Data Retention and Preservation
The IT Budget Killer is Tamed

Shawn Brume
The LTO Program
What is the LTO Program?

Technology Provider Companies

Write LTO technology specifications
Specifications are an open standard
- License to any organization
- Multiple Licensees
- 5 Media manufacturers
  (Fuji Film, Imation, Maxell, Sony, TDK)

Publish the LTO Roadmap
- 10 Generations
- Capacity targets of up to 120TB per cartridge
What is the challenge for IT professionals?

Data Growth
Driven by Unstructured Data

New Use cases are transforming storage

37 Exabytes

Growing 42% Per Year

125 Exabytes

80% Unstructured Data

Digital Archives
Low cost
Secure
Portable
Cold Data Dominates Storage

- 80% of data is untouched
- Prevent data sprawl
- Improve Margins with storage
- Fund I/O intensive workloads
  - LTO7 technology for long term retention

Tape in the Cloud

“Where do you think Zettabytes of data will be stored?”...you probably have to store it on tape.”
Aaron Ogus (Development Manager for Windows Azure Storage)

- Lowest cost storage\(^1\)
- Reduced Hardware replacement

- Reduce power consumption by up to 105\(^2\)
- Less media disposal

- Retain data on same media for 10 years reducing migrations
- Less resource spent replacing and rebuilding data storage

\(^1\) LTO.org LTO6 cost of storage announcement
\(^2\) Clipper Group Long Term Retention TCO
LTFS: The easy button for tape storage

- Tape drive appears as a drive letter
- Move data without an ISV
- Browse tapes like disk
LTFS has changed the world we live in
Information Lifecycle Management

- Quickly deliver the cost and performance advantages of tape

- Help control the cost of storage by moving cold data from tiers that rely on higher-cost disk drives to tiers that incorporate lower-cost tape media

- Provide the scalability, manageability, and performance in a single managed solution
Areal Density Trends

- **CD** (1982)
- **DVD**
- **HDD**
- **BluRay 3 layer 100GB**
- **Proposed roadmap 2 sided, 3 layer**
- **30% CAGR??**
- **33% CAGR**

**Gb/in^2**

- **1990**
- **1992**
- **1994**
- **1996**
- **1998**
- **2000**
- **2002**
- **2004**
- **2006**
- **2008**
- **2010**
- **2012**
- **2014**
- **2016**
- **2018**
Tremendous potential for future scaling of tape track density
Key technologies: improved track follow servo control improved media, reader, data channel

2015 Storage Bit Cells and Extendibility

Tape is not challenged even at the densest technology Demonstration
### Tape Reliability is Unsurpassed

<table>
<thead>
<tr>
<th>Device</th>
<th>Hard Error Rates in bits</th>
<th>Equivalent in Bytes</th>
<th>PB Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>SATA Consumer</td>
<td>10E14</td>
<td>1.25E+13</td>
<td>0.01</td>
</tr>
<tr>
<td>SATA Enterprise</td>
<td>10E15</td>
<td>1.25E+14</td>
<td>0.11</td>
</tr>
<tr>
<td>SAS/FC Enterprise</td>
<td>10E16</td>
<td>1.25E+15</td>
<td>1.11</td>
</tr>
<tr>
<td>Enterprise SAS SSD</td>
<td>10E17</td>
<td>1.25E+16</td>
<td>11.1</td>
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<tr>
<td>LTO7</td>
<td>10E19</td>
<td>1.25E+18</td>
<td>1110</td>
</tr>
<tr>
<td>Enterprise tape</td>
<td>10E20</td>
<td>1.25E+19</td>
<td>1120</td>
</tr>
</tbody>
</table>

### Bit Error Rate will continue to improve

![Tape Bit Error Rate Road Map](image_url)
Efficacious Storage...LTO Pays Back

In a 10 Year TCO Study

Disk Media costs raised by over **9X per year**

LTO media costs grew by less than **50%**

LTO has a **577%** Return On Investment!!
Tape Market: Stable and Growing

- Shipped Capacity continues to Grow YTY by more than 17%

- Capacity shipped shows significant uptick in 1H2016

- Units shipped show signs of market stabilization
  - 2015 unit shipments were an anomaly

- Introduction of LTO7 is driving greater units of LTO6
  - Driven by Low cost of LTO6 media.

- Tape media exceeding capacity demands of the market.
LTO Technology has a “BIG” Future

ADDRESSING YOUR STORAGE NEEDS

PARTITIONING
ENCRYPTION
WORM
LTO ULTRIUM ROADMAP

Note: Compressed capacities for generation 1-5 assume 2:1 compression. Compressed capacities for generations 6-10 assume 2.5:1 compression (achieved with larger compression buffer).

Source: The LTO Program, The LTO Ultrium roadmap is subject to change without notice and represents goals and objectives only.

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LTO Exceeds Modern Business Needs

**PR²OPEL** your storage

- **Protected** – Off-line content creates an “Air Gap” protection of data
- **Reliable** - Transform Archive data into revenue generating content
- **Reduce Environmental impact** – Less replacement of media = less waste
- **Optimize** – Reduce time to data by up to 3X in streaming applications
- **Portable** – Share content in a standard format (LTFS)
- **Expandable** – Add archive storage with no capital expense
- **Low Cost** - Reduce Storage costs by up to 90% over traditional disk storage