

# ***LTFS***

## ***Linear Tape File System***

**Setting Your Videos and Data Free  
Now and for the Future!**



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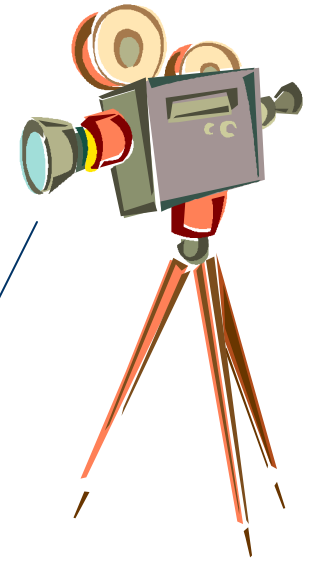
**Quantum<sup>®</sup>**

## **What is the LTO Program?**

- **HP, IBM, Quantum:**
  - Write LTO technology specifications and published roadmap
- **Specifications are open standard**
  - License to any organization
  - Over 30 Licensees
  - 5 Media Manufacturers (Fujifilm, Imation, Maxell, Sony, TDK)
- **LTFS for LTO-5 tape drive is a free download offered by HP, IBM, Quantum**

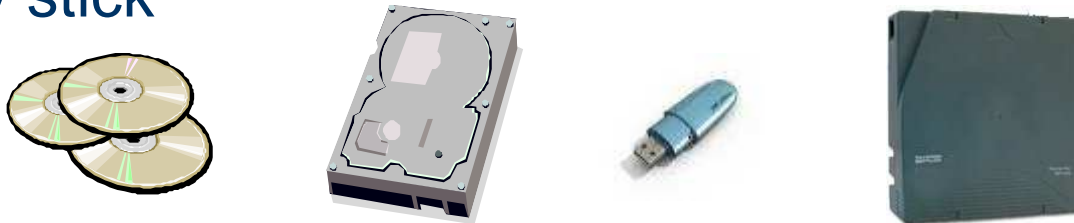
# Agenda

- What is LTFS?
- How does it work?
- What are the cost comparisons?
- What are the benefits?
- What LTFS Supported Offerings are Available?
- LTO User Stories
- What the experts are saying
- How do I start using LTFS?



## What is the Linear Tape File System?

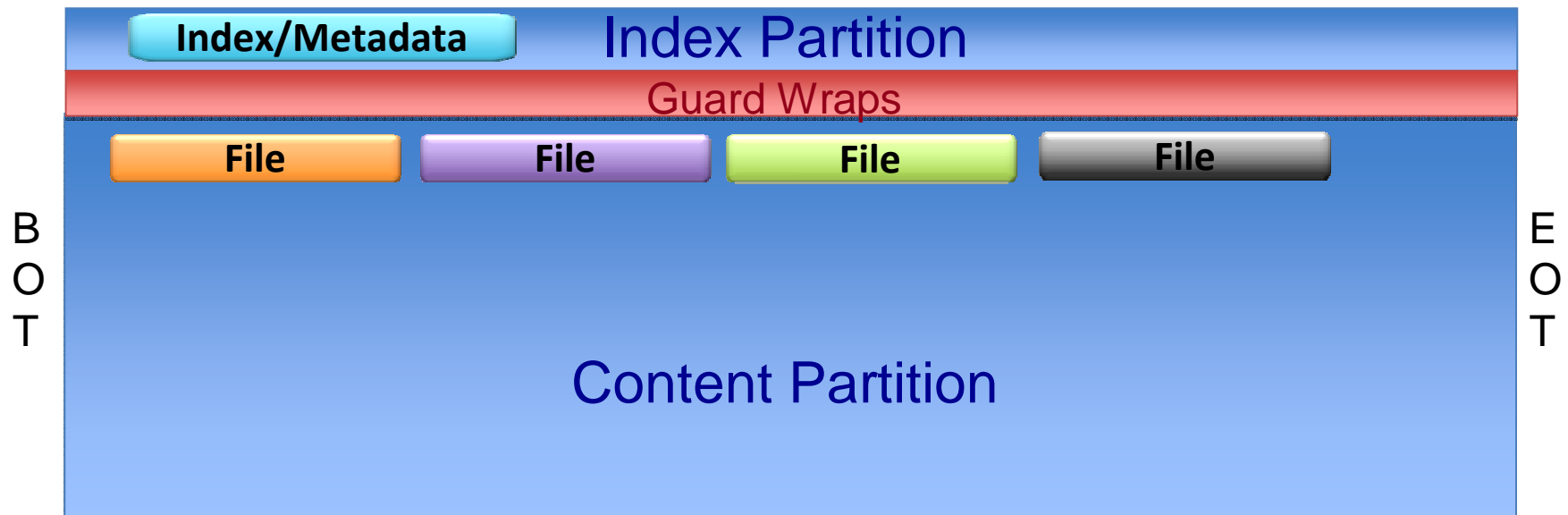
- A open software specification that allows simple and new ways of accessing data on tape  
(LTFS spec doc available at: [www.ultrium.com/lvfs](http://www.ultrium.com/lvfs) )
- Self-describing tape format to address data archive requirements
- Implemented on dual-partition LTO-5 tape
  - First partition holds the tape index / metadata
  - Second partition holds the content
- It presents a tape as an extension of the operating system: appears as another drive letter, icon or folder like a disk or memory stick



*LTO Tape Joins the Ranks of Easy to Use Portability*

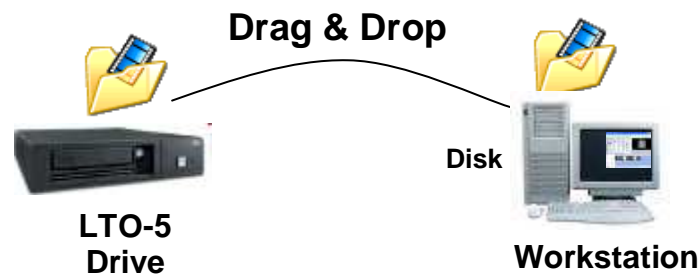
## LTFS: How does it work?

- LTFS utilizes media partitioning (new to LTO Gen 5)
- Tape is logically divided “lengthwise” into two partitions
  - **Index partition:** File system info, index, metadata (37.5 GB)
  - **Content partition:** Contains the files / content bodies (1425 GB)
- When mounting the tape, the Index is copied to the workstation/server memory for fast access and updates
- Periodically the index is backed up to the content partition



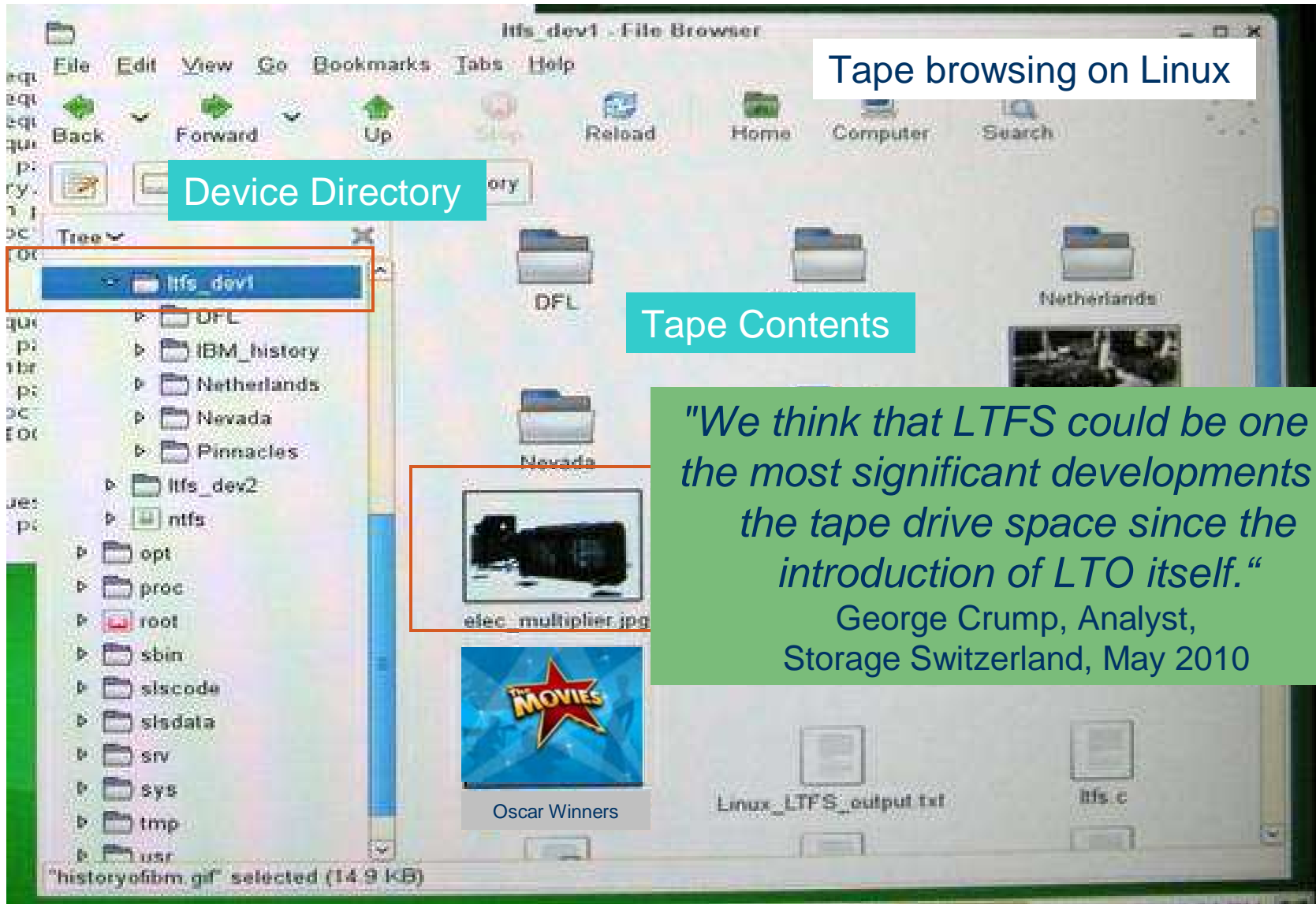
## How it works: LTFS – Drag and Drop

- File access on an LTO-5 is similar to hard disk, CD/DVD disc or USB media
- Access with OS browser (e.g. Windows Explorer) and drag & drop to/from the tape
- Can use workstation applications: File Open, Write, Read, Append, Delete and Close from workstation applications
- Use directory tree structures: the tape can be used in a random access fashion...
- ...The Tape is still a sequential device
  - Requires media to be moved to the correct position
  - On average can take 40 to 60 seconds to reach beginning of file
  - After location of the file, provides a transfer rate of up to 140MB/s (280MB/s 2:1 compressed)

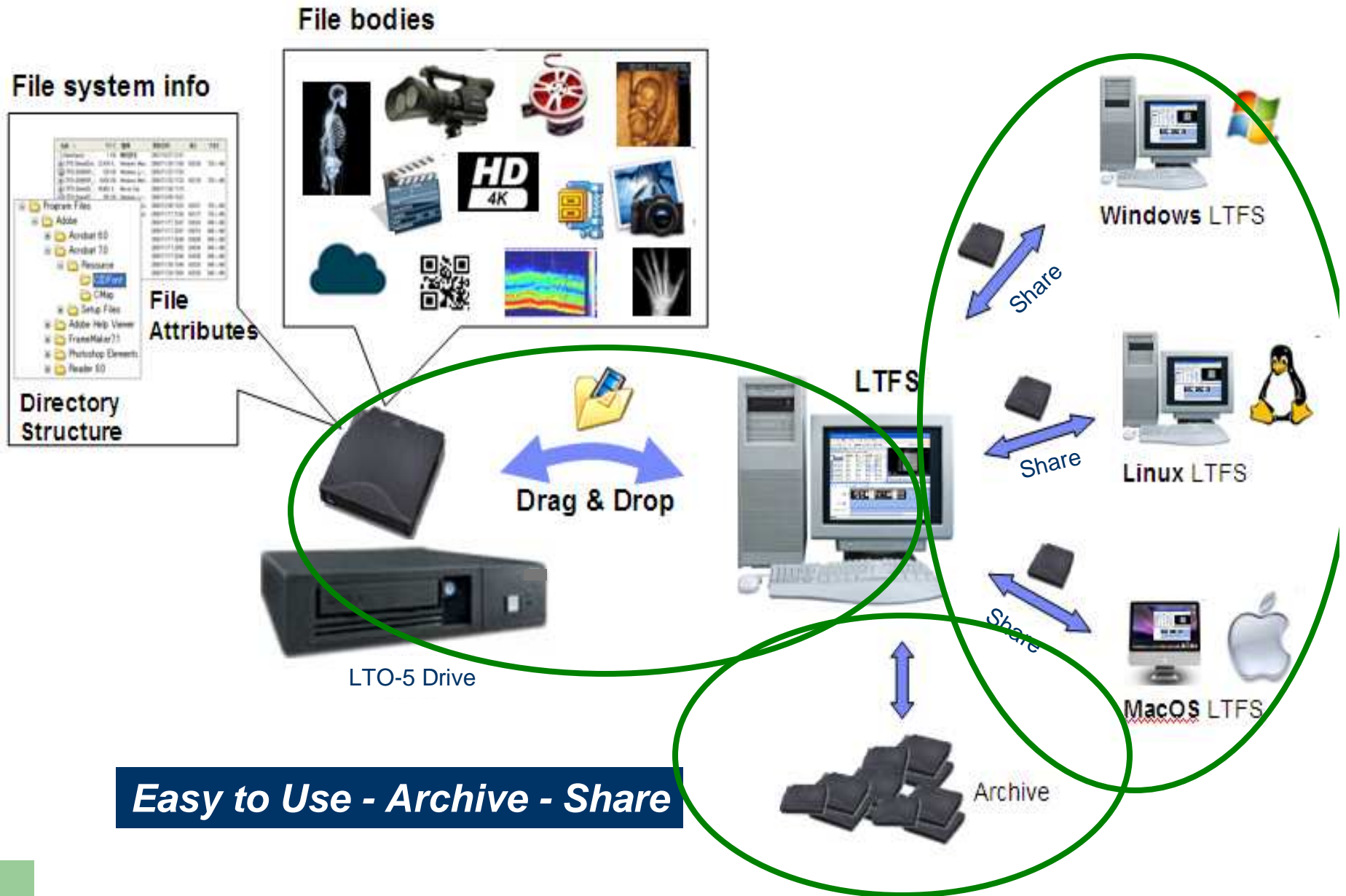


# How it Works: LTFS in Action with File Browser

Files can be accessed on tape directly from any application



# LTFS – Easily Exchange, Archive and Share Files





# LTO Tape Can Help Reduce Storage Costs

## LTO-5 Tape vs. Video Media

Format	GB	Cost per unit <sup>1</sup>	\$ / GB	LTO Tape Advantage
LTFS/LTO 5 tape	1425 <sup>2</sup>	\$52.50	\$0.04	NA
G-Tech G-Drive	3072	\$297.00	\$0.10	3 X
HDCAM SR tape	698	\$217.00	\$0.31	8 X
XDCAM disc	50	\$67.50	\$1.35	37 X
P2 SSD card	64	\$828.00	\$12.94	350 X

Source: MTMP March 2012

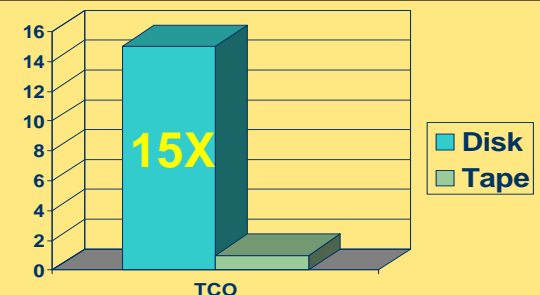
1. Cost per unit based on market prices as of February, 2012

2. Capacity of an LTFS formatted LTO 5 tape data partition

## TCO: SATA Disk System vs. LTO-5 Tape Library System<sup>1</sup>

- 12 Year TCO Archiving Study
- Back-end storage costs: hardware, maintenance, floor space and energy
- Disk storage is **15 times** Tape TCO

**The cost of energy alone for the average disk-based solution exceeds the entire TCO for the average tape-based solution**



<sup>1</sup>Clipper Notes report "In Search of the Long-Term Archiving Solution - Tape Delivers Significant TCO Advantage over Disk", The Clipper Group, Dec.23, 2010. This was a general TCO study and did not specifically focus on LTFS or video storage.

# Tape Reliability Soars

Both disk and tape have made significant reliability improvements in recent years. **For tape, reliability progress has been even better than disk** comparing the BER (Bit Error Rate), which is quickly becoming a more popular means of measuring reliability.

## Published Values for Bit Error Rate (BER)

Tape drives (Midrange and Enterprise)		
Midrange (typical LTO Ultrium drive)	Hard Error Rate	$1 \times 10^{17}$ bits


Disk (FC, SAS, SATA)		
Enterprise FC/SAS	Hard Read Errors per Bits Read	1 sector per $1 \times 10^{16}$ bits
Enterprise SATA	Hard Read Errors per Bits Read	1 sector per $1 \times 10^{15}$ bits
Desktop SATA	Hard Read Errors per Bits Read	1 sector per $1 \times 10^{14}$ bits

BER is the percentage of bits that have errors relative to the total number of bits received in a data transfer

**LTO Tape: 1 bit error in 100 Petabytes**  
**Ent. SATA disk: 1 bit error in 1 Petabyte**

# LTFS: What are the potential benefits?

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



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



- **Easy to use**

- View contents in OS browser directory tree
- Simple "Drag & Drop" movement of data

- **Improved archive storage**

- "Memory stick like" self describing file system
- Tape can tell you what's on it now and in the future
- Up to 30 year shelf life

- **Increased data mobility-portability**

- Compatibility across OS environments
- No backup/archive software needed to view content
- A single storage media standard
- File, HW, SW and camera agnostic



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

- **Reduced costs and energy consumption**

- LTO tape is less expensive than other storage formats
- Tape is "green"...a cartridge draws no power!



# Some Independent LTFS Supported Developments



- **1Beyond**: high performance video production and post production, tapeless workflow and storage systems (<http://www.1beyond.com/>)
- **Arkivum**: assured archiving, 100% guaranteed safe data storage service (<http://arkivum.com/>)
- **Cache-A**: archive appliances serving the digital video industry (<http://cache-a.com/about.php>)
- **Crossroads**: online, file-based archive, combining disk storage with LTFS tape storage for a fast, cost effective, long-term data archive ([www.crossroads.com](http://www.crossroads.com))
- **Digital Media Logix**: LTFS enabled solutions for M&E, Video Surveillance, Archive Management (<http://digitalmedialogix.com/>)
- **FOR-A**: innovative products & advanced video/audio technology (<http://www.for-a.com/>)
- **Masstech**: media asset management (MAM) solutions for the media and entertainment industry ([www.masstech.com](http://www.masstech.com))

## And more...LTFS Supported Developments



- **Panasonic**: this product can easily archive P2 content and preview P2 content from LTO tape directly like video tape ([www.panasonic.com](http://www.panasonic.com) )
- **Qstar**: enterprise-class archive, data management and archive disaster prevention software ([www.qstar.com](http://www.qstar.com))
- **SGL**: content archive and storage management solutions to the media and entertainment (<http://www.sglbroadcast.com/> )
- **Storage DNA**: Intelligent LTO-5/LTFS archiving for file-based workflows, application archiving (Avid, Final Cut etc.) and continuous backup (<http://storagedna.com>)
- **T3Media (formerly Thought Equity Motion)**: large scale archive management and “smart content” metadata tools ([www.t3media.com](http://www.t3media.com))
- **TOLIS Group Inc**: Bru Backup Software-Producers Edition version 2.3.0 provides native LTFS support for OS X users (<http://knowledgebase.tolisgroup.com/?View=entry&EntryID=260>)
- **XenData**: LTO video archives for the media industry scaling to multiple petabyte enterprise solutions ([www.xendata.com](http://www.xendata.com))

# FotoKem Uses LTFS for Reality TV Post Production

- **FotoKem background**

- 700+ employees; HQ in Burbank, California USA
- Film lab & post production facility

- **Business Need**

- Must have reliable long term archive from XDCam disks
- TAR tapes not self describing
- Need ease of use, reliable technology, low cost



[www.fotokem.com](http://www.fotokem.com)

- **Solution - Benefits**

- LTO-5 tape library and LTFS; Open standard; Cross O/S platform compatibility
- Self describing tapes: Can easily determine tape contents with browser
- Offers long term reliable archive, easy to use, cost effective
- Can store 100 XDCAM disks on 1 LTO-5 tape
  - Saves considerable space
  - Allows reuse of XDCAM disks
  - Can make 2 LTO tape copies inexpensively (keep one copy onsite)

# AlphaTV Reduces costs with LTFS and LTO-5 tape technology

## The need:

AlphaTV in Greece needed to store huge amounts of television programming content while shrinking their storage footprint, creating efficient backups and reducing storage management costs.

## The solution:

AlphaTV deployed the LTFS, LTO-5 tape drives and a tape library to handle their television programming archive.

## The benefit:

- **Reduced physical storage footprint by 74%** from 1,507 sq. ft. to 388 sq.ft.
- **Lowered storage maintenance costs by 77%** from \$39,369 to \$9,186
- **Can now store three times the number of television series at 1% of the media cost** \$79-92, versus \$11,811 for one series on DVCPRO



*“I had to do the calculations for the LTO solution twice, because I could not believe that the amount of savings could be true.”*

*–Constantinos Colombus,  
chief technology officer,  
AlphaTV*

# BAMM.TV Archives Music Videos to LTO-5 Tape and LTFS



“LTO-5 technology is very reliable. Over the last year we’ve used over 60 tapes and have had zero failures!”

Jamie Morganstern, Director of Operations

## ▪ **Company Profile: BAMM.TV**

- San Francisco based
- Produces and distributes video for independent musicians
- 12 video / audio editors
- In house production and post-production

## ▪ **Business Need:**

- Large storage need (HD, Hoard all footage)
- SAN storage is expensive
- Removable HDs are fragile (~8% failure rate), limited shelf-life, expensive and take up excessive space
- On site and off-site copies are needed
- Video/data is BAMM’s livelihood and must be protected!

## ▪ **Solution Results: LTO-5 Technology with LTFS**

- Effectively backed up 80TB of uncompressed video and finished projects
- Slashed storage costs from ~ \$0.20/GB to ~\$0.05/GB
- Built an archive and restore workflow with fast recovery
- Scalable archive solution with a 30-50YR life
- LTFS standard format for easy sharing
- Assured data is protected with reliable off-line and off-site protection

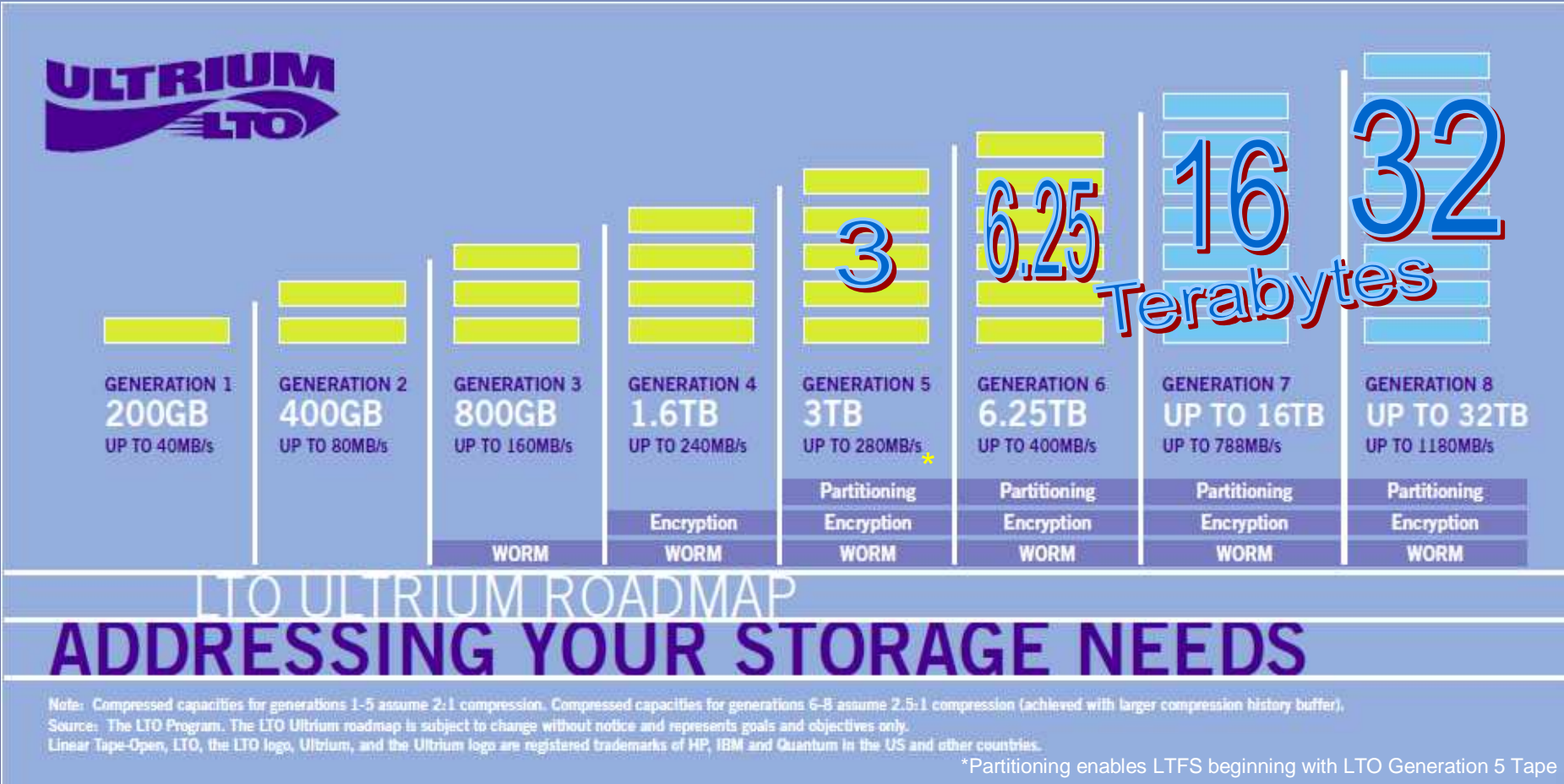


# What the experts are saying!



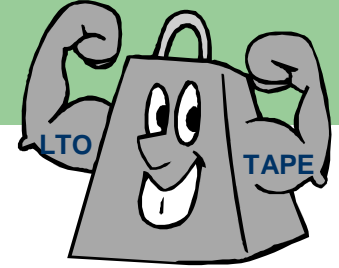
- **Hot Storage for 2012! LTFS: “...opening up new new possibilities for incorporating tape into workflows and making archive easier”** Storage Magazine
- **LTO5 with its own File System: An Enabling Technology for Archive, Backup, Simple DR - even the Cloud**  
By Eric Slack, Senior Analyst, [Storage Switzerland](#)
- **LTO-5 and LTFS: Shaking the Pillars of Heaven**  
By Mark Ferelli, [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, [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, [SearchDataBackup.com](#)
- **What is LTFS? ...could be one of the most significant developments** in the tape drive space since the introduction of LTO itself.  
By George Crump, Storage Switzerland
- **LTO-5 with LTFS Gives Tape a New Lease on Life**  
By Jerome M. Wendt

# LTO Ultrium Roadmap to the Future



- ✓ Over 4M LTO Tape Drive Shipments
- ✓ Over 200M LTO Cartridge Shipments

# LTO-6 Specifications – Big Data Preservation



- **Optimal Blend of Attributes:**
  - Capacity, performance, compatibility, interchange, cost control
- **Store more with LTO-6 Tape – Reduced Space**
  - 2.5 TB/cartridge native: 6.25 TB / cartridge (2.5:1 compressed)
  - More than twice the compressed capacity of LTO-5 tape
  - That's about 50 DVD movies per cartridge
- **Improve Job Productivity**
  - Up to 160MB/sec native; Up to 400 MB/sec (2.5:1 compressed)  
43% increase over LTO-5 data rate
  - That's nearly 1.5TB of saved data per drive / hr (compressed)
- **Compatibility for Investment Protection – Ease Implementation**
  - Read/Write LTO-5 cartridges, Read LTO-4 cartridges
  - Interchange between vendor drives

# How do I get started using LTFS?

*For stand alone drives it's free!*

**1- Get an LTO-5 tape drive and LTO-5 cartridge.**



**2- Download and install LTFS software from your drive vendor's weblink.**

**3- Format and mount an LTO-5 cartridge using LTFS**

**4- Start using files on tape from your browser directory tree.**

*Now you can drag and drop files to and from your LTO-5 tape!*

Addresses the needs of industries with rich media such as:

- Media and Entertainment
- Digital Surveillance
- Medical Imaging
- Legal files / documents
- Architectural drawings
- Cloud applications and more!



# **LTFS**

**Linear Tape File System**

thank  
you!

**Learn about LTO technology at: [www.trustlto.com](http://www.trustlto.com)**

**New LTFS White Paper by MTMP at [www.ultrium.com](http://www.ultrium.com)**

**Learn about LTFS, see LTFS Videos and User Stories at:  
[www.ultrium.com/LTFS](http://www.ultrium.com/LTFS)**

# **Tape \$aves**

**LTO Tape Can Save Your Costs - Energy - Data - Company - Job**

**Come to the LTO Program Booth for a Live LTFS Demo**