



Tape Technology Update

April 15th, 2024, Presented at Designing Storage Architecture Meeting - 2024

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FUJIFILM North America Corp., Data Storage Solutions

Agenda

1. Tape Media Evolution
2. Tape Capacity Roadmaps
3. Innovation in Tape Libraries, Active Archive
4. Why Tape for Long-Term “Cool/Cold/Frozen” storage



IBM/Fujifilm Tech Demos



2006 6.6GBPSI / 8.0 TB

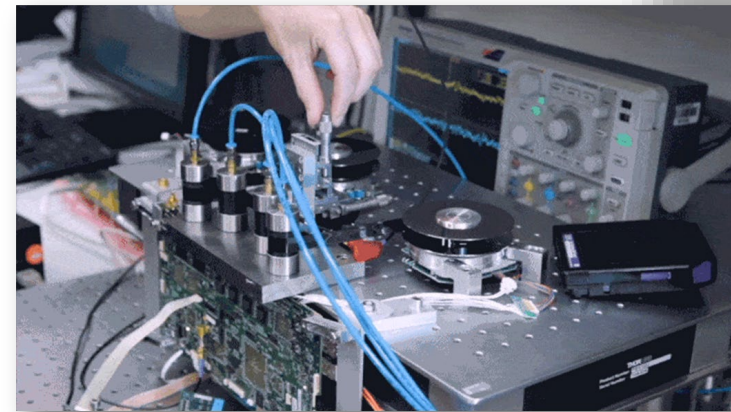
2010 29.5GBPSI / 35TB

2014 85.9GBPSI / 154TB

2015 123GBPSI / 220TB

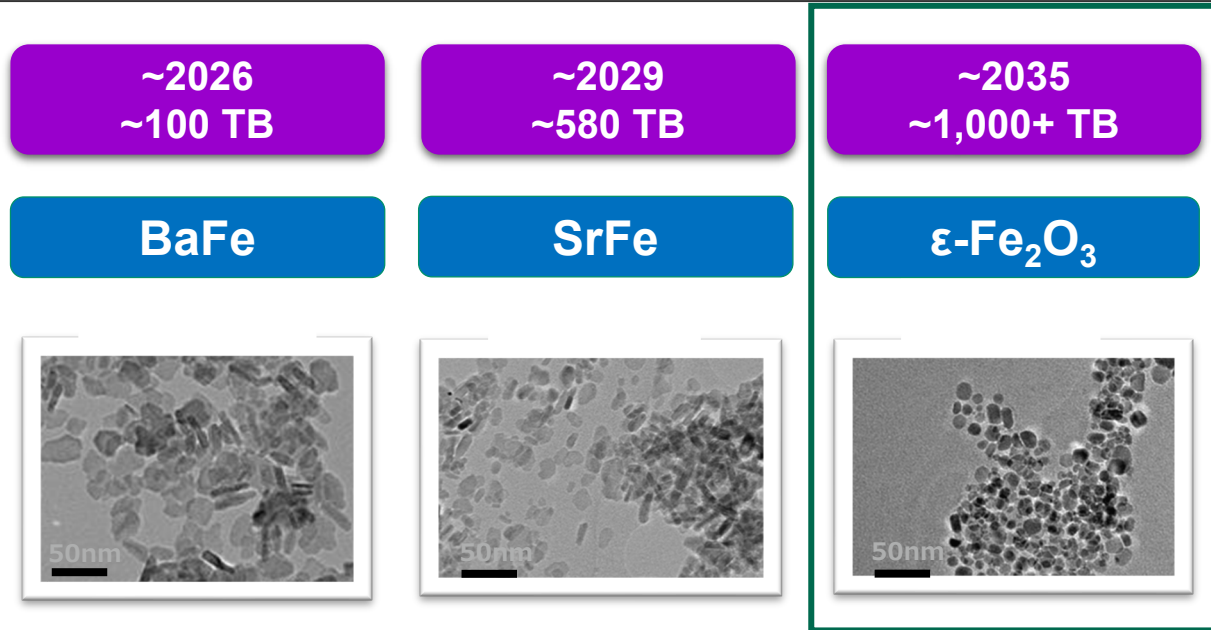
2020 317GBPSI / 580TB

New Material **Future** Higher Capacity



- IBM Zurich, 580 TB demo testing

Beyond BaFe and SrFe: Epsilon Ferrite



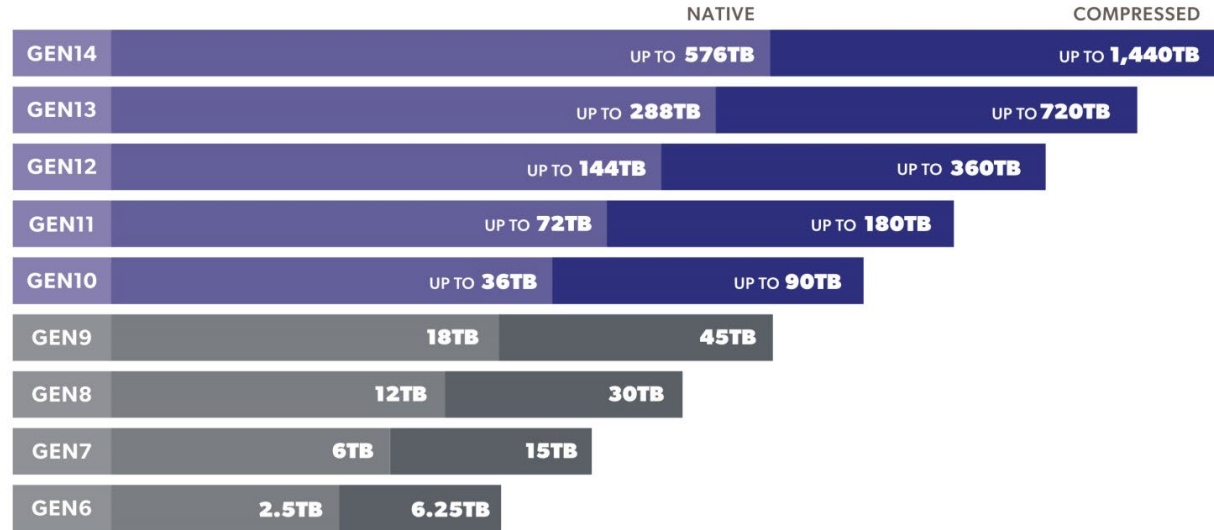
• **Epsilon Ferrite** enabled by Focused Millimeter Wave–Assisted Magnetic Recording (**F-MIMR**)*

* The present research was supported in part by the “Advanced Research Program for Energy and Environmental Technologies / Development of a millimeter wave assisted magnetic recording method for magnetic tapes” project (Ohkoshi Laboratory, **The University of Tokyo** / Nakajima Laboratory, **Osaka University** / Recording Media Research Laboratories, **FUJIFILM Corporation**) commissioned by NEDO of METI. <https://www.chem.s.u-tokyo.ac.jp/~ssphys/english/research.html>, Oct. 2020

LTO Roadmap

LTO ULTRIUM ROADMAP

Addressing your storage needs



PARTITIONING ENABLED LTFS | ENCRYPTION | WORM

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.

IBM TS1100 Roadmap

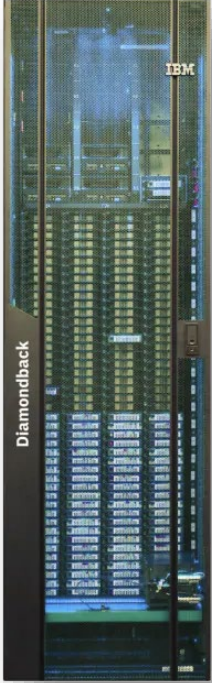
TS1100 Enterprise

Specifications	TS1160	TS1170	Gen 8
Compatibility	Compatibility	Capacity	Capacity
Max Format Capacity (Native)	Up to 20 TB (JE) 15 TB (JD) 7 TB (JC)	Up to 50 TB (JF)	Up to 100 TB (JG)
Other Format Capacities (Native)	15 TB (JD) 10 TB (JD) 7 TB (JC) 4 TB (JC, R/O)	Under assessment	Qualified
Native Data Rate	Up to 400 MB/s	Up to 500 MB/s	Up to 1000 MB/s
Attachment	FC-16, 10 GigE (RoCEv2), 12Gb SAS	FC-16, 12Gb SAS	FC-32, 12Gb SAS, ????

TS1100 Enterprise Technology



Innovation in Tape Libraries




Capacity* per 8 sq.ft.

- LTO-9: 69.7 PB**
- LTO-11: 279 PB**
- LTO-13: 1.1 EB**
- LTO-14: 2.2 EB**

** Based on 1,548 carts with 2.5:1 compression*

The image shows a tall, black IBM Diamondback tape library. The front panel is perforated, and the IBM logo is visible at the top. The word 'Diamondback' is written vertically on the left side.



Capacity* per 11.3 sq.ft.

- LTO-9: 75 PB**
- LTO-11: 300 PB**
- LTO-13: 1.2 EB**
- LTO-14: 2.4 EB**

** Based on 1,670 carts with 2.5:1 compression*

The image shows a black SPECTRA CUBE tape library. The front panel is perforated and has the word 'CUBE' written vertically. The SPECTRA logo is at the top. There is a small screen and a control panel on the front.



Quantum

Scalar i7 RAPTOR

Delivering AI Infrastructure for Hyperscale & Exascale Environments with the Leading Cyberresiliency and Ransomware Recovery.

The image shows a Quantum Scalar i7 RAPTOR tape library. The front panel is dark with a blue, glowing network pattern. The Quantum logo is at the top left.

Moving Cold Data to Tape Simply Makes Sense



Compared to equivalent HDD capacity, tape provides for:

87% less energy usage

97% less CO2e over lifecycle

78% lower TCO

Air Gap capability

- Brad Johns Consulting, Aug. 2022

Online and offline tape consumes **no energy** unless being read or written to by a tape drive, whereas HDDs are constantly spinning 24/7 consuming energy and generating heat.

Cyber Security Defenses Improved with Tape Air Gap

Offsite/Offline Capable Tape



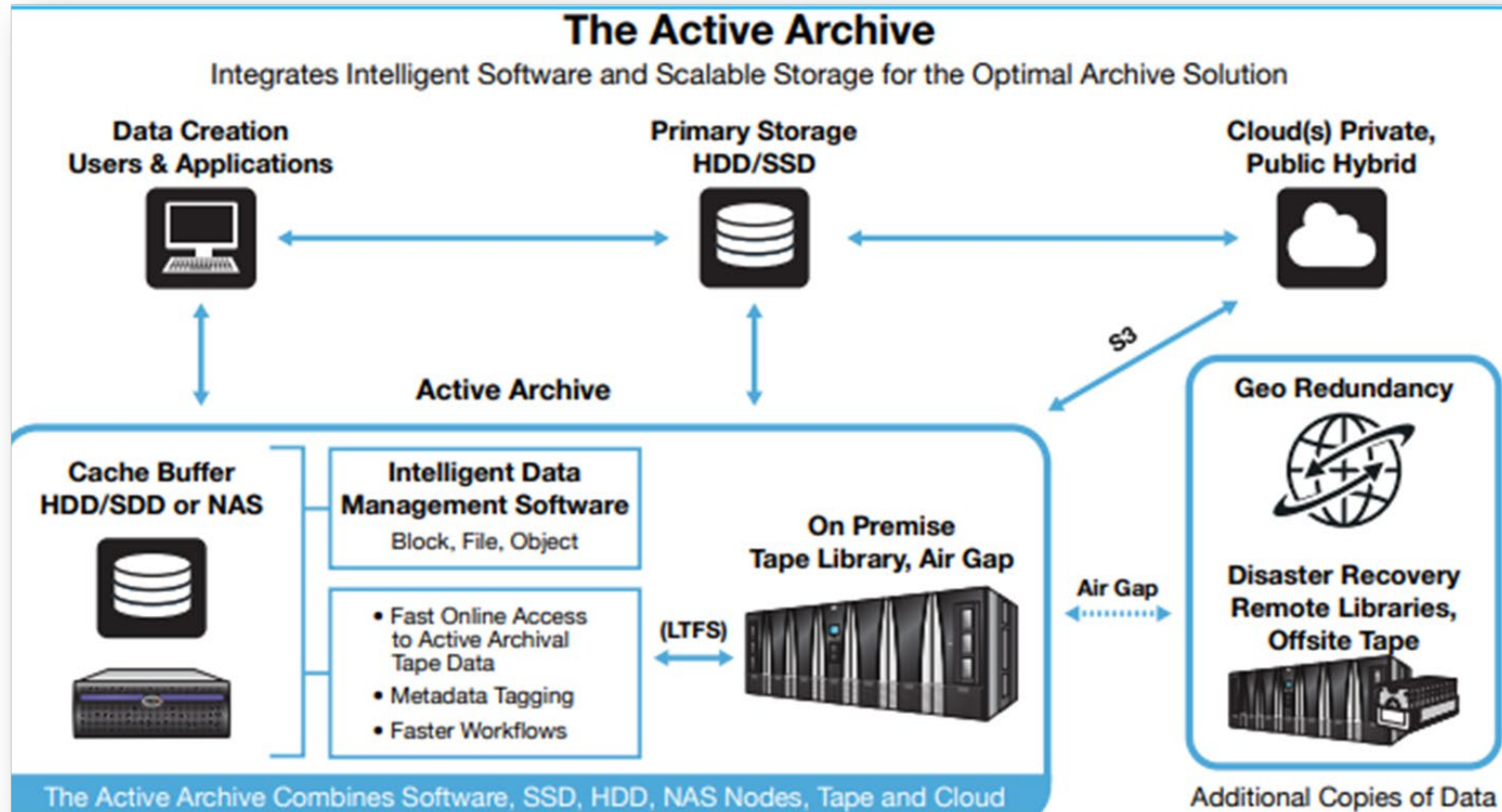
<AIR GAP>

Internet Connected Network



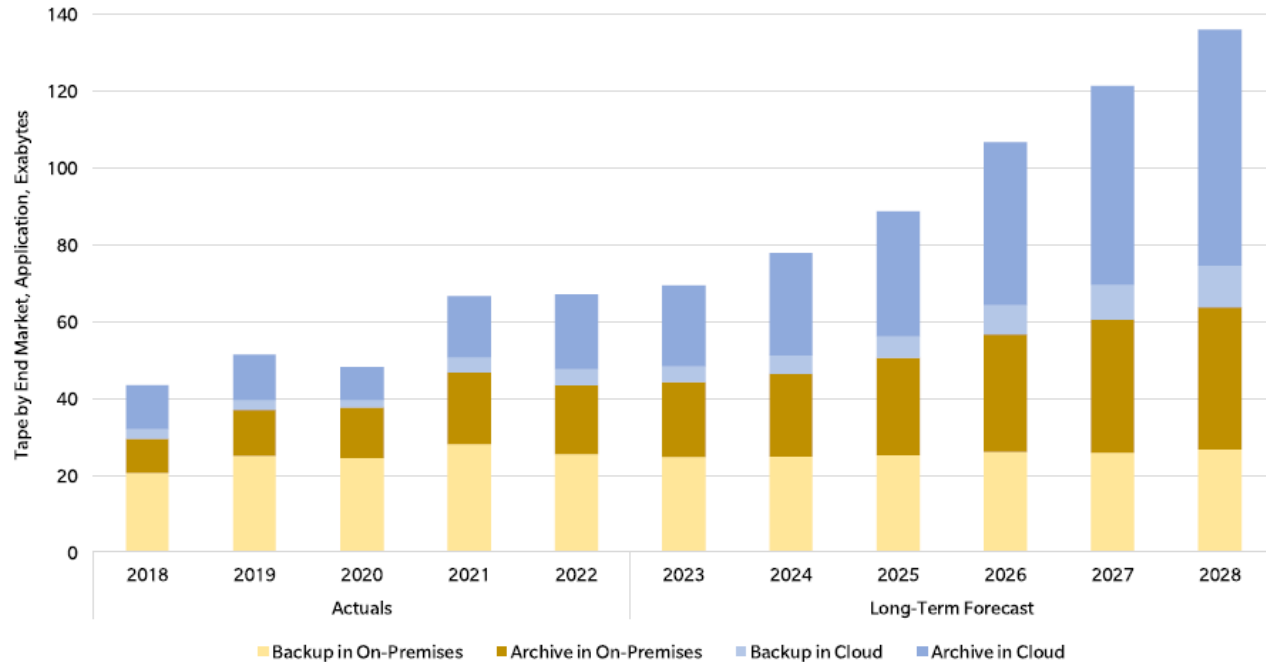
Simply put, an air gap has no electronic connection to the data on the removable tape cartridge, therefore preventing unauthorized access.

Active Archive Leverages Benefits of Tape



Tape Market Trend, Backup/Archive Applications Share, TRENDFOCUS, 12/22/23

Chart 3
Native Tape Capacity and Long-Term Forecast by End Market, Application, Exabytes



In Summary

- ❑ **AI/ML driving demand for storage and active archive**
- ❑ **Tape technology ready for future data growth**
- ❑ **Innovative tape solutions deliver on capacity, TCO, low energy, CO2e, and cyber security**





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**NEVER
STOP**

Thank You!

FUJIFILM
Value from Innovation
