DVS)
- Broadcast Production
- Content Distribution
- Digital Archive
- NGN (Next Generation Networks)

Law Enforcement:

- European city government stores video evidence from city park cameras to LTO tape
- Large U.S. city PD stores squad car live action video surveillance to LTO tape library

Video Archive:

- Major Asian broadcaster stores video to LTO archive to save cost and maintain longevity
- Large US entertainment news show stores video content to LTO tape library
- Major US TV broadcaster uses LTO system for high def archive and retrieval – lowers costs

LTO Worldwide Acceptance

✓ Over 3.3M LTO Tape Drives Shipped

✓ Over 150M LTO Cartridges Shipped



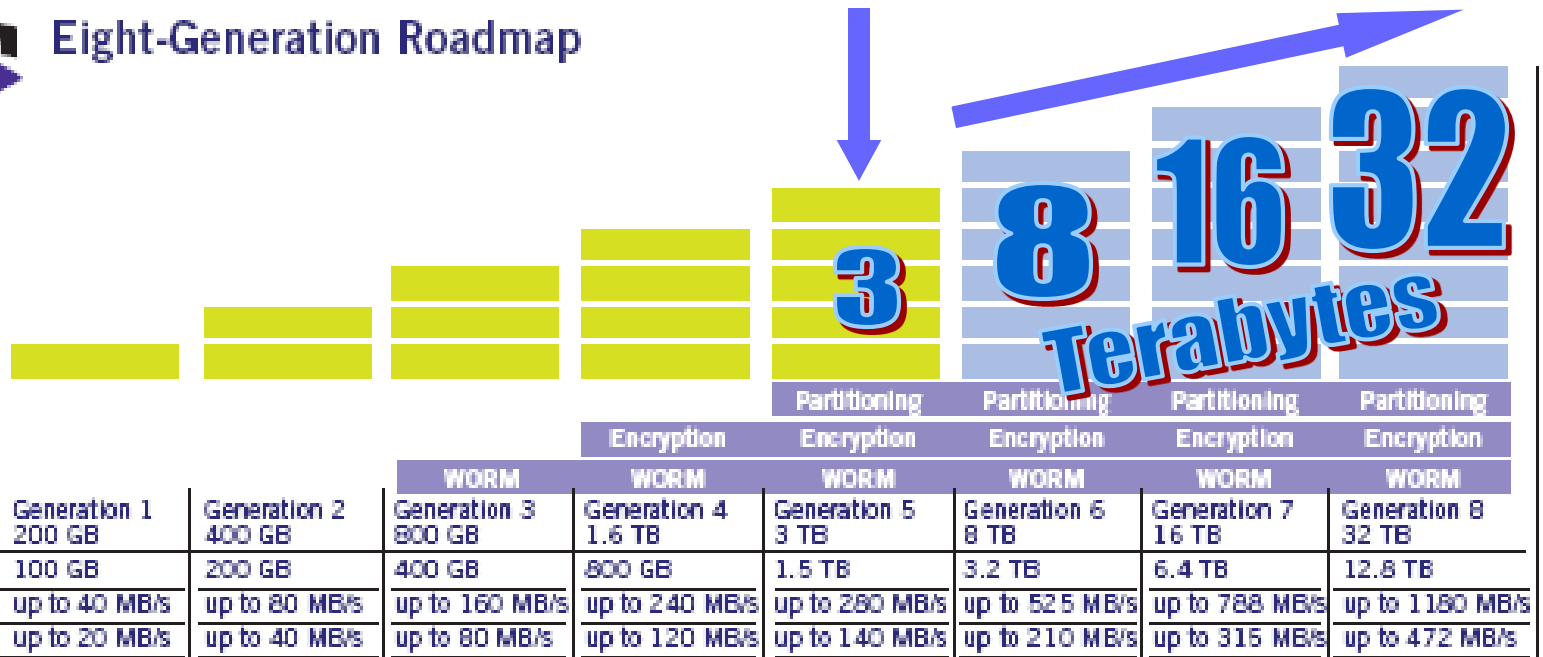
Storage Manager Survey Results*

- 61% of current disk-only users plan to start using tape

LTO Ultrium Roadmap Soaring to the Future



Eight-Generation Roadmap



Note: Compressed capacities for generations 1-5 assume 2:1 compression. Compressed capacities for generations 6-8 assume 2.5:1 compression (achieved with larger compression history buffer).
Source: The LTO Program. The LTO Ultrium roadmap is subject to change without notice and represents goals and objectives only.

See the LTO Ultrium Roadmap at ULTRIUM.com

Thank You!

Soar to New Heights

**LTO-5 technology can help to reduce
storage costs and energy consumption,
improve data management
and protect data!**

**Go to Ultrium.com
for a copy of this presentation and lots more!**

***Visit the LTO booth, see the technology, get
a free gift, and plan to protect your data!***

More info at TRUSTLTO.com



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