



# New Challenges - New Solutions with LTO-6 Technology and LTFS

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LTO Consortium



## What is the LTO Program?



Quantum.

- › Technology Provider Companies: HP, IBM and Quantum
  - Write LTO technology specifications and published roadmap
- › Specifications are an open standard
  - License to any organization
  - Over 30 Licensees
  - 5 Media Manufacturers (Fujifilm, Imation, Maxell, Sony, TDK)
- › LTFS for LTO-5 and LTO-6 tape drive is a free download offered by HP, IBM and Quantum
- › LTO program website: [www.lto.org](http://www.lto.org)

## Agenda (all the bits and bytes)

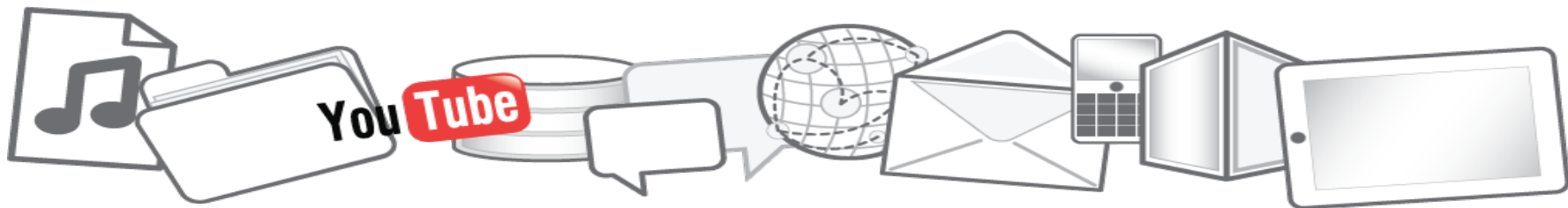
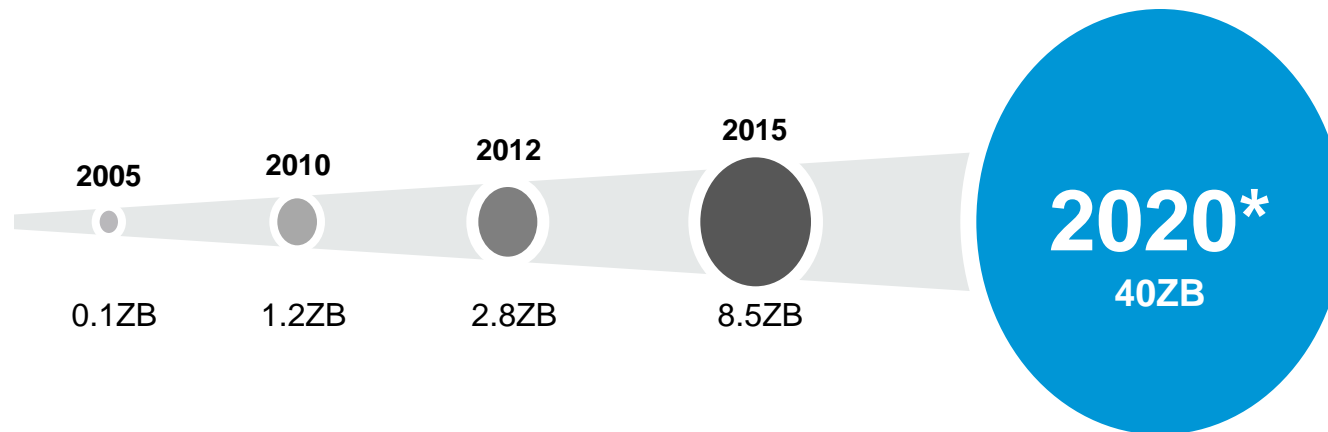
- › Storage Issues
- › Why tape is critical: Top 10 reasons
- › Best Practices in Data Protection
- › Overview – LTO-6 Technology
- › What is LTFS? How does it work?
- › User Examples

## Storage Issues...Objectives

- › Data content is growing faster than I can manage
- › Not all data is alike – need to treat them differently
- › Costs are out of control
- › Data access requirements are changing
- › My backup repository is growing
- › Need to easily transport some data
- › Must protect and preserve data assets now and for the future

# The Data Growth Challenge

Primary storage growth accelerating at unprecedented rates



Social Media is growing even faster

48 Hours of video are uploaded to YouTube™ every Minute!

IDC: Digital Universe 2012

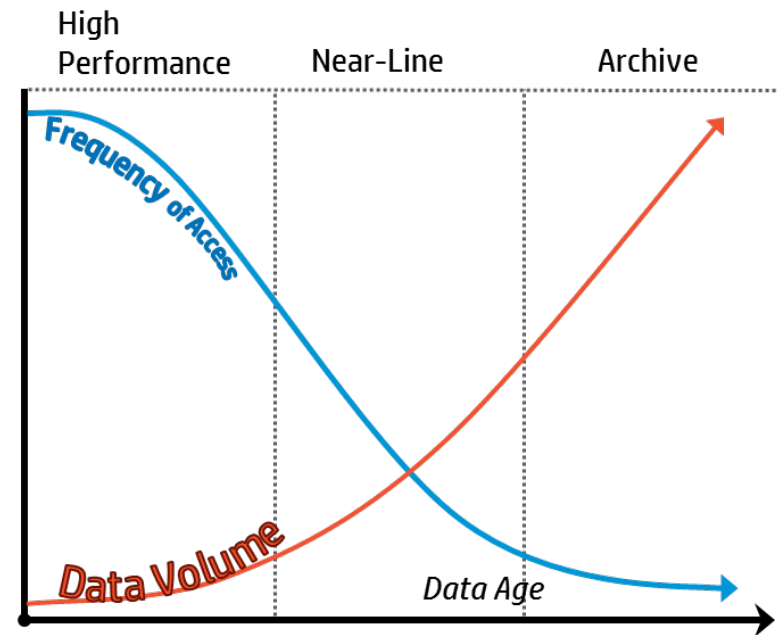
# Managing Data Growth

## ▶ Putting cold data on ice

- Estimates suggest that over 95% of data is never accessed again beyond 90 days after creation\*
- Actively archive older data from disk to less expensive tape
- Why fly all you data first class when coach will do?

## ▶ Delivering the most economical storage

- Saves power and cooling costs
- Minimizes floor-space utilization
- Infinitely scalable
- 30-year shelf-life for LTO Media enables long-term retention



\* Source: Government Computer News, "Most network data sits untouched" by Joab Jackson

# Numerous threats can corrupt and destroy your data

## ➤ LTO Technology provides the last line of defense

- Inherently off-line to intentional threats from virus, hackers, sabotage, disgruntled employee
- Easily removable for off-site storage – protects against accidental threats from natural disasters, fire, system errors, human errors, mirroring errors
- Easy to use – load, unload and storage of media

## ➤ Risks of downtime

- Lost of revenue and market share
- Lost of productivity
- Loss of reputation and customer trust
- Ultimately, loss of the business



# Managing Data Access

## Transactional *Databases and Analysis* (application data, block level, virtualization)

- I/O intensive
- Random read/write
- Large/Small files
- Modest storage growth
- Steady growth rates
- Mission Critical
- Block-level virtualization
- Structured data (mostly)

### Analysis Database



20GB



8MB

## Persistent Data *Files, Data Protection and Archive Data* (user data, file level, abstraction layer)

- Large files
- Very large storage
- Infrequent access
- Event driven
- Reference content
- Business vital
- Created but not modified
- Data accumulation
- Data integrity
- Long-term retention
- Explosive growth

### Backup



10MB

### Replication



20MB

### Maps



60MB

### Video



300MB

### Imaging



48GB

### Document



80KB

Transactional data

Persistent data

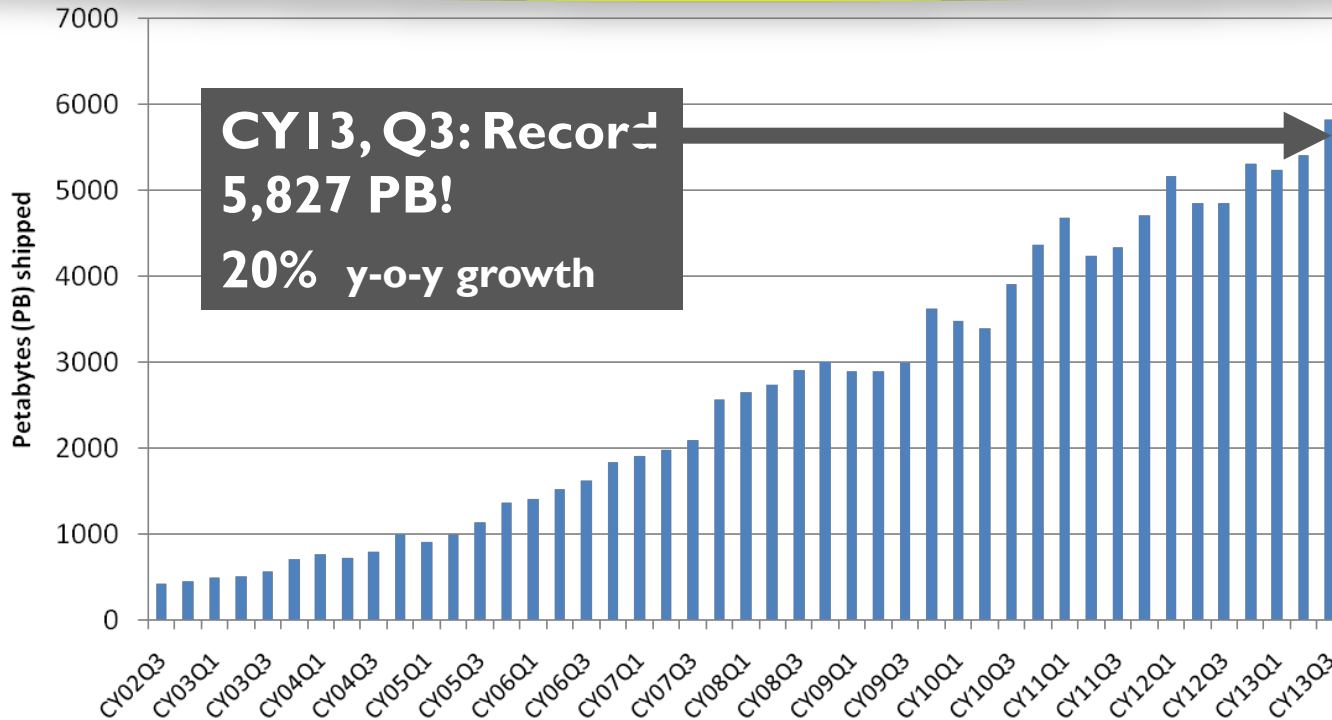
***Within 30 days the majority of data becomes “persistent data”.  
Users still want access to the data nearline***



# 10 Reasons for Tape

1. **Costs Less:** 1.3¢/GB compressed. Up to 26X less than disk.
2. **Easy to Manage:** PBs of tape vs. ~100TB of disk
3. **High Dependability:**
  - Read after write verification for high data integrity
  - Servo tracking to help ensure precision tracking
  - Better bit error rate than disk!  $1 \times 10^{17}$  bits vs.  $1 \times 10^{15}$  bits
4. **Data Protection:** off-line protecting against on-line data corruption
5. **Easy to Use:**
  - Tape automation has simplified the process of using tape
  - LTFS makes tape easier to use than ever before
  - NAS - like
6. **Long shelf life:** up to 30 years or more
7. **Scalable:** Add cartridges for nearly “infinite capacity” on demand
8. **Green storage:** cartridges on a shelf consume no energy
9. **Transportable:** Media is easy to ship --» high bandwidth in a box
10. **High Performance:** Streams very fast --» high capacity

# Tape media shipment capacities reach record levels to keep pace with data growth



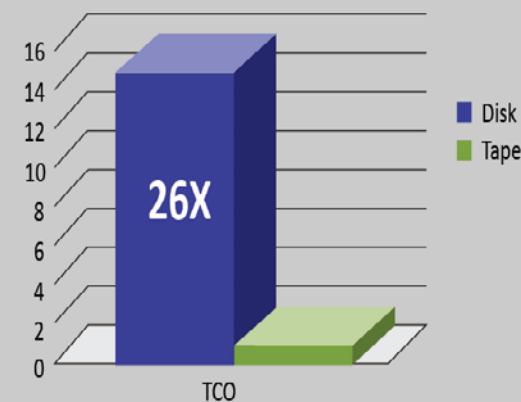
- LTO generation 6 is experiencing faster adoption than LTO generation 5
- LTO-5 tape maintains double-digit growth over previous year
- More than 6.4 million drives have been shipped since the program conception
- The 225 millionth LTO cartridge has been shipped
  - This totals 90,000 PB of data protected and retained using LTO technology

Source: Santa Clara Consulting CY13Q2 report

# LTO Tape Can Help Reduce Storage Costs

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

- 9 Year TCO Archiving Study
- Back-end storage costs: hardware, maintenance, floor space and energy
- Disk storage is 26 times the average Tape TCO
- The cost of energy alone for the avg. disk-based solution exceeds the entire TCO for the average tape-based solution



1. The Clipper Group Calculator report “Revisiting the Search for Long-Term Storage – A TCO Analysis of Tape and Disk”, May 13, 2013.

# Best Practices in Data Protection

## 1. Have multiple copies or layers of protection

- Depending upon value of data, keep at least 3 copies
- Keep in different locations; one out of region
- Use disk and tape

## 2. Isolate one copy

- At least one copy offline for logical system isolation
- Avoid intentional/unintentional corruption that can occur with online storage
- Use tape; Keep offline

## 3. Have technology diversification

- Copies on different forms of media to avoid media or system disaster
- Use disk and tape

## 4. Protect access to data

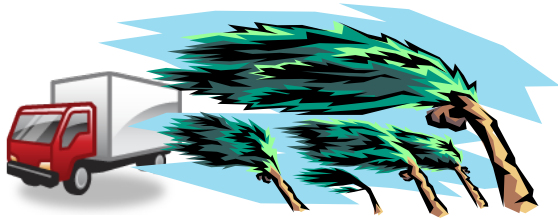
- At rest and in transit
- Use encryption & WORM

## 5. Manage backup differently than archive

- Backup: multiple, point in time consistent copies for operational and DR
- Use disk and tape
- Archive: single instanced data for long term retention
- Use tape

\*Best Practices Source: Debbie Beech, Sylvatica Consulting / David Hill, Mesabi Group

# Large Truck Express Line Survives Hurricane Flood



## Business Challenge

- Hurricane Gastone flooded Data Center with 5 ft. of water
- Total loss of HW, network, phone, generator, and utility power
- **Good news:** a tape backup of 100% of the data was made the night before – stored off site!

## Solution

- Protect assets and business resilience with best practice strategy
- Create nightly disk flash copy for fast retrieval and window-less backup to tape
- Backup 100% production data to LTO tape library nightly
- On-site and off-site copies
- Global Mirror DR site and backup to LTO tape library – Lights out!
- Creates 5 copies of data (2 offline on tape in different locations)

## Benefits

- No production system interruption
- No save window-Set it & forget it
- No production cycles, no operators, lights out operations
- Logical data protection and out of region protection
- Able to control TCO, access data and protect data with tiered storage strategy

" When it comes to disaster recovery, you can buy new hardware but you can't buy new data."

**Dick Crosby**  
Systems Manager, Estes

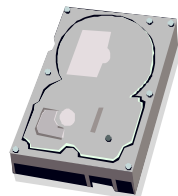
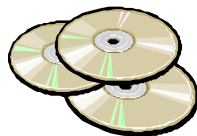
# LTO-6 Attributes – Big Data Preservation



- **Designed for an 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
- **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 1.5 TB of saved data per drive/hr (compressed)
- **Compatibility for Investment Protection**
  - Read/Write LTO-5 cartridges, Read LTO-4 cartridges
  - Interchange between vendor drives
- **Security**
  - WORM (Write Once Read Many)
  - Encryption

# What is the Linear Tape File System?

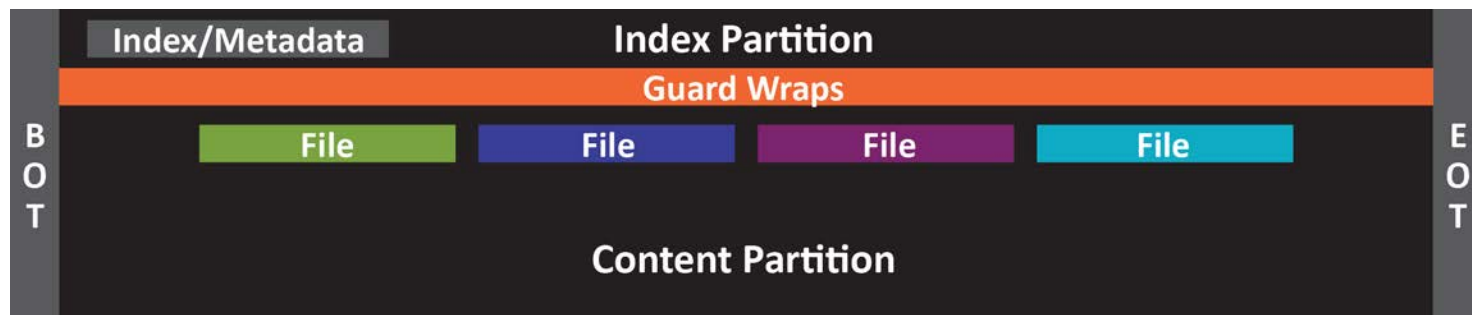
- Open software specification
  - Allows simple and new ways of accessing data on tape (LTFS spec doc available at: [www.lto.org/ltfs](http://www.lto.org/ltfs) )
- Self-describing tape format
  - Addresses data archive requirements
  - Tape tells you what is on it!
- It presents tape as an extension of the operating system
  - Appears as drive letter, icon, folder like a disk or USB stick
- No traditional backup software needed



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

## LTFS: How Does it Work?

- LTFS utilizes media partitioning (available on LTO-5 and LTO-6 drives) to create a self describing storage medium
- Tape is logically divided “lengthwise” into two partitions
  - Index partition: File system info, index, metadata (5% of capacity)
  - Content partition: Contains the files/content bodies
- 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



See LTFS Introduction video at [www.lto.org/technology/lfts](http://www.lto.org/technology/lfts)



# LTFS Benefits

## Easily View, Archive and Share Files

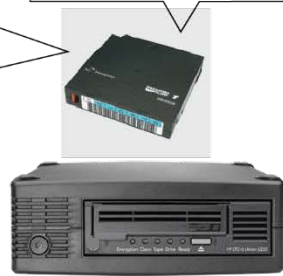
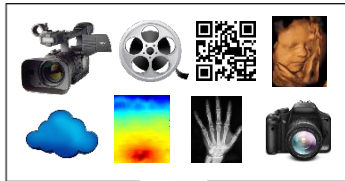
### File System Info

File Name	File Type	Ext.	Size in bytes
app10	Media File	*.MP	14,708
app101	CHM File	*.chm	565
app102	GP Image	*.gpf	1,027
Application	Application	*.exe	70,206
app201	3PL Document	*.xml	700
app202	3PL Image	*.jpg	1,119
app203	3PL Image	*.gif	4,657
CD File	CD File	*.iso	300
GP Image	GP Image	*.gpf	1,128
HTML Docu...	HTML Docu...	*.htm	14,281
HTM Docu...	HTM Docu...	*.htm	2,999
GP Image	GP Image	*.gpf	1,062
GP Image	GP Image	*.gpf	899
Text Docu...	Text Docu...	*.txt	1,389
GP Image	GP Image	*.gpf	305
HTM Docu...	HTM Docu...	*.htm	5,178
GP Image	GP Image	*.gpf	12,890
GP Image	GP Image	*.gpf	517
GP Image	GP Image	*.gpf	1,224
			11,211

**File Attributes**

**Directory Structure**

### File Bodies



Windows LTFS



Linux LTFS



Mac OS LTFS

**Easy to Use – Archive – Share**



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



## Company Profile

- 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 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 30-50 year life.
- LTFS standard format for easy sharing
- Assured data is protected with reliable off-line & off-site protection

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

**JAMIE MORGANSTERN,  
DIRECTOR OF OPERATIONS**

# How Do I Get Started Using LTFS?

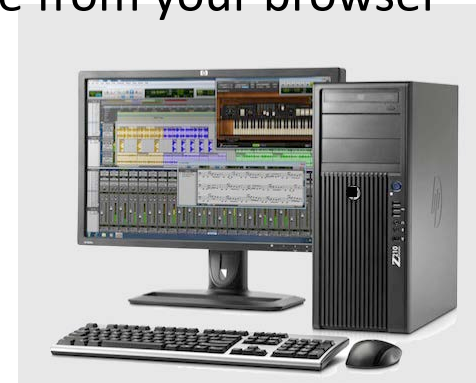
## Addresses the needs of Industries with rich media such as:

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

## LTFS software is free!

1. Get an LTO-5 or 6 tape drive and LTO-5 or 6 tape cartridge
2. Download and install LTFS software from your drive vendor's web link
3. Format and mount an LTO-5 or 6 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 AND 6 TAPES!**



**LTO.ORG**

Thank You!



Learn more about LTFS at: [www.lto.org/technology/lvfs.html](http://www.lto.org/technology/lvfs.html)

Thank You!

Q&A

# Backup Slides

# Some of the Many Vendors with LTFS Supported Developments

- › 1Beyond: [1beyond.com](http://1beyond.com)
- › Arkivum: [arkivum.com](http://arkivum.com)
- › Bright Technologies: [4bright.com](http://4bright.com)
- › Cache-A: [cache-a.com](http://cache-a.com)
- › Codex Digital: [codexdigital.com](http://codexdigital.com)
- › Crossroads: [crossroads.com](http://crossroads.com)
- › FOR-A: [for-a.com](http://for-a.com)
- › HP: [hp.com/go/ltfs](http://hp.com/go/ltfs)
- › IBM: [bit.ly/ibm-ltfs](http://bit.ly/ibm-ltfs)
- › Masstech: [masstech.com](http://masstech.com)
- › Odyssey: [odyssey.com.uy](http://odyssey.com.uy)
- › Panasonic: [panasonic.com](http://panasonic.com)
- › Qstar: [qstar.com](http://qstar.com)
- › Quantum: [quantum.com](http://quantum.com)
- › SGL: [sglbroadcast.com](http://sglbroadcast.com)
- › Storage DNA: [storagedna.com](http://storagedna.com)
- › T3Media: [t3media.com](http://t3media.com)
- › Tiger Technology: [tiger-technology.com](http://tiger-technology.com)
- › TOLIS Group Inc: [tolisgroup.com](http://tolisgroup.com)
- › XenData: [xendata.com](http://xendata.com)

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