

The Quantum logo features the word "Quantum" in a bold, sans-serif font. The letter "Q" is a dark blue, while the remaining letters "uantum" are a lighter blue. A registered trademark symbol (®) is located at the top right of the "m".

Quantum®

Your difference is in your data.™

The background of the slide is a dark blue gradient with a network of white dots and lines, resembling a data network or a molecular structure. The dots are connected by thin white lines, creating a complex web of connections. The overall aesthetic is modern and technological.

Advanced Archiving with ActiveScale Cold Storage

Lower cost, lower power, higher performance

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ActiveScale Cold Storage reduces tape hardware *and* boosts performance

2-Dimensional Erasure Coding combines the best of both worlds

Lowest storage overhead:

Up to 60% lower

Best performance:

Up to 5-10x faster

Up to 80% fewer tape drives for
same performance



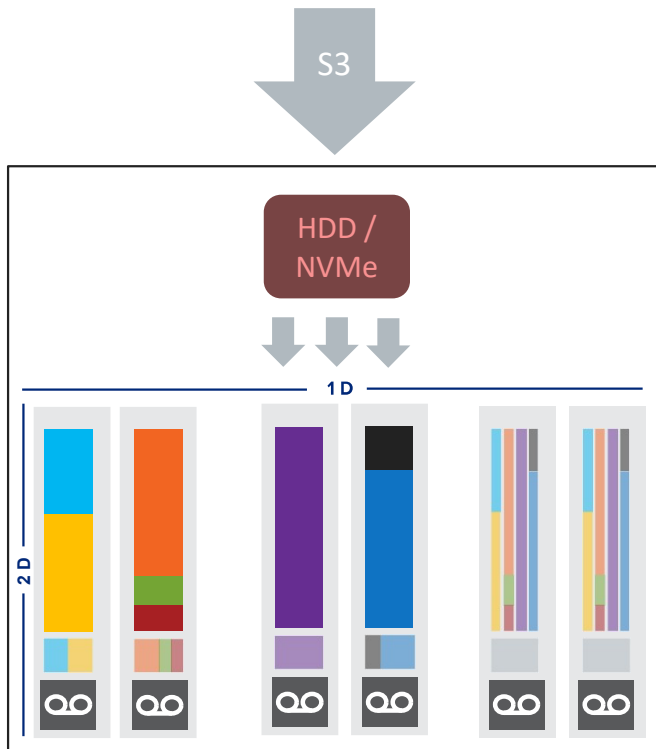
Ability to offer both simultaneously, gives big cost savings for ASCS

ASCS (2D EC) requires

- Less tape cartridges
- Less tape library slots
- Less tape drives



ActiveScale Cold Storage – Reminder



Patented 2-dimensional Erasure Coding

Across-Tape EC

- Protect against entire tape failure

Within-Tape EC

- Reduce read errors by factor 100

What this enables

Lowest storage overhead

- As low as 15%

Optimal performance

- Read object from single tape
- Reordered reads

Optional RAIL

Redundant Array of Independent Libraries

How much performance can you squeeze out of an LTO tape drive?



Benchmark scenario

12 LTO-9 tapes (100% full, small objects)
1 LTO-9 tape drives
Read 50,000 objects



How long does this take?

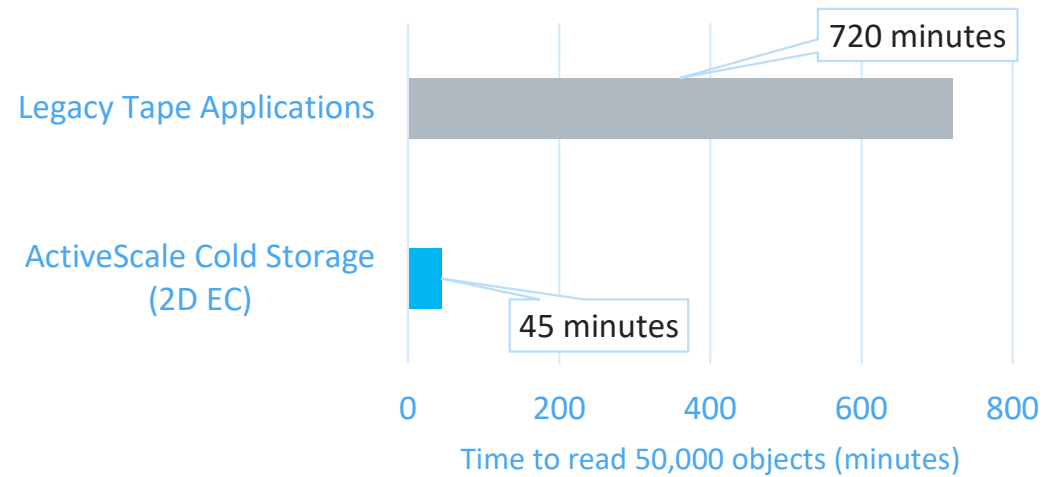
~12 hours in total
Assuming reasonably optimized workflow

Can we do better? Yes!

How much performance can you squeeze out of an LTO tape drive?

- Improved result

- Read 50,000 objects in 45 minutes



- How did we do this?

- Re-order **all** 50,000 read requests
- Intelligent skip/dump algorithm
 - Calculate shortest time to read all requested objects from a tape
 - Only seek/skip to a specific byte offset when it's faster than to continue reading

Benchmark Scenario

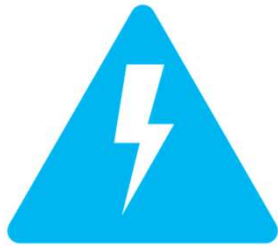
12 LTO-9 tapes (100% full, small objects)
1 LTO-9 tape drives
Read 50,000 objects

ActiveScale Cold Storage: The 2D EC advantage

- How much extra HW do you need to match ASCS (2D EC)?
 - Multi-copy approach
 - 73 – 94% more tape drives
 - 73 – 159% more tapes
 - RAIT (Redundant Array of Independent Tapes)
 - 30 – 44% more tape drives
 - 8 – 15% more tapes

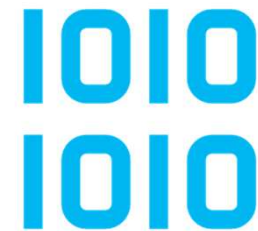
	Legacy Tape 2-Copy	Legacy Tape 3-Copy	4+2 EC (RAIT)	6+2 EC (RAIT)	8+2 EC (RAIT)
Extra Tapes Needed	+ 73%	+ 159%	+ 30%	+ 15%	+ 8%
Extra Tape Library slots	+ 73%	+159%	+ 30%	+ 15%	+ 8%
Extra Tape Drives (to match ASCS Performance)	+ 73%	+ 94%	+ 30%	+ 44%	+ 35%

Cost & Power constraints make tape unavoidable – 2D EC makes it fast enough



Challenges in today's storage market

HDD / NVMe / DRAM prices are exploding
Power limitations → prices are going up
GPUs are very power-hungry



Tape-based cold storage with 2D EC is the right direction

Lower power consumption
Lower cost
Highest performance

Quantum[®]

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