

Tape for Long-term Storage

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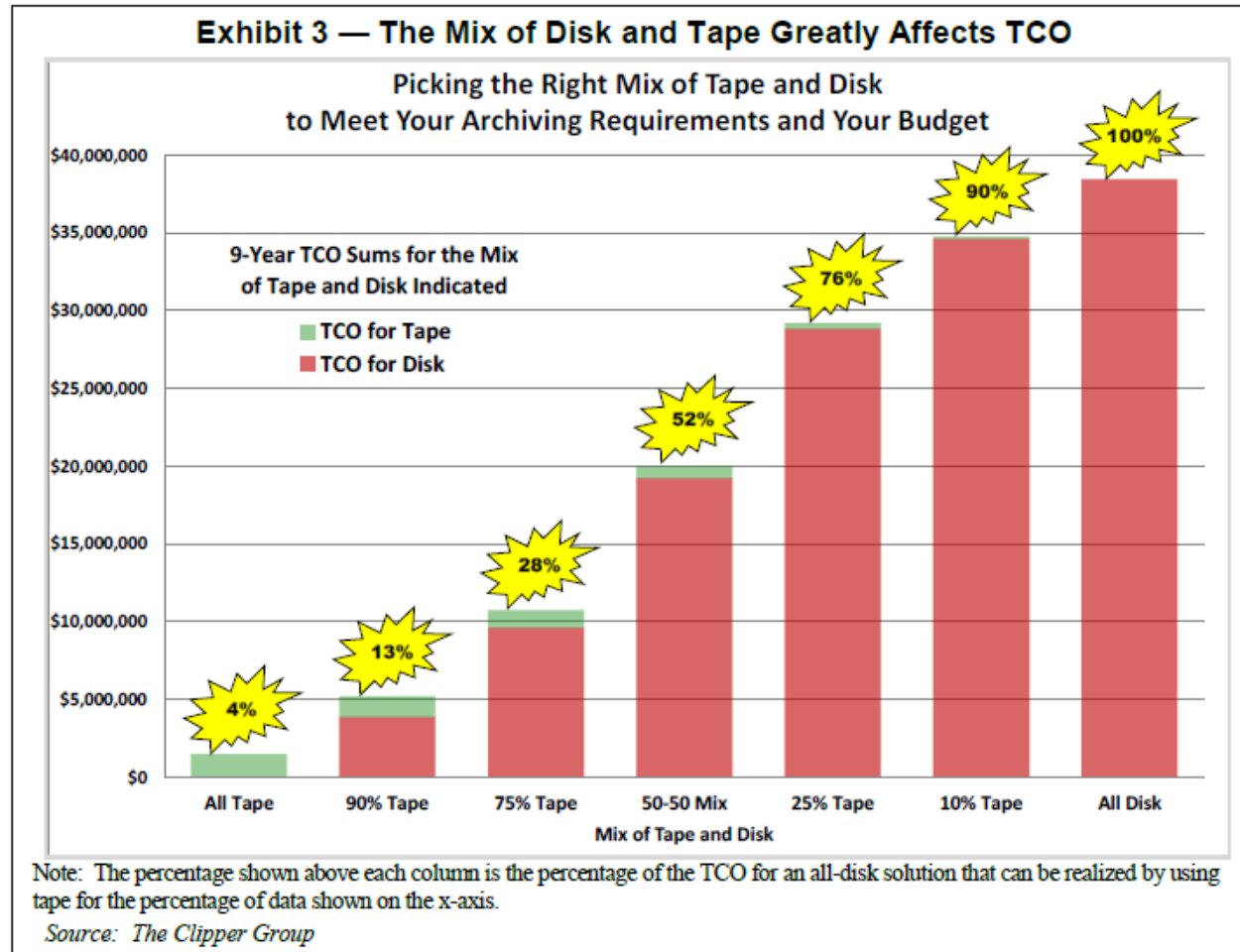


Tape is Ideal for Delivering the Lowest Cost Storage

Tape is 26x Less Expensive than Disk

Study compares a 1 PB archive growing at 45% annually for 9 years on disk and tape.

Assumes 1:1 compression



* Includes equipment, media, maintenance, energy, and floor space

The Clipper Group, <http://www.oracle.com/us/corporate/analystreports/industries/clipper-tco-storage-2013-1959019.pdf>

Storage Technologies Areal Density Trends

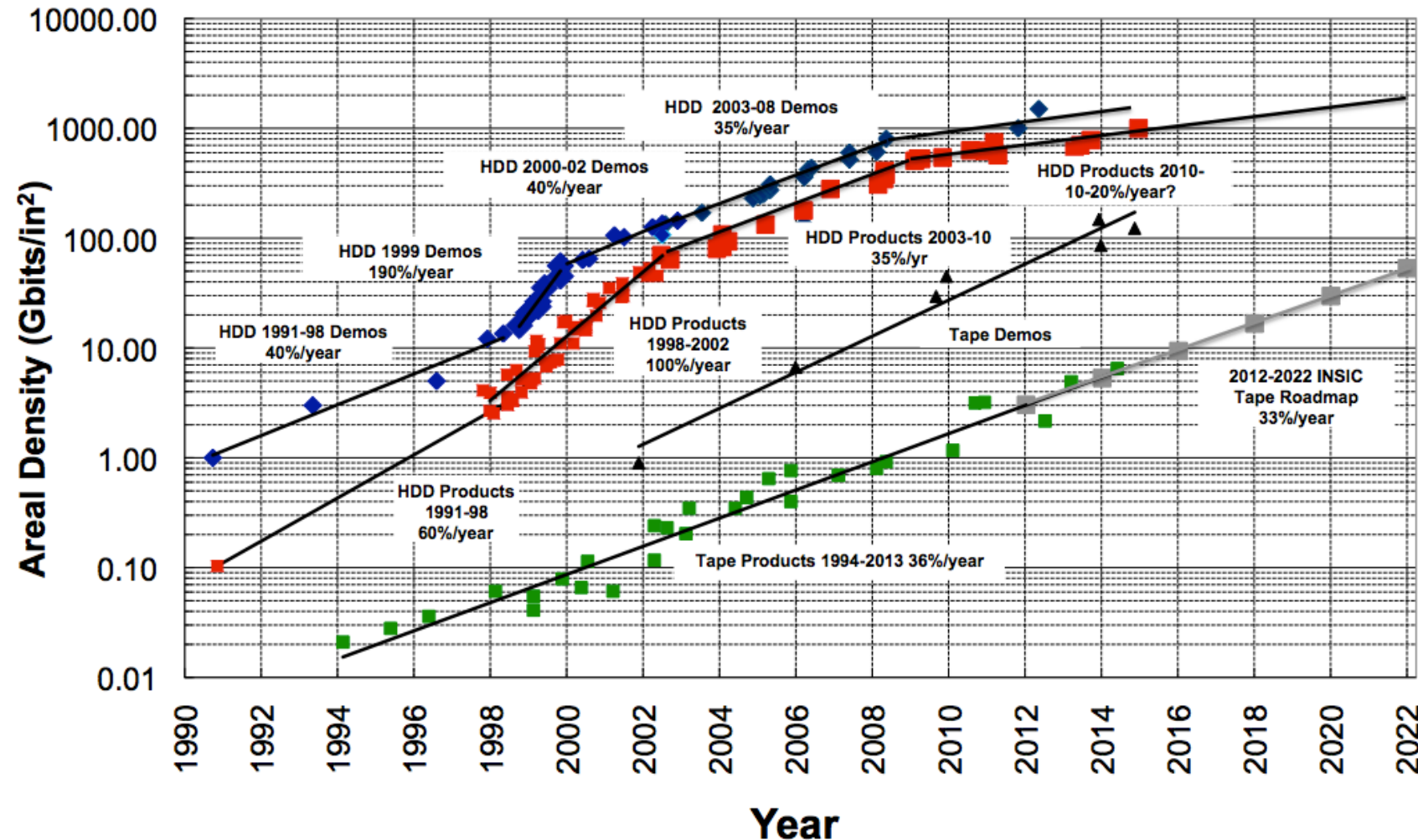


Chart courtesy of INSIC

Tape gets its capacity by having 1000X the recording surface area comparing a 1/2 inch cartridge to a 3 1/2 inch disk.

Tape Advantages for Long-term Data Retention

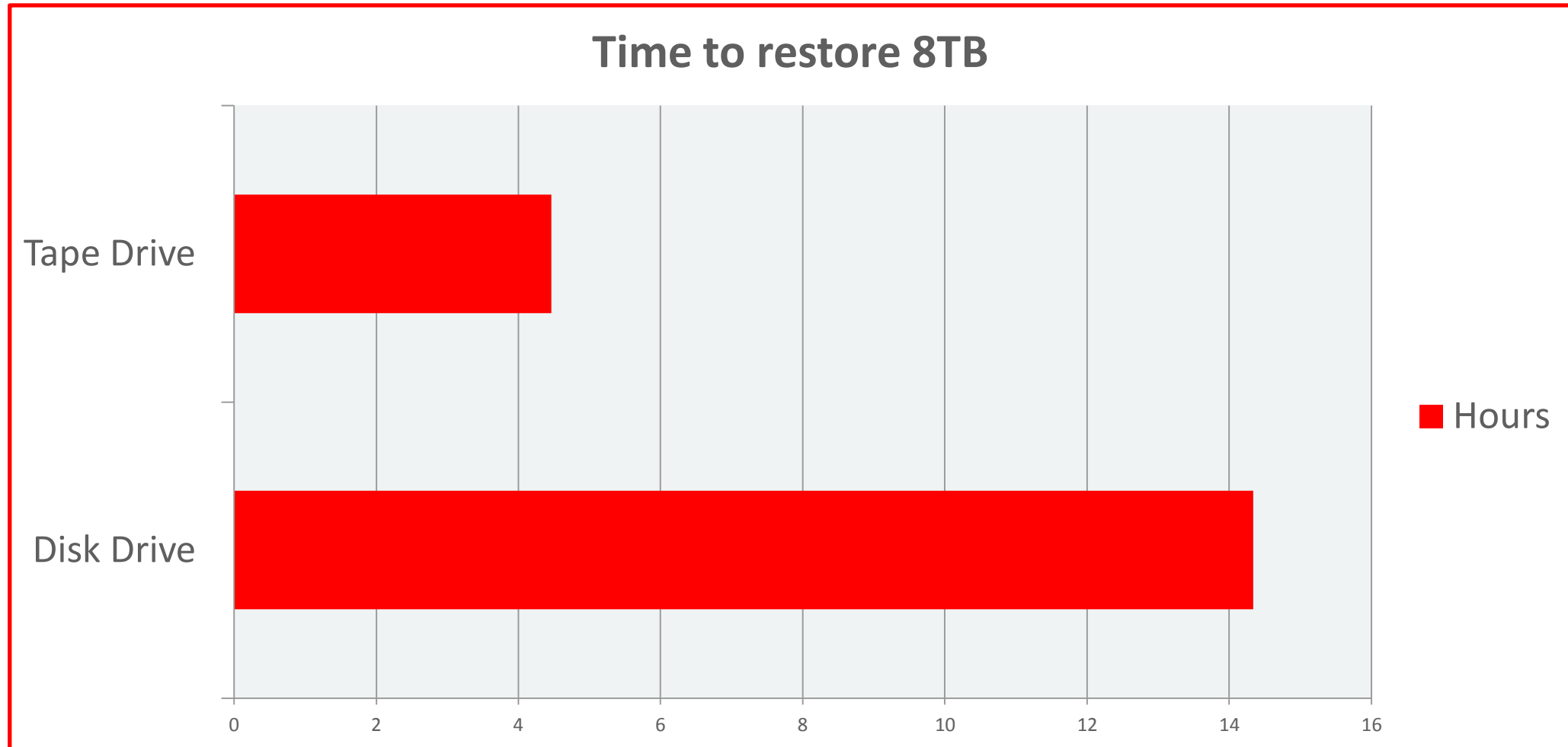
	Disk	Tape
Total Cost of Ownership ¹	26X	X
Power and cooling	>100X	X
Uncorrected bit error rate, Probability (avg 1 error in x TB)	10 ⁻¹⁴ (~10's of TB)	10 ⁻¹⁹ (~1 million TB)
Max shelf life (bit rot)	10 years	30 years
Best practices for data migration to new technology	3-5 years	7-10 years
Labor (TB managed per storage admin) ²	100's	1,000's

¹ The Clipper Group, <http://www.oracle.com/us/corporate/analystreports/industries/clipper-tco-storage-2013-1959019.pdf>

² Moore, F. Horison Information Strategies, "Tiered Storage Takes Center Stage,"

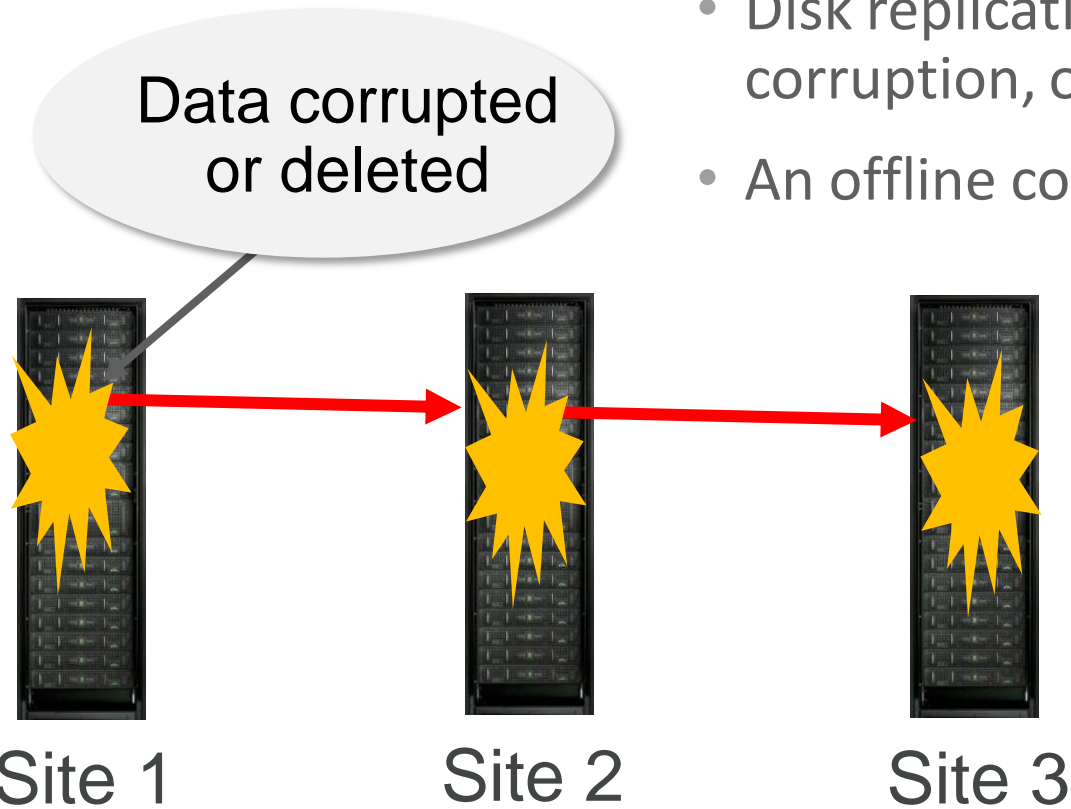
Tape Streams Data Faster

Single Stream Restore is Faster for Large Files



Tape is Decoupled

Tape Protects Digital Assets from Software Bugs, Viruses, and Hackers



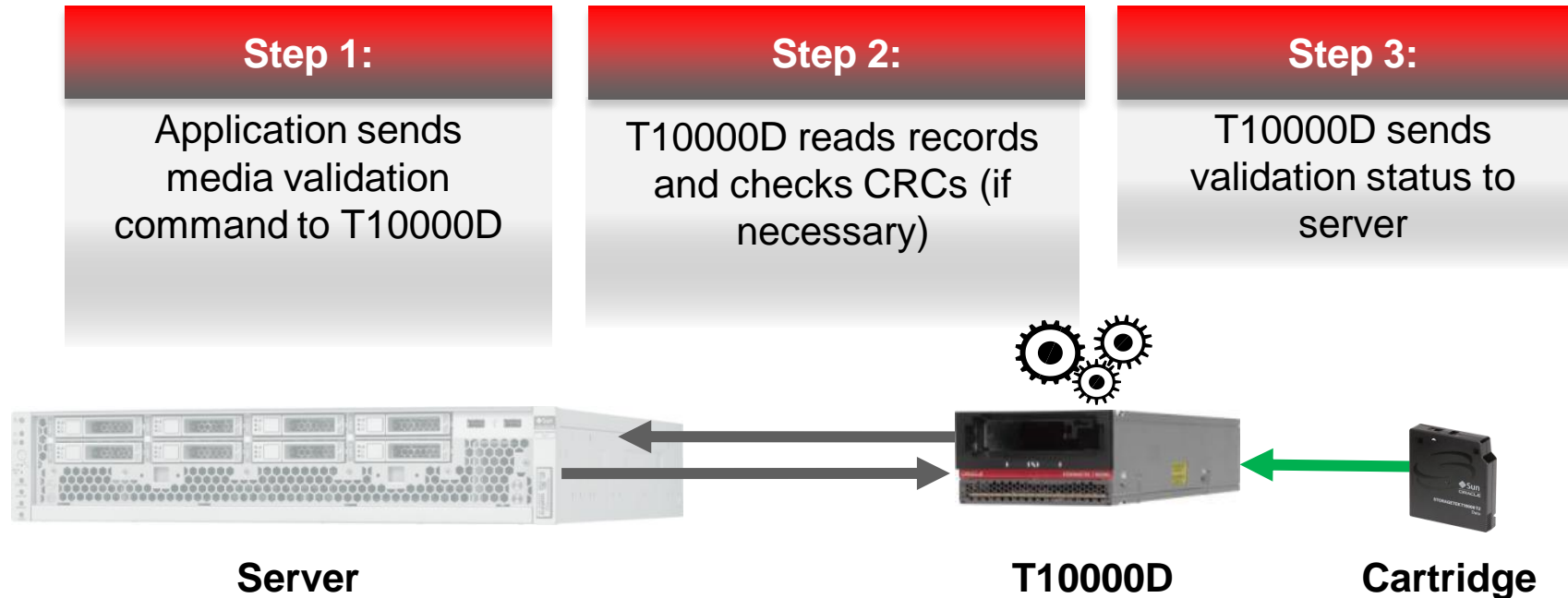
- Disk replication does not prevent against software bugs, corruption, or accidental deletion
- An offline copy on tape is **best practice**



Offline Copy on Tape is Protected

StorageTek T10000 Media Validation

Easily Validate the Integrity of Your Digital Assets with T10000D*

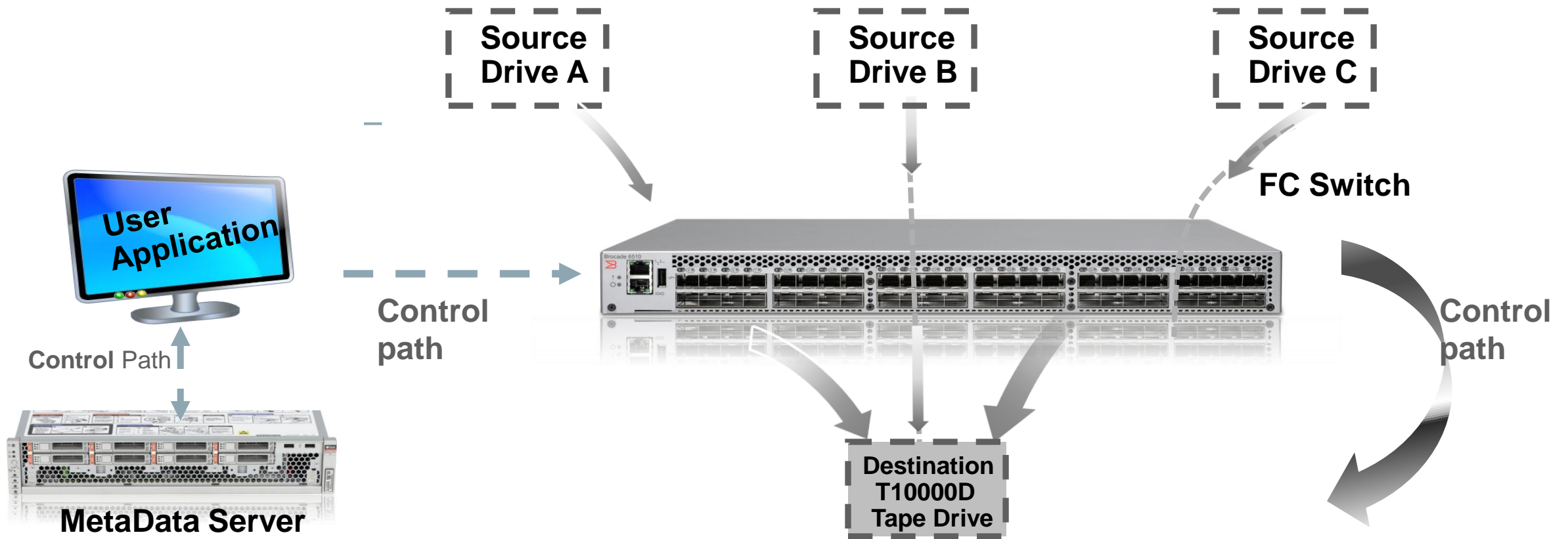


In-Drive Validation Saves Network Bandwidth and Server Resources

* Not available in LTO tape drives

Data Migration Multiple Source Files to One T10000D Drive (Synchronous)

Uses no server resources



Large Internet Information Provider

Object Storage for 7 Billion Images

BUSINESS RESULTS → Provided web services infrastructure and long term storage of objects at ultra-low cost



Cost-Effective Data Retention

Backup software eliminated and reduced storage costs



Massive Archive Scale

Scale to billions and billions of files and >17PB's of data



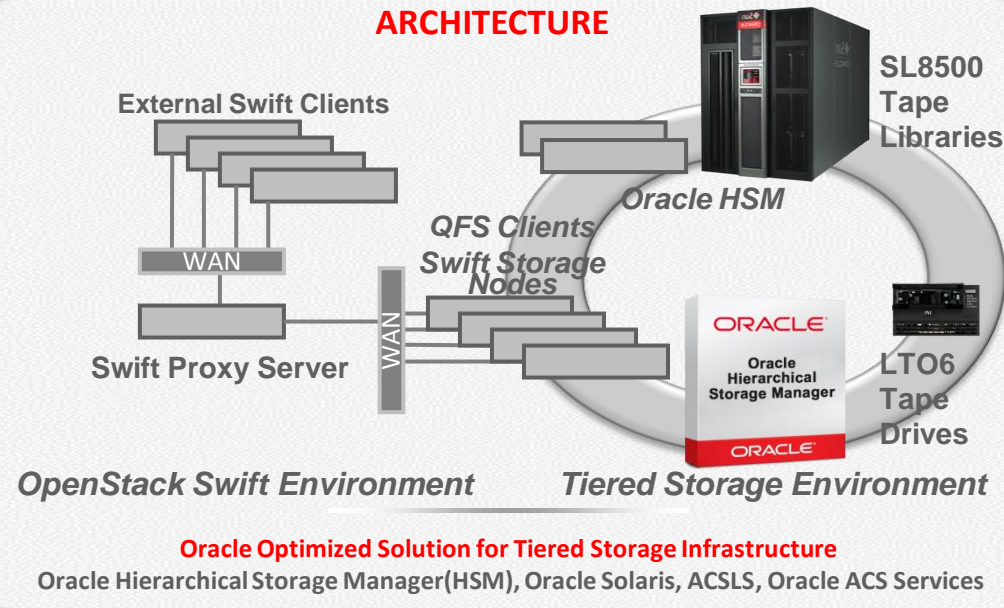
Web Interface

Web interface for end users with tape storage on the back end

WINNING SOLUTION



ARCHITECTURE

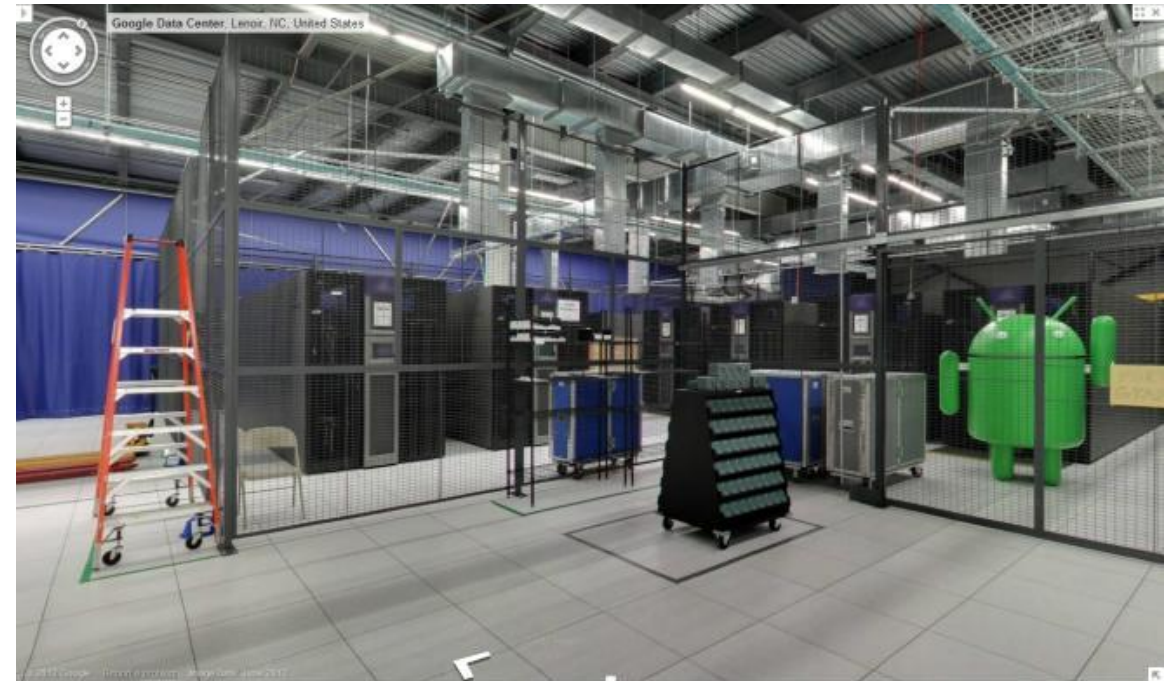


HIGHLIGHTS

- Writes objects to Oracle HSM via OpenStack Swift Interface
- Store additional copies of data on tape for data protection
- New data capacity is 17 PB

Recent Cloud Example

- 38,000 Gmail users lost access to their emails
- A new software version corrupted all replicated copies of data on disk.
- Google was able to recover the data because a copy had been stored offline on **tape**.



Source: <http://gmailblog.blogspot.com/2011/02/gmail-back-soon-for-everyone.html>

Summary

- Tape is 26x less expensive than disk for long-term retention
- Areal density of tape improving faster than disk
- Uncorrected bit error rate 10,000x better than commodity disk
- Tape excels at streaming large objects
- Recent trends for tape use
 - Archive and Data Protection at web-scale
 - Lower cost tier of cloud storage

Hardware and Software Engineered to Work Together

ORACLE®

Tape is More Reliable

Uncorrectable Bit Error Rate of Tape is 10,000 Times Lower Than Disk

Seagate
Constellation ES.2
Hard Drive



Disk: 100 TB

StorageTek
T10000D
Tape Drive

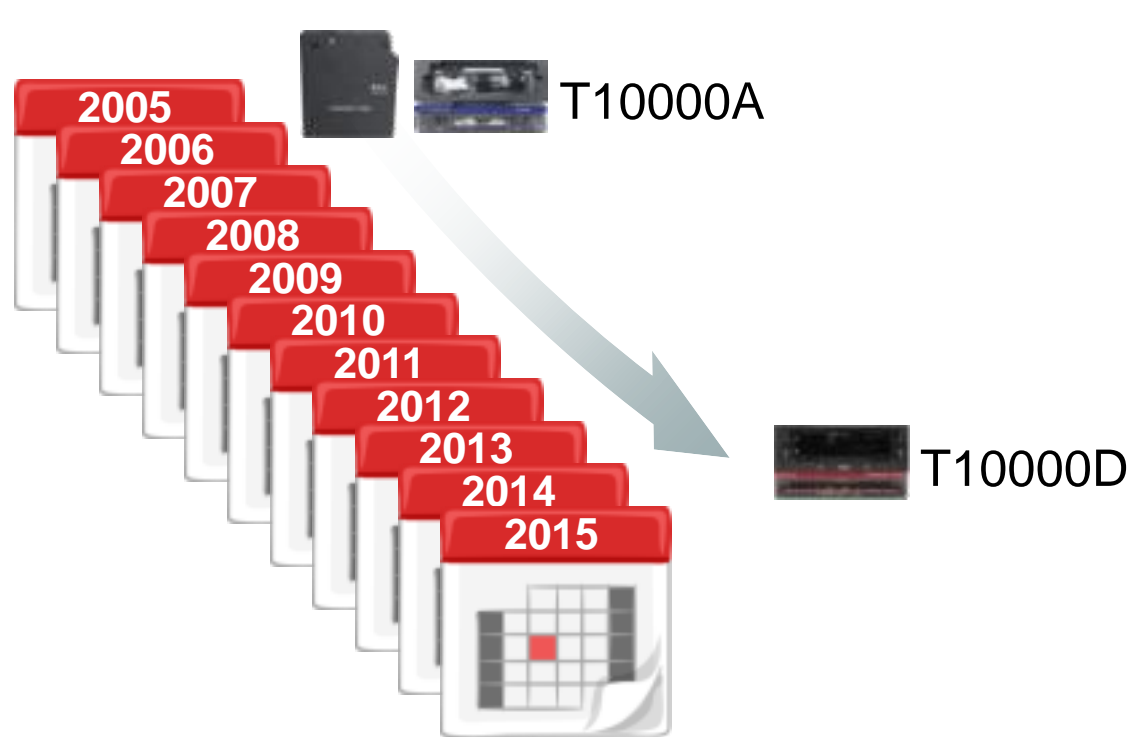


Tape: 1,110 PB

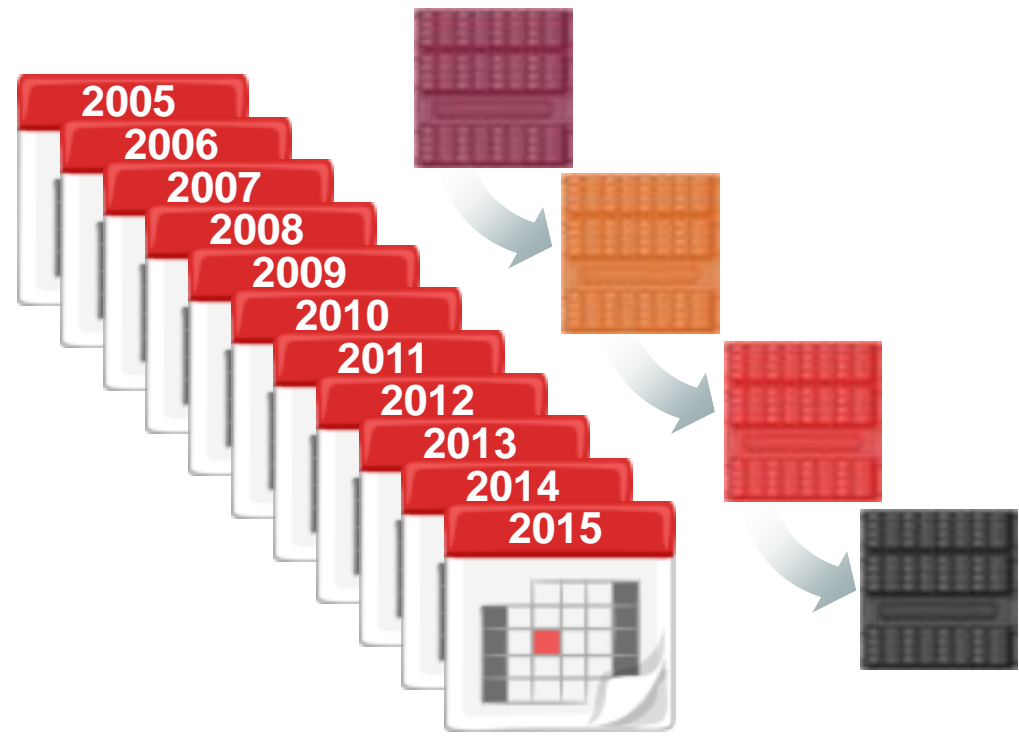
Assumes 1:1 compression and sustained data rate of 155 MB/s for Constellation ES.2 and 252 MB/s for T10000D

Tape Requires Less Frequent Migration

Migrate Once Per Decade with Tape or Every Three Years with Disk



Backward Read Capability
Spans a Decade



Migrate Disk Data Three
Times in the Same Period

Tape Web Interface for Cold Storage / Cloud Archive

Simplify the use of Tape

