

A wide-angle photograph of a mountain range during autumn. The foreground and middle ground are covered in a dense forest of trees showing vibrant yellow, orange, and red foliage. The mountains in the background are dark and silhouetted against a sky filled with wispy clouds colored in shades of orange, yellow, and pink from a setting or rising sun.

# Removable Media Trends

## MSST 2025

Matt Ninesling

9/23/2025



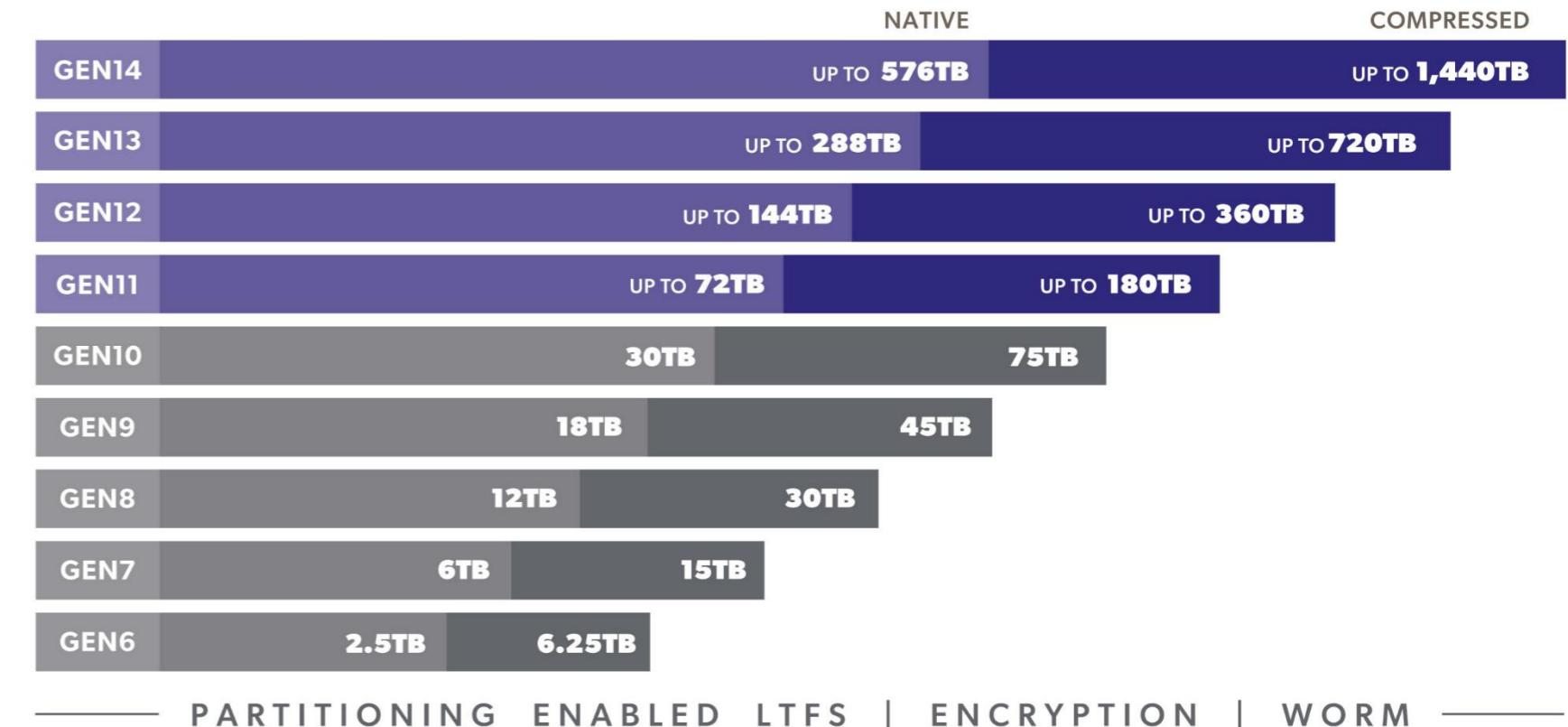
# 25 Years of LTO

## 25 years of LTO Dominance

- LTO-1 released in 2000
  - 100 GB per tape
  - 20 MB/s
- LTO-10 now available
  - 30 TB per tape
  - 400 MB/s
  - Designed for future generations

### LTO ULTRIUM ROADMAP

Addressing your storage needs



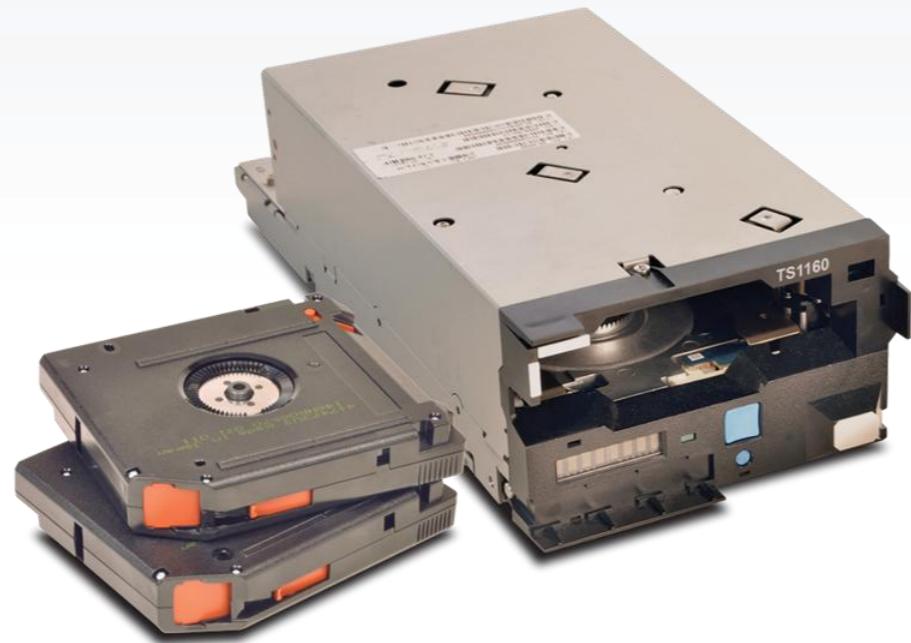
NOTE: Compressed capacities assume 2.5:1 compression (achieved with larger compression history buffer).

SOURCE: The LTO Program. The LTO Ultrium roadmap is subject to change without notice and represents goals and objectives only. Linear Tape-Open LTO, the LTO logo, Ultrium and the Ultrium logo are registered trademarks of Hewlett Packard Enterprise Company, International Business Machines Corporation and Quantum Corporation in the US and other countries. Please contact your supplier/manufacturer for more information.



Hewlett Packard Enterprise Company, International Business Machines Corporation and Quantum Corporation collaborate and support technology specifications, licensing, and promotions of LTO Ultrium products.

# First a Look Back



## TS1170

- Released August 2023
- 50TB native capacity, JF media
- 400 MB/s native throughput
- 16G fibre channel
- 12G SAS TS1170 also available

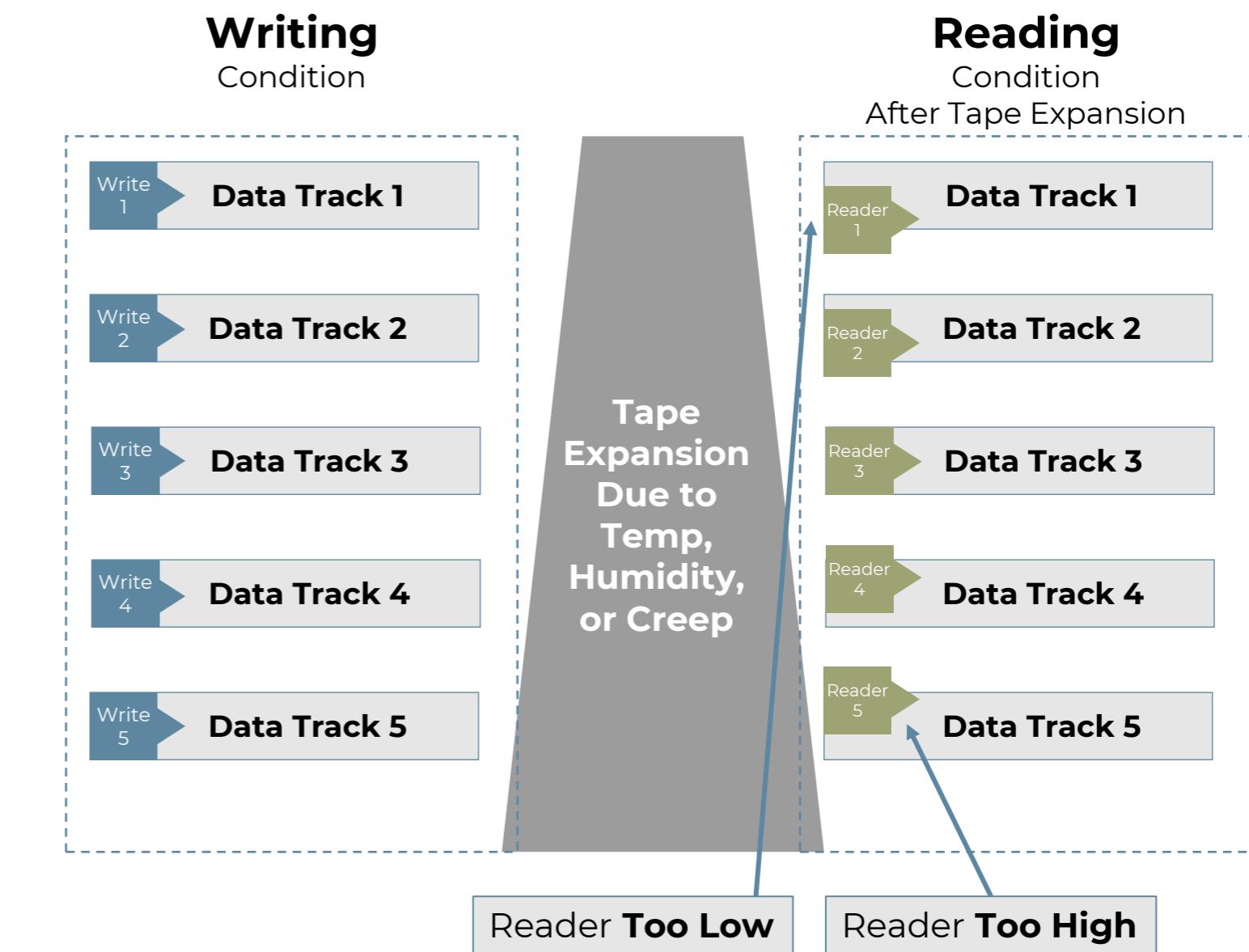


## LTO-9

- Released September 2021
- 18 TB native capacity
- 400 MB/s native throughput (FH)
- 8GB fibre channel
- 12Gb SAS FH now available
- Now with oRAO for similar read to TS11XX

# Challenge after LTO-9 Tape Dimensional Stability (TDS)

- Next challenge—but has solution
- Data is written on tape in a parallel fashion with 32 **writers**
- All 32 **readers** have to stay on their respective written tracks
- Variation in dimensions can occur in both the media and heads due to:
  - Temperature changes
  - Humidity changes
  - Tape tension variation
  - Tape aging/creep
  - Head wear/aging
  - Head manufacturing variation
  - Tape tension
- Any mismatch of track centerlines results in increased error rates for that channel



**TDS in an Example 5-Track System**

# Introducing LTO-10

## *A Revolutionary Tape Platform*

- 30 TB Uncompressed Capacity
- 400 MB/s Throughput
- 32G FC or 12G SAS Copper or Active Optical
- New Strontium Ferrite Media
- No Backward compatibility
- Entirely New Platform
- Available now



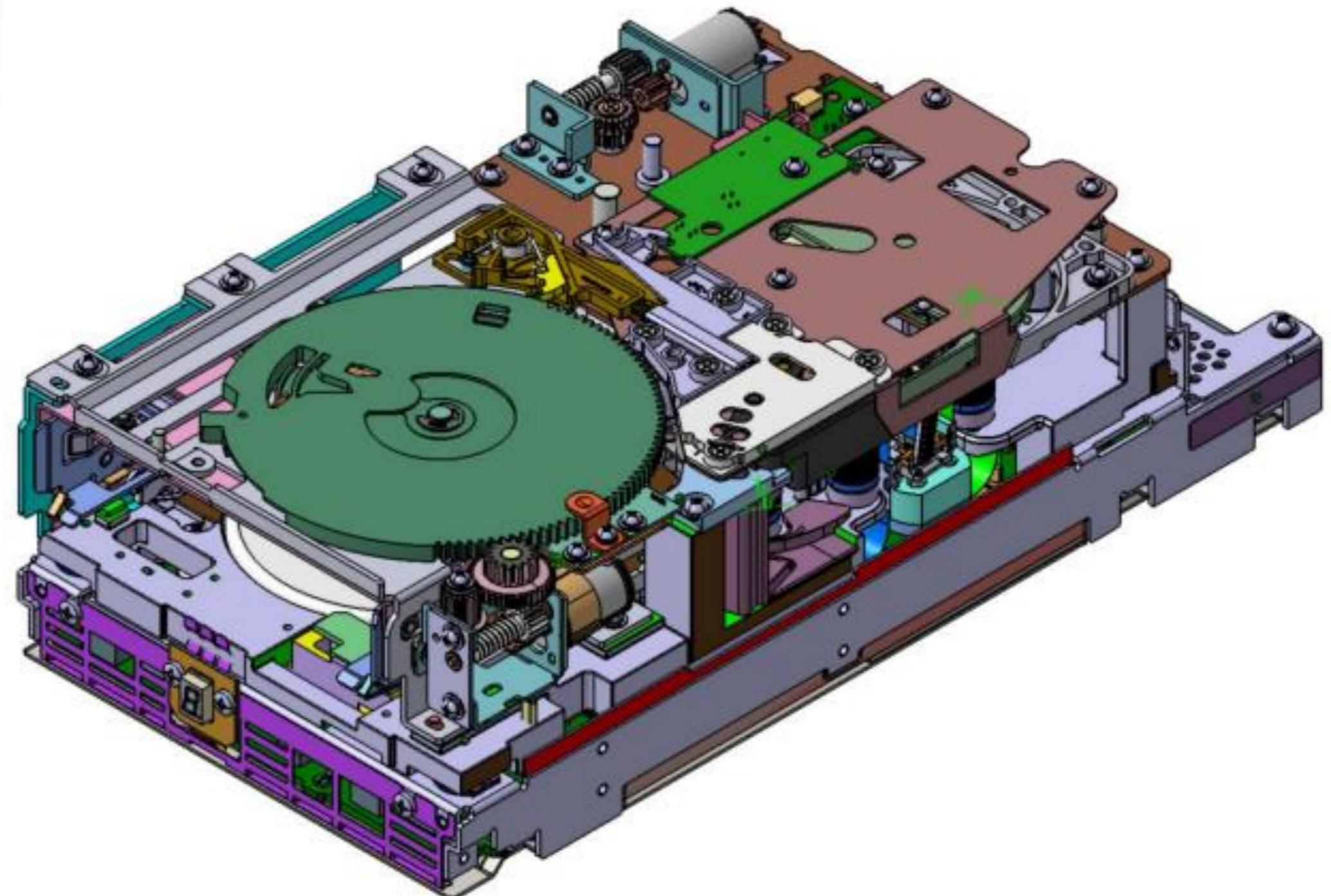
# Breakthrough Technologies

## New Platform enables LTO-10, LTO-11, LTO-12 and beyond...

- Deeper Deck/Actuator
- Data Flow ASIC
- Writer ASIC
- Analog ASIC
- Internal cabling



Data Flow ASIC\*

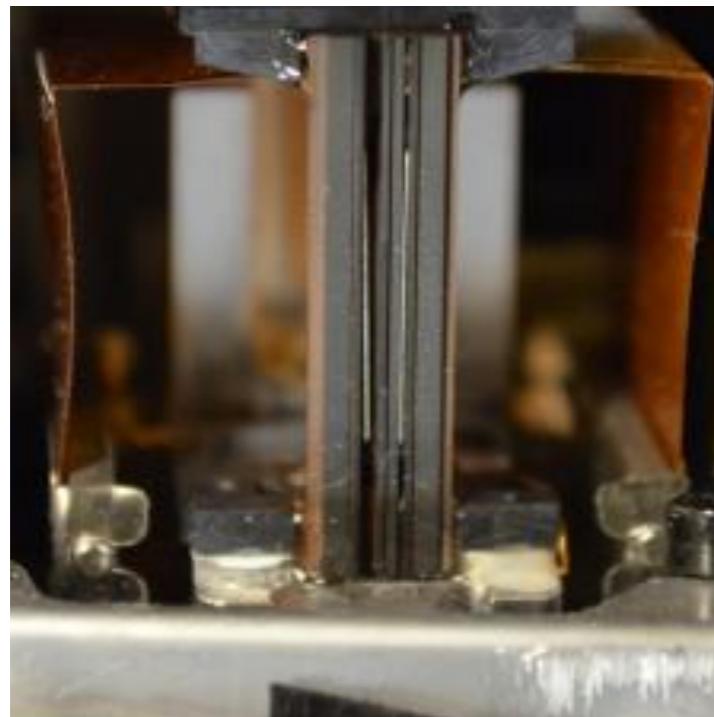


# Operational Simplification

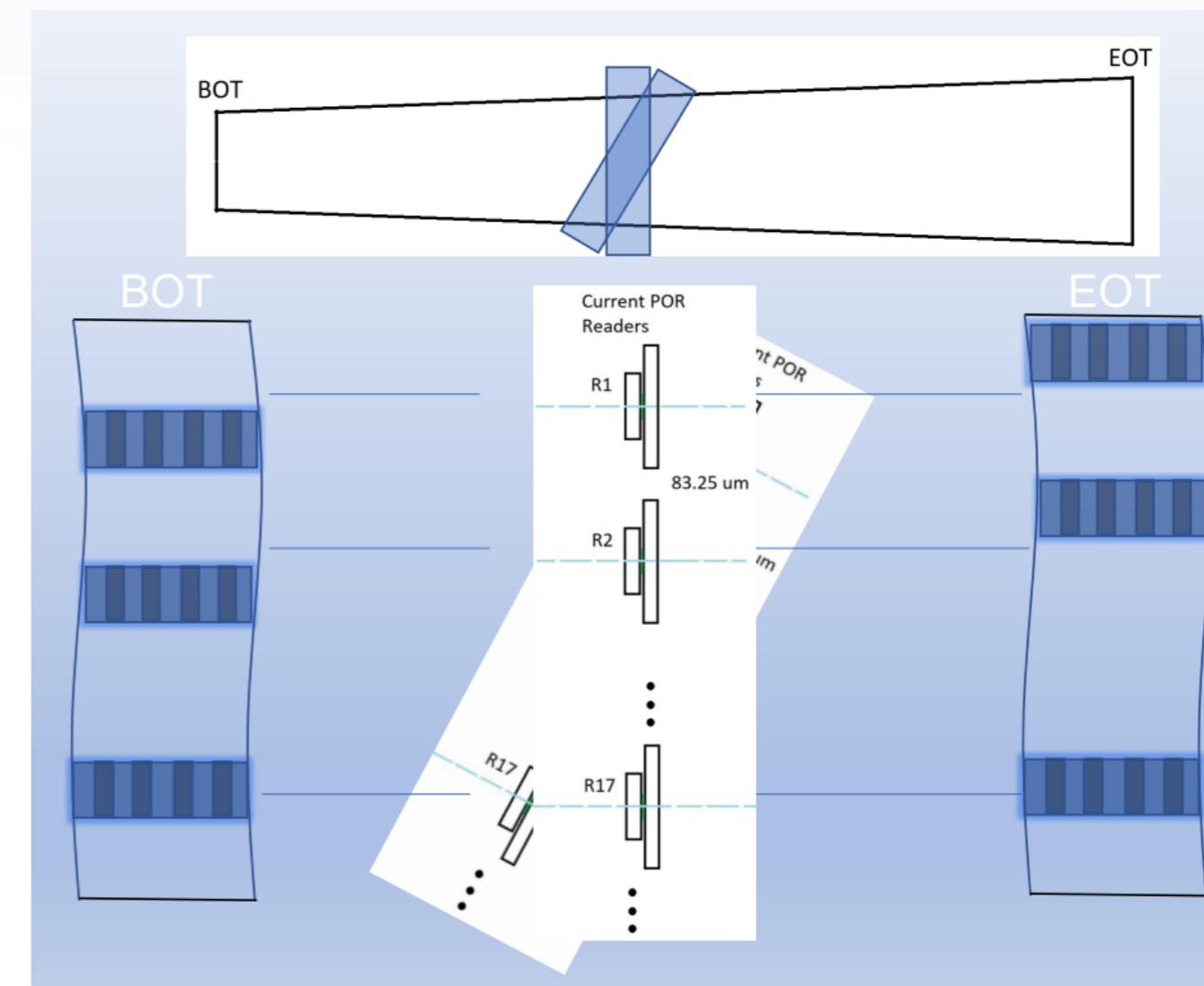
## Reimagined Read/Write Head & Tape Path

Pivoting 32-channel “Pisa” Head

- Improves Tape Dimensional Stability
- Eliminates Media Initialization
- Eliminates Archive Low Tension Unload
- Increases Environmental Design Margin



Pisa Read/Write Head\*



Pisa Head Geometry\*

# Spectra Tape Library Portfolio



Library	Max. Media/Slot Count <sup>1</sup>	Max. Native Capacity <sup>1</sup>	Max. Compressed Capacity <sup>1</sup>	Max. Drives <sup>2</sup>	Max. Native Throughput (TB/hr.)	Tape Drives Supported	Dual Robotics	Dimensions H x W x D (Inches) Rack Units
Spectra Stack	560	<b>16.8PB</b>	42.0PB	42 Half Height 21 Full Height	45.4 HH 30.2 FH	LTO	N/A	78.7 x 19 x 47 42U (Standard 19-inch rack)
Spectra Cube	1,670	<b>50.1PB</b>	125.3PB	30 Half Height 16 Full Height	32.4HH 23.0 FH	LTO	N/A	79.4 x 35.9 x 45.4 42U (Standalone frame)
Spectra T950	10,020 (LTO) (8-frames)	<b>300.6PB</b>	751.5PB	120	172.8	LTO	N/A	79.12 x 29 x 39.4 (45U) (Individual frame)
TFinity Plus	56,400 (LTO) (45-frames)	<b>1.7EB</b>	4.2EB	168	241.9	LTO, IBM® TS11XX and Oracle® T10000	Yes	79.12-82 x 29 x 43.25 45U (Individual frame)
	42,930 (TS1170) (45-frames)	<b>2.2EB</b>	6.4EB	168	241.9			

1. Capacities and throughputs are based on LTO-10 and IBM TS1170 tape technology.
2. Drive types are full height unless noted.



# SAS vs Fibre channel

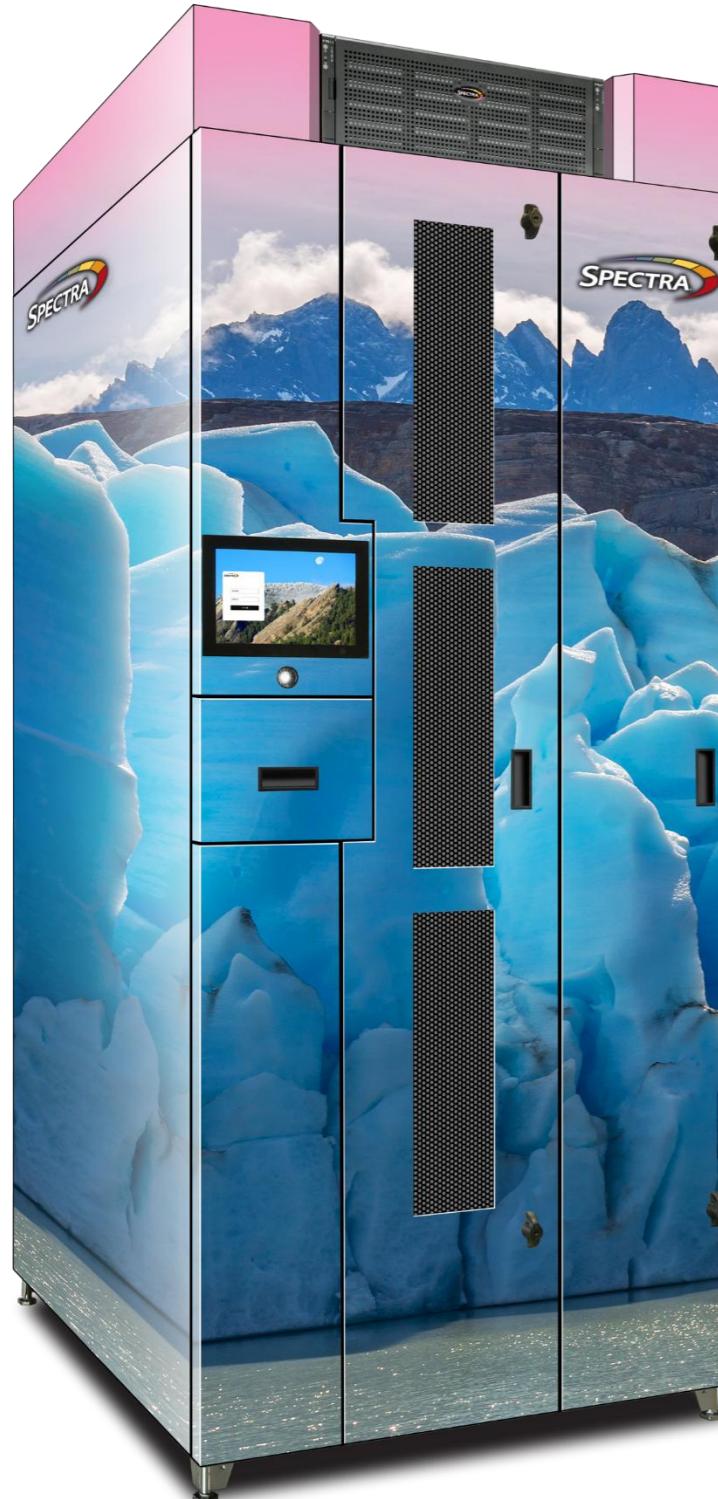




# Data Center Pain

- **Fibre Channel** is the traditional connection
  - Switches with complex Zoning
- Most Fibre has phased out for SAN in favor of Ethernet
- Expense continues to grow
  - 64G switches \$30-90K - plus HBAs, cabling, maintenance, expertise, etc
- Tape underutilizes Fibre bandwidth per drive
- Spectra customers openly vocal about wanting an alternative to Fibre Channel
- **SAS** is also available for Tape Drive connectivity
  - SAS is the highest ship by volume ~70% of the market
  - LTO-9 introduced FH-SAS , same with LTO-10 and beyond
- SAS is cheaper by ~\$1000 per Tape drive and direct connect so no switch needed or hassle
- **But...** SAS is 3-4 meter max so the server has to be on top or **RIGHT** next to the library.

# We sometimes put the Host server on top of the library and direct connect SAS

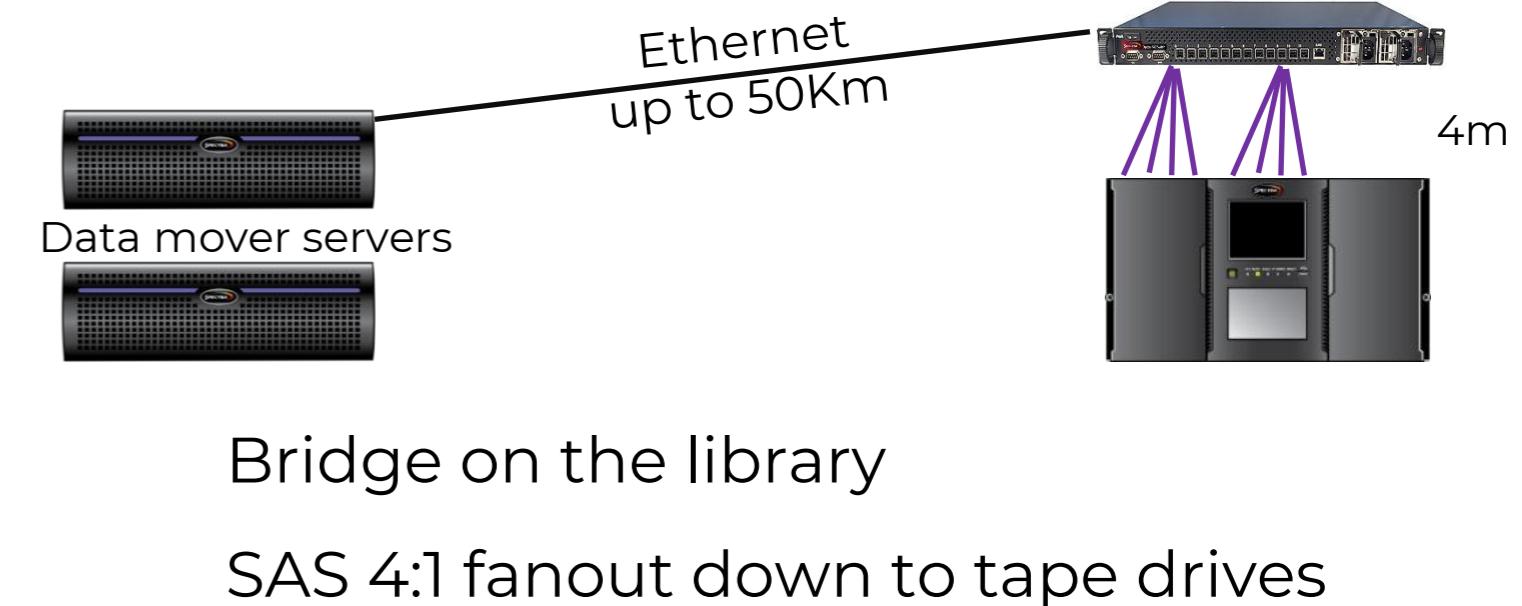


- Lowest cost
  - ~\$1000/Tape drive savings to go SAS
  - 1:4 Fanout cables are low cost so one HBA runs 16 drives
- Logistics are sometimes an issue
  - Rack height
  - Serviceability
  - 4:1 SAS breakouts have length limitations
  - Not all libraries have well placed top mounts
- Expansion Limitations
  - What happens if you want multiple shelves of Disk storage
  - What happens if one host needs to run 2-3 libraries

# There are good alternatives

## Ethernet Backbone, Local SAS breakout

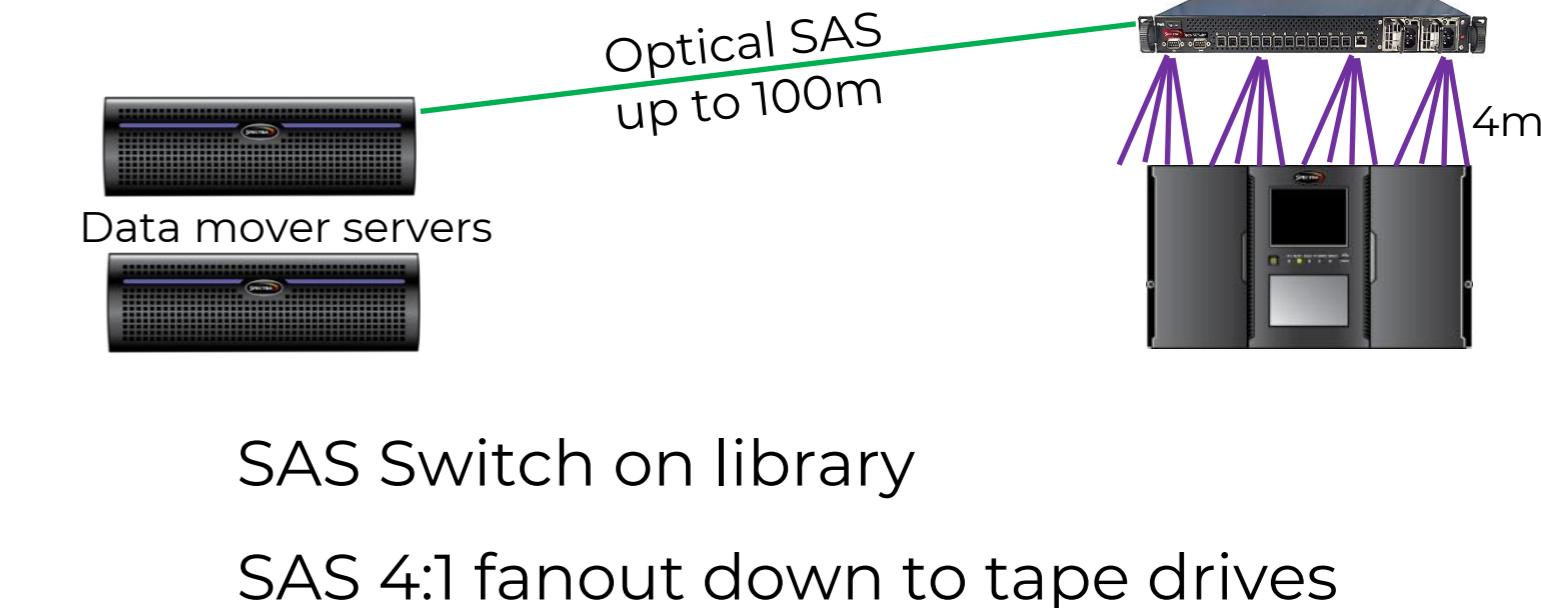
- Ethernet to SAS bridge - midrange cost
- - up to 50Km Host to Switch
- - up to 8 tape drives iSCSI or 12 iSER/RoCE



## AOC SAS Backbone, Local SAS breakout

SAS switch - very low cost

- up to 100m Host to Switch – Active Optical SAS
- up to 36 tape drives at 400MB/s each
- connectivity multiplier if limited slots on host



# Optimize Tape Connectivity!

## Simplicity

- Modernize legacy storage networking
- Easy to setup, manage and maintain

## Flexibility

- SAS and FC Tape Libraries
- Optical SAS switch networking
- Greater distances between servers and storage

## TCO

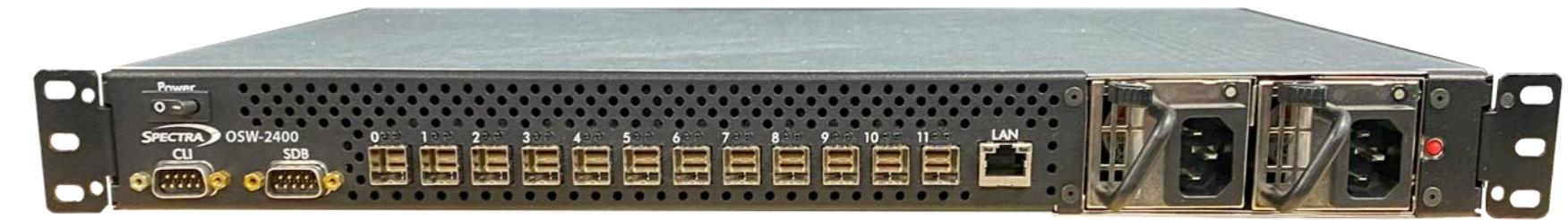
- Up to 60% lower cost per port
- Maximize tape library ROI



# Spectra OSW-2400 Optical SAS Switch

## *Transforming Tape Connectivity*

- **Industry's only 24Gb/s SAS-4 switch**
- **Up to 100m w/ Active Optical Cables**
- **Fast! 12-48 Lanes @ 22.5Gb/s**
- **Lowest per-port cost vs FC & Ethernet**
- **Reduces or eliminates FC dependency**
- **Modernizes and standardizes tape connectivity without special skills**
- **Maximizes flexibility, enables switched topologies**
  - Resource sharing | performance aggregation | HA
- **Supports all Spectra Tape Libraries & Object-Based Tape solutions**
- **Plug-and-Play Simplicity**



# Easy to Setup & Manage

The screenshot displays the SPECTRA Optical SAS Switch management interface. The top navigation bar includes the SPECTRA logo, a 'Dashboard' dropdown, a timestamp (9/18/2025 3:35:05 PM CDT), and a 'LOG OUT' button.

**PHY Connections:** Shows 12 lanes, with Lane 2 and Lane 11 marked as 'Active' (green). A legend indicates: Off (black dot), 6G (orange dot), 12G (yellow dot), 22.5G/24G (green dot), and Error (red dot).

**Environment:** Monitors Die Temperature (38.5°C), Board Temperature 1 (36.9°C), and Board Temperature 2 (25.8°C). A red progress bar is shown below.

**Fans:** Monitors RPM levels for three fans: 2550 (Good), 800 (Warning), and 0 (Error).

**Active Zones:** Lists three zones: Production Zone A (9 Members), Backup Zone B (1 Member), and Archival Zone C (2 Members). Each zone table includes columns for WWN, Device Type, Link Speed, and Status (e.g., Active, Error, Warning).

- Plug and Play compatibility
- Complete, easy-to-use User-Interface
- Ethernet
- The Optical SAS Switch monitors the status of every port/Phy
  - Physical Phy number
  - Protocol
  - Line speed
  - Connection status
  - Zoning
- Built in DataBolt technology
  - End Device Frame Buffering (EDFB)
  - Allows a fast backbone to efficiently share many slower Tape Drive links by buffering



**Questions?**