



The Evolving Roles of Tape and Disk in the Energy-Cost Conscious Data Center

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Agenda

- **Today's IT Environment - Storage Issues**
- **Best Practices for Backup, Archive and Data Protection**
- **Security, Cost, and Energy Strategies**
- **User Examples**



Today's IT Environment

- **Massive Data Growth**

- By 2011, users will install almost 6.5 times the amount of terabytes that they installed in 2007*

- **Daunting Compliance and Data Security Requirements**

- Disclosure laws
 - Security breach can be costly: Recovery Costs, Penalties and Fines, Loss of business

- **Significant TCO and Energy Consumption Challenges**

- Rising costs, insufficient power and space



VIRUS ALERT

YOUR SYSTEM HAS BEEN COMPROMISED

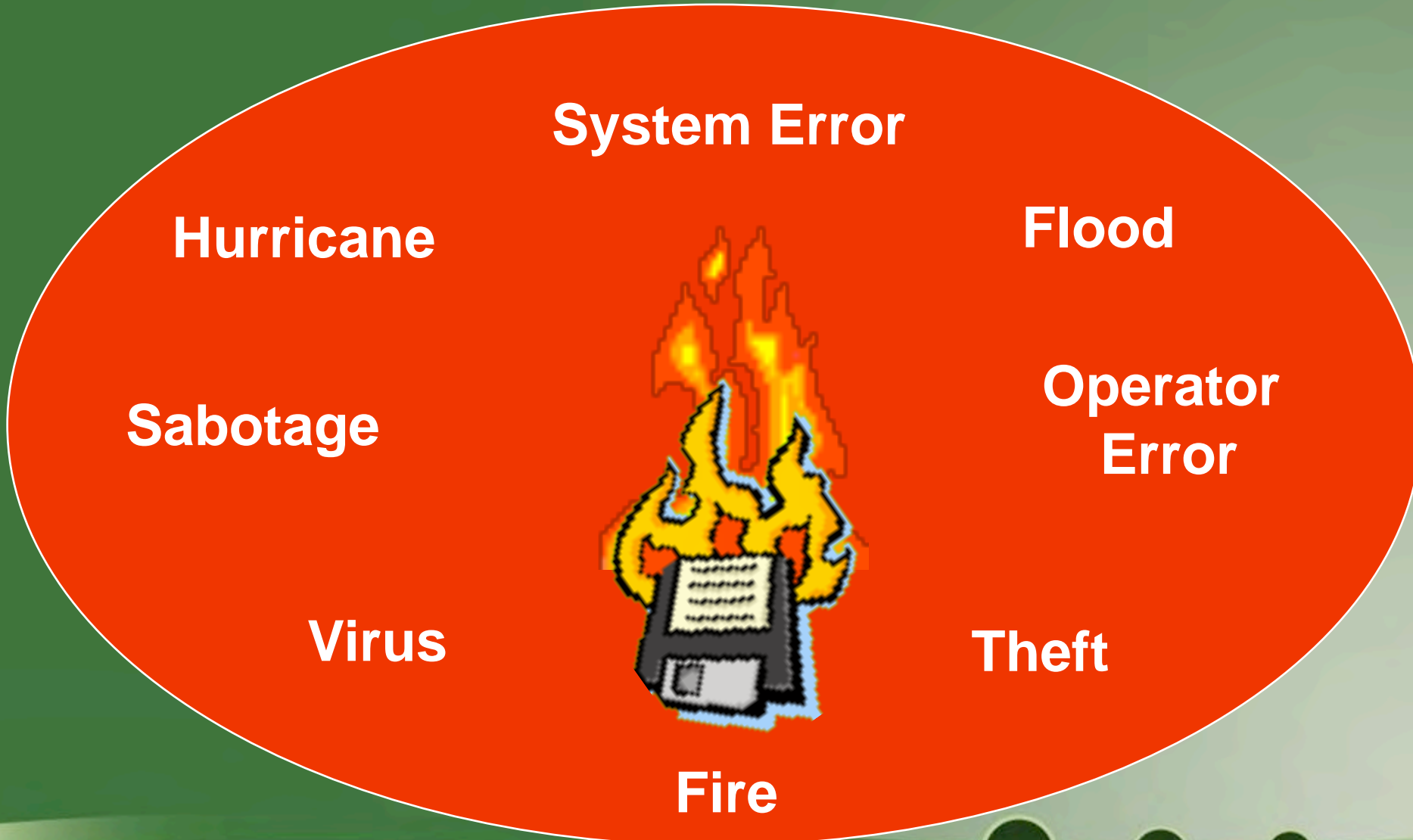
DATA MAY BE DESTROYED

Take the necessary action to safeguard your data.

[Security Message Code 21877]

This was only a simulation.

Your Data Is At Risk



Hard Lessons Learned

Blogging Service JournalSpace

Company Data is Wiped Out

- Completely wiped out after the drives that housed their entire database were overwritten.
- Problem: the backups weren't actually backups at all.
- Servers were set up with a mirrored RAID system
- If the primary drive should fail the secondary drive would be used to recover the primary.
- This alone is risky business: it only protects you from the failure of one drive.
- In this case, the drive didn't fail but instead due to system error the data was erased on one drive leading the other drive to follow suite and clear itself.
- A data recovery team was unable to retrieve the database.
- If you are replicating/mirroring and the data is corrupt then your replicated sites most likely have corrupt data

Don't Gamble With Your Data



Backup and Archive Best Practices – Protect Data

- **Have multiple degrees of protection:** at least 3 copies of data in different locations and one out of 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 I/O isolation:** at least one copy offline to avoid intentional / unintentional corruption* - Use tape
- **Protect access to data** at rest and in transit – Use tape 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

"You are out of your mind if you think you can live without tape."
Dick Cosby, Systems Admin.

■ Solution

- Create flash copy for fast retrieval and window-less backup to tape
- Backup 100% production data to LTO-4 tape and 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



Compliance and Data Security

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

RECENT LOSSES

- Nov 2007: 25m child benefit details on two discs
- Dec 2007: 7,685 Northern Ireland drivers' details
- Dec 2007: 3m learner drivers' details lost in US
- Jan 2008: 600,000 people's details lost on Navy officer's stolen laptop
- 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
- July 2008: 658 laptops stolen in four years
- Sept 2008: Details of thousands of criminals held on a computer memory stick are lost

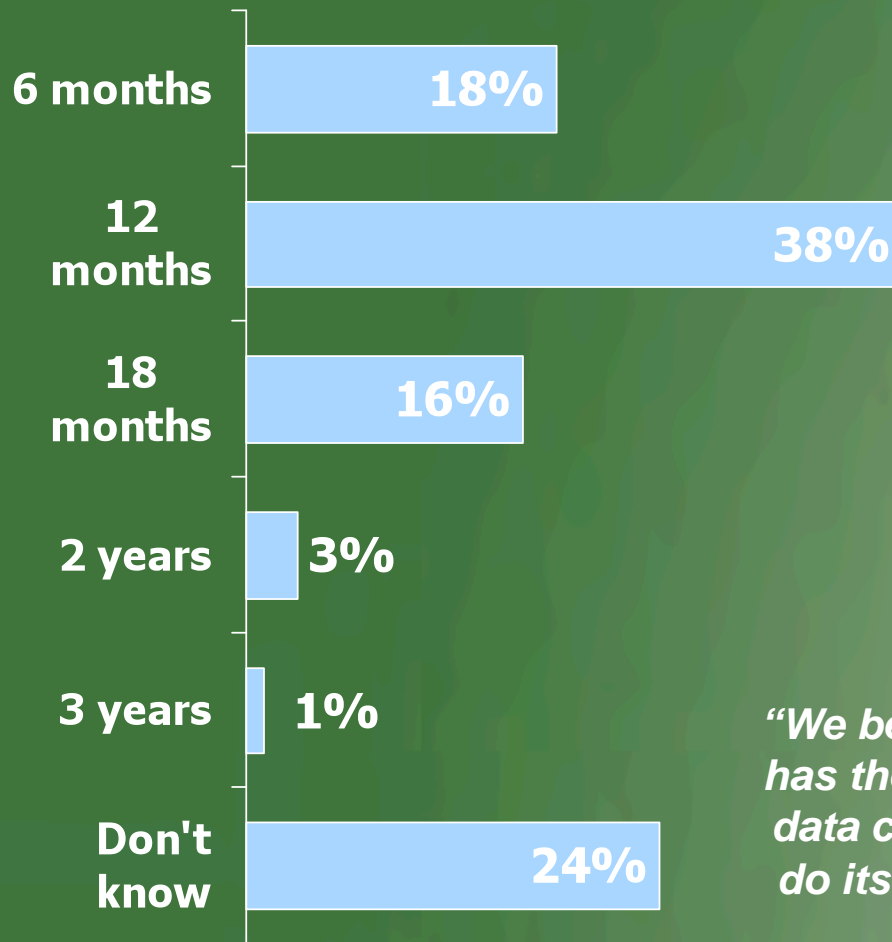
*A security breach can cost up to \$150 per record.**

Best Practices in Data Security*

- **SAN - secure against unauthorized access**
 - LUN Masking
 - Zoning
 - Port binding
 - Virtual or logical SANs
 - Fibre Channel Security Protocol (FCSP)
- **Data at rest – encrypt sensitive tape data especially that which will or could be transported off-site**



Survey: Encryption of Tape Backups on the Rise



Base = All respondents (n = 206)

“Will you be required to encrypt your tape backups within the next...?”

72% expect to encrypt tape data within the next 18 months.

“We believe tape encryption with LTO-4 products has the potential to become ubiquitous. Just like data compression, users can turn it on and let it do its magic.” Heidi Biggar, Enterprise Strategy Group, September 2007

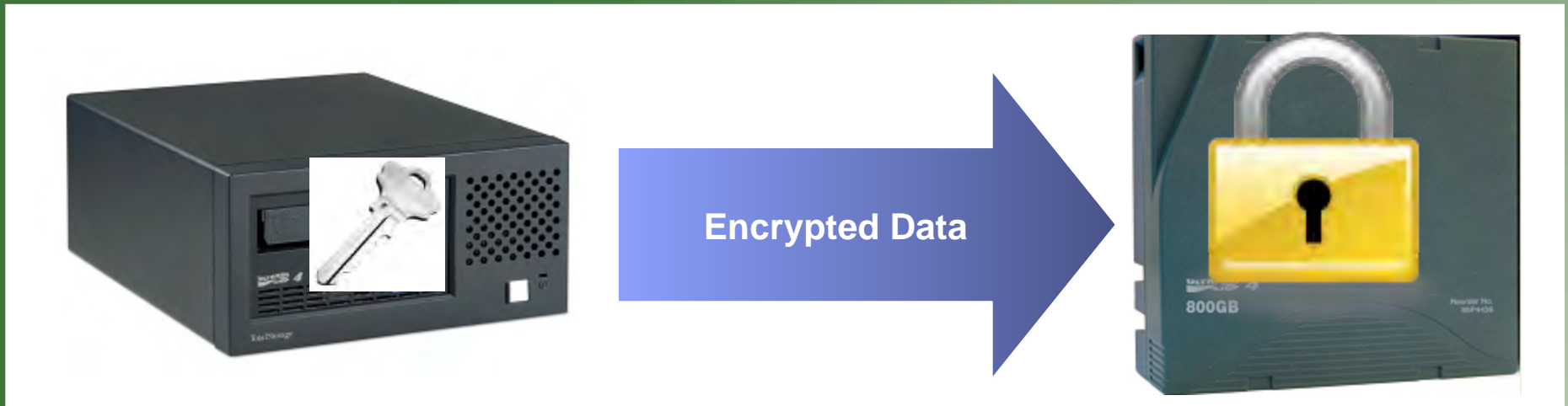
Tape Encryption: Helping Protect Vital Information

- **High performance**
 - Compresses the data then encrypts
 - Encryption at tape drive speeds
 - Off-loads encryption task from servers
- **Cost effective**
 - Leverages existing tape automation infrastructure
 - Can eliminate need for encryption appliances
- **LTO-4 Encryption**
 - AES-256 bit symmetric data key is used to encrypt data
 - Supports T10 SSC-3 standards based security protocol commands
 - Symmetric data key is stored in key store



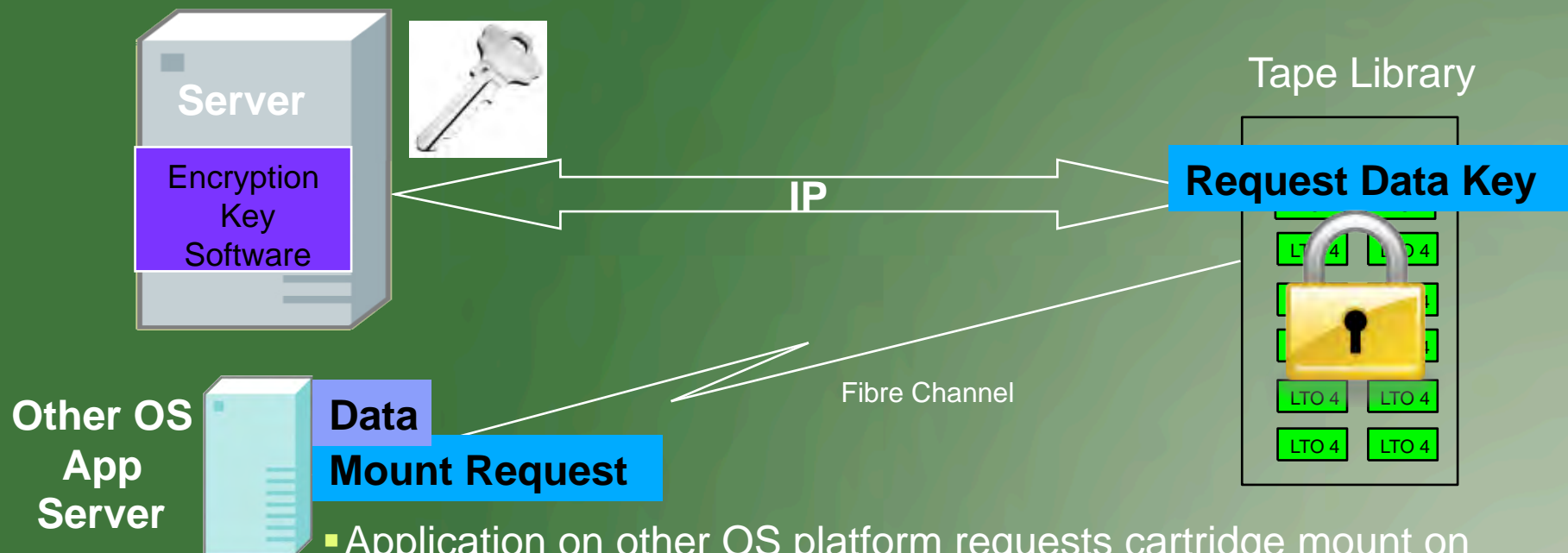
LTO Ultrium 4 Can Help Secure Your Data

Tape Drive Encryption Process Overview



1. AES 256 bit encryption data key provided to tape drive
2. Data is compressed then written to tape cartridge in encrypted form
3. Encrypted data helps protect sensitive information
4. Key management is “key” and is offered by system suppliers

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

Providence Health & Services Encrypts with LTO-4 Tape Drives



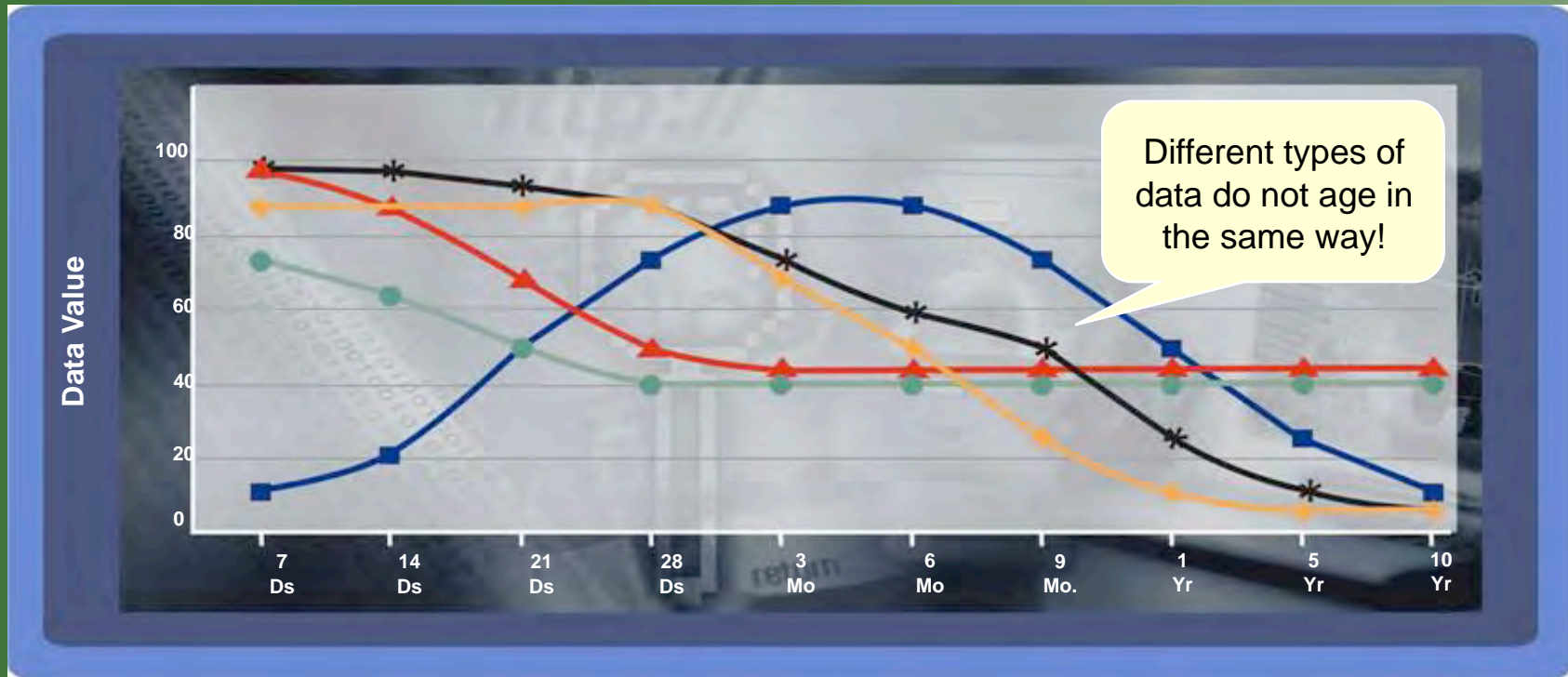
- Five data centers in four states all encrypting off-site media
- Daily backups are between 1 – 8 TB per site
- Centralized, automated data protection system eliminated manual management of backups
- Effectively established a disk to disk to tape strategy
- Assured data is protected – LTO-4 addresses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



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

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

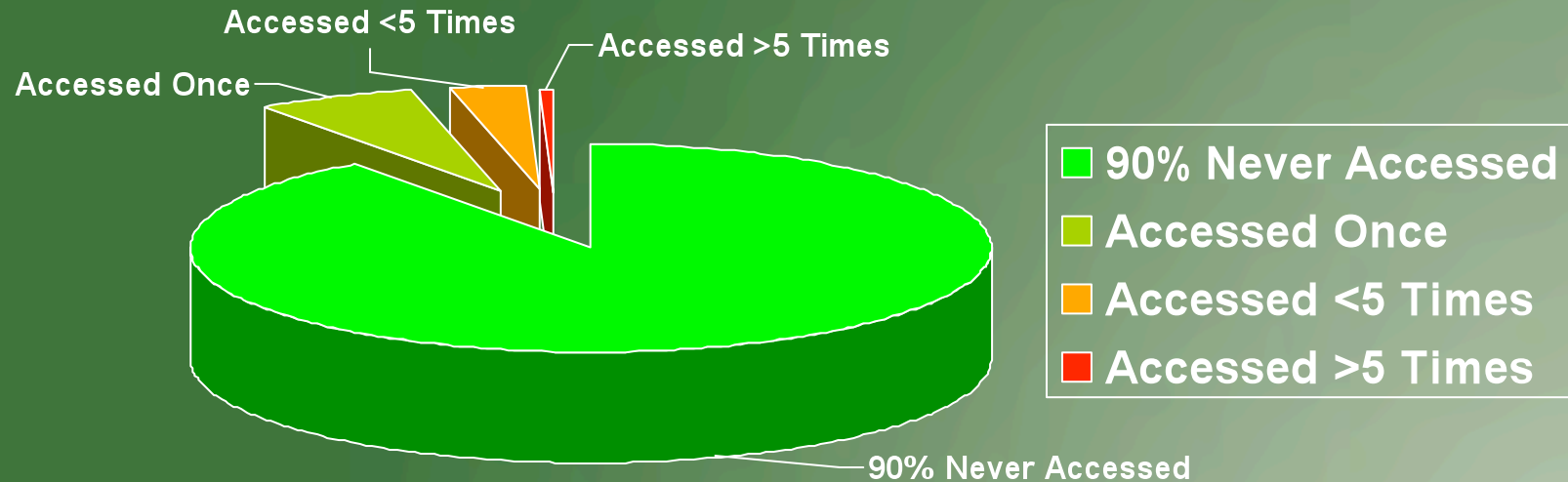
Not all data is Equal and Its Value Varies Over Time



- All data, when created, does not have equal value
- Data changes in business value and in service level requirements over time
- IT resources should be allocated according to the value of data, that is, its access frequency
- Data must be managed and leveraged effectively throughout its entire lifespan

Most Network Data Sits Untouched

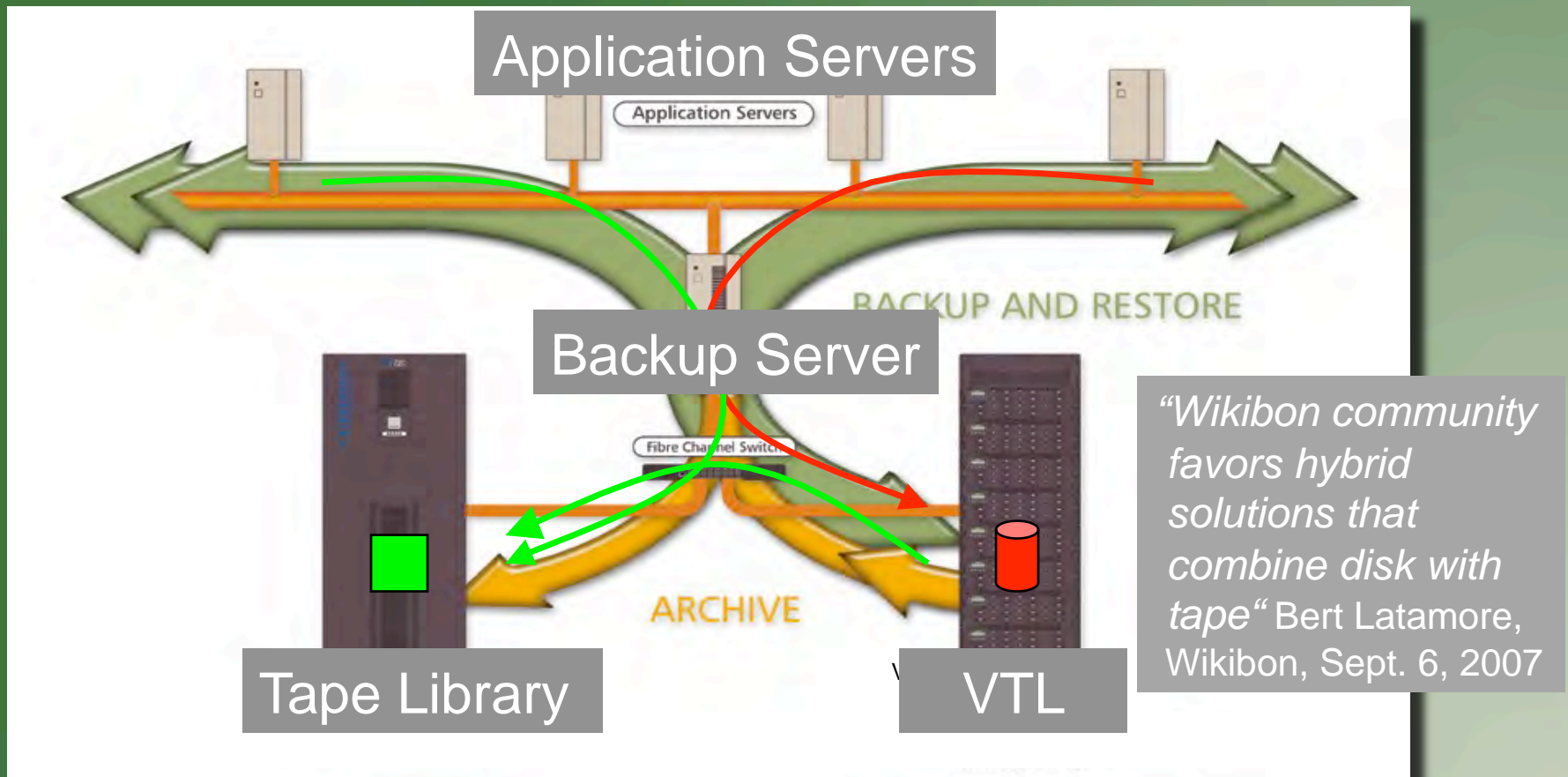
Access Patterns of Data Stored on Disk.



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

Blended Tiered Storage Example



Storage Manager Survey Results*

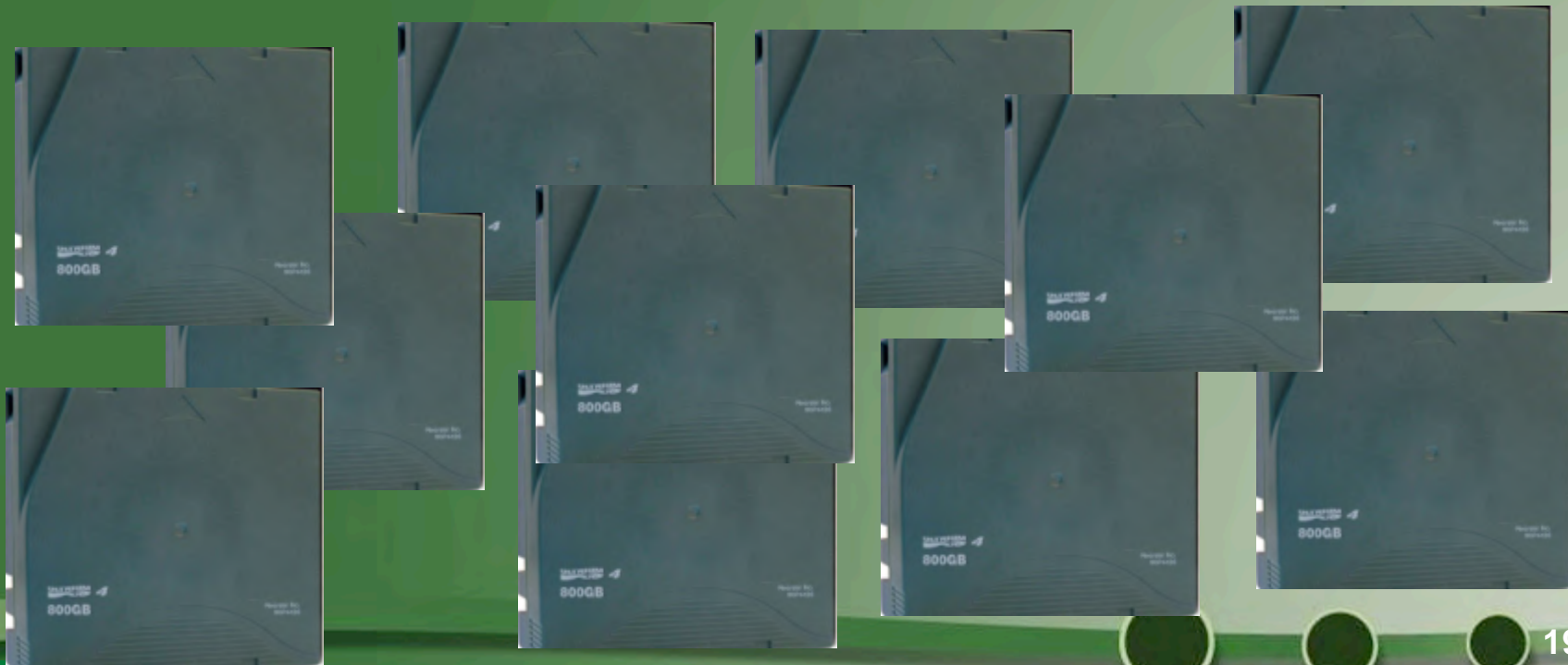
- 60% of current disk-only users plan to start using tape

*Source: Fleishman-Hillard Research Dec. 2009

The Value of Tape

- Tape is **removable** for data protection against bugs and viruses
- Tape is **portable** for optimum business continuity – offline - offsite
- Tape is **infinite capacity**.... LTO 4 is up to 1.6TB* per cartridge

When you need more capacity... just add more cartridges



*Assumes 2:1 compression

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just add more cartridges

- Tape is **fast**



LTO Ultrium 4 is up to 240 MB / second
That's 864 GB per hour!*

- Tape is **reliable from generation to generation**

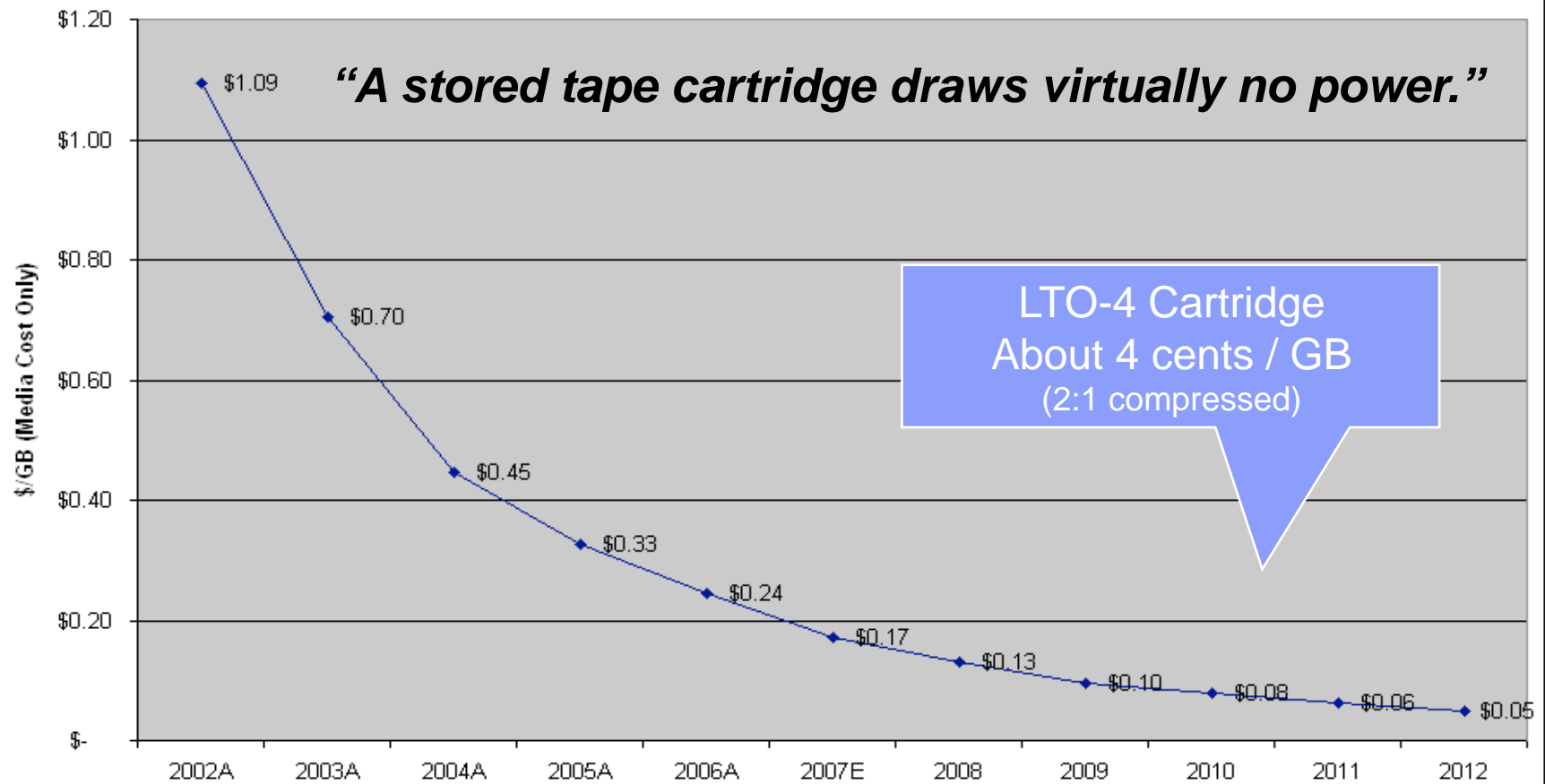


- Read after write verification to help assure data integrity
 - State of the art Servo Tracking and Heads for accurate reads and writes
 - Advanced metal particle media for reliability and longevity up to 30 years
 - 250,000 hours mean time between failure at 100% duty cycle
- Tape is **low cost**

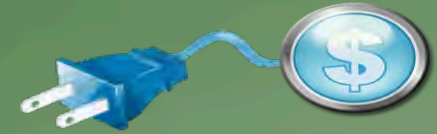
*Assumes 2:1 compression

Tape Cartridge Price/GB Estimates

Magnetic Tape Cost Improvement Projections



Source: Estimates from Industry Market Research & Imation

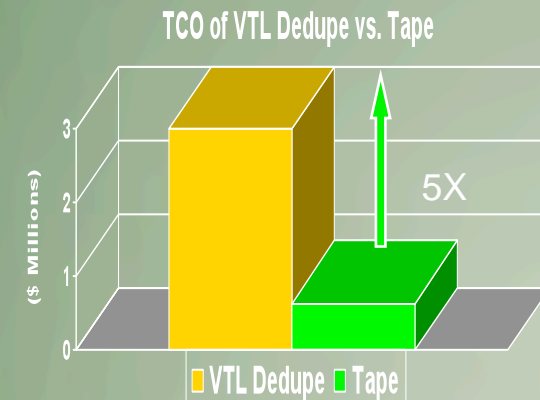
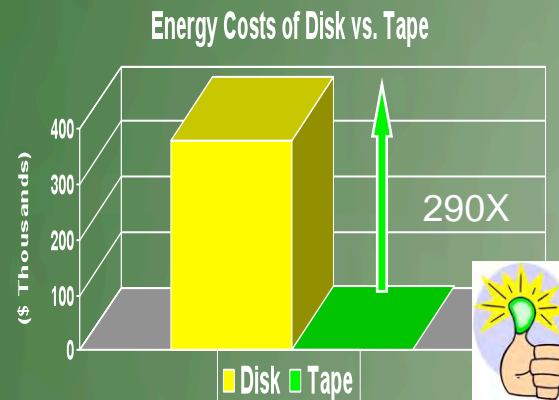
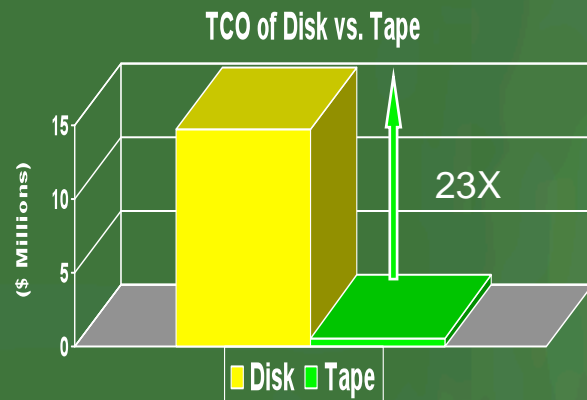


Disk and Tape TCO Archive Study

- 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**



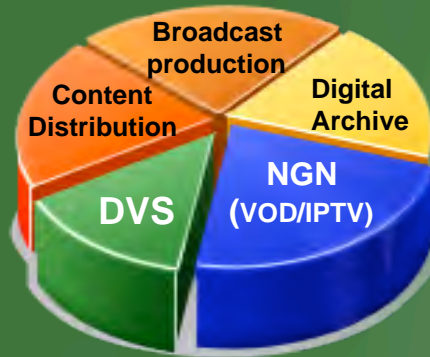
"Tape continues to provide the fiscal responsibility and functional value that enterprises require in the twenty-first century." The Clipper Group

*Source: The Clipper Group, "Disk and Tape Square Off Again" Report #TCG2008009LI, Feb 2008

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

Fox Goes Digital with LTO Technology

Improves Video Storage and Reduces Costs



Problem

- Production costs are rising
- Analog storage is aging and difficult to access
- High definition puts more demands on infrastructure

Objective

- Lower production costs especially analog tape
- Improve archive / retrieval process
- Improve the quality of output for audiences

Solution

- LTO Tape Library and drives, Linux servers
- Data base manager and backup manager

Benefits

- Significantly lower production costs for HD broadcasts
- HD broadcast content is now available on demand
- Better viewing experience for the audience
- Faster access to stored video and a longer shelf life



Note: Do not contact customer directly. Individual user results may vary.

Summary: Storage in the High Performance Data Center

Disk and Tape Work Together to Address Needs

- **Disk for backup target for some apps**
 - Fast backup & retrieval for high performance SLAs
 - Tape is a key target for low SLA apps
- **Tape for active and deep data retention**
 - Best practices
 - Offline for I/O isolation-protection
 - Portable for disaster protection
 - Different form of storage for media protection
 - Provides multiple copies economically
 - Lowest TCO and energy conservation
 - Long shelf life (up to 30 years)
 - High reliability
 - Encryption for data security
 - WORM capability for compliance



Thank You!

谢谢



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