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Why Tape? Understanding the Top Ten Perils of Going Tapeless

Wendy Johnson
Oracle StorageTek Enterprise Data Protection and Mainframe Product Management

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SHARE in Boston

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A modern data protection architecture is comprised of

disk and tape technology.

The strengths of disk and tape are combined to deliver

lower risk of data loss,

faster access & restore,

and lower TCO

than either technology can offer on its own.

What percent of data centers use tape for enterprise backups?

82%

Five big reasons **explain why 82% use tape as their last line of defense**

Source: Mark Peters, Enterprise Strategy Group, Inc. “A Comparative TCO Study: VTLs and Physical Tape,”

#1 Tape Has Much Lower Bit Error Rate Burden

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

Seagate
Constellation ES.2
Hard Drive

How many petabytes
are transferred before an uncorrectable error?

Enterprise
Tape Drive

Assumes 1:1 compression and sustained data rate of 155 MB/s for Constellation ES.2 and 240 MB/s for T10000C

#1 Tape Has Much Lower Bit Error Rate Burden

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

Seagate
Constellation ES.2
Hard Drive

Disk: 0.1 PB

Enterprise
Tape Drive

Tape: 1,110 PB

Assumes 1:1 compression and sustained data rate of 155 MB/s for Constellation ES.2 and 240 MB/s for T10000C

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#1 Tape Has Much Lower Bit Error Rate Burden

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Seagate
Constellation ES.2
Hard Drive

Disk: 9 days

...equivalent to **40**

RAID recoveries
per year
per disk!

Enterprise
Tape Drive

Assumes 1:1 compression and sustained data rate of 155 MB/s for Constellation ES.2 and 240 MB/s for T10000C

#1 Tape Has Much Lower Bit Error Rate Burden

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

Seagate
Constellation ES.2
Hard Drive

Disk: 9 days

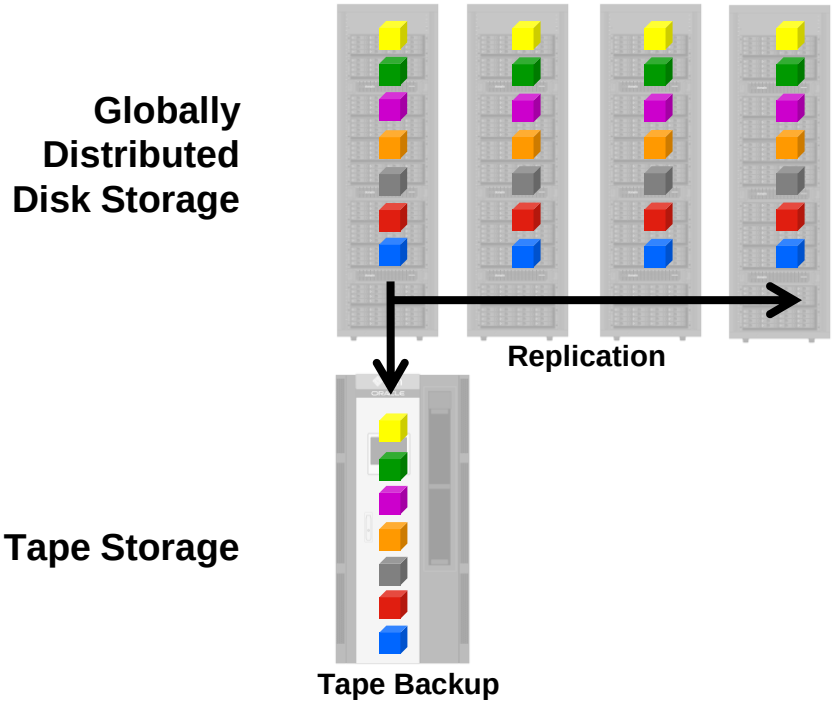
Enterprise
Tape Drive

Tape: 165 Years

Assumes 1:1 compression and sustained data rate of 155 MB/s for Constellation ES.2 and 240 MB/s for T10000C

#2 Tape is Decoupled From Corruption Sources

Google Recovered Thousands of Corrupted Email Accounts Using Tape



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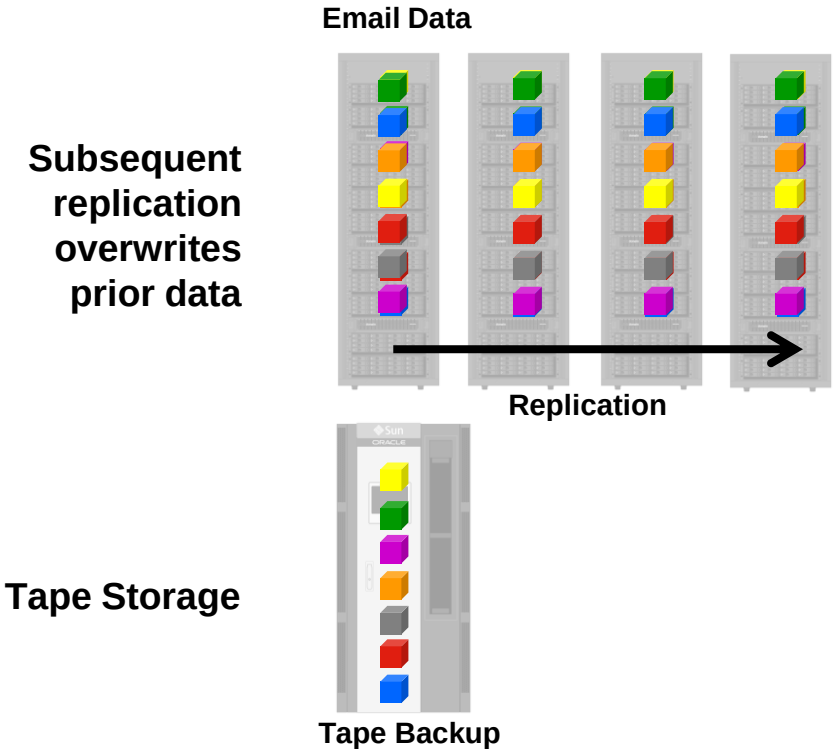
Google Recovered Thousands of Corrupted Email Accounts Using Tape



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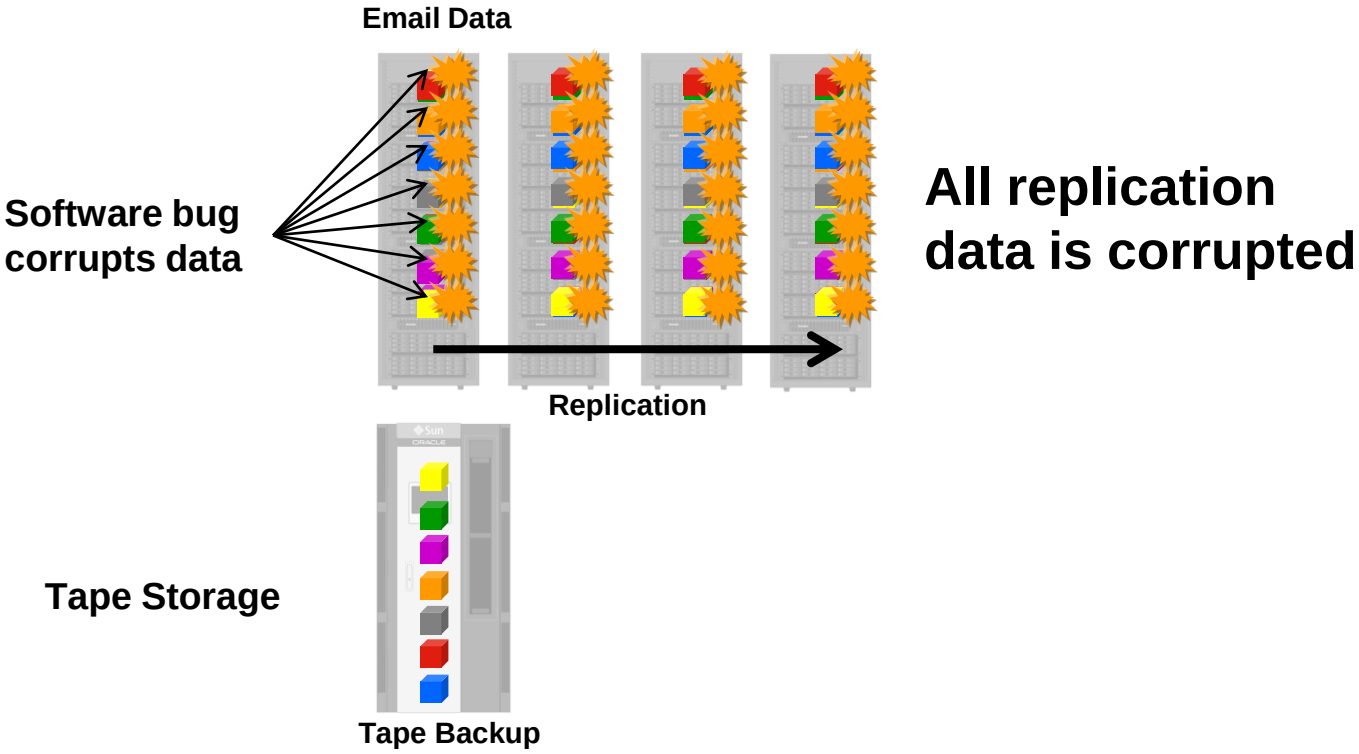

All replication data is corrupted

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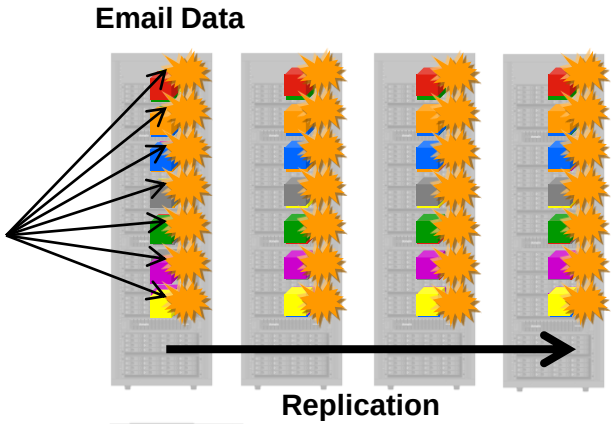

Without tape
Google would have had nothing to restore from

Without tape
40,000 Gmail users would have lost data

"Since the tapes are offline, they're protected from such software bugs."

Ben Treynor
VP Engineering, Google

#2 Tape is Decoupled From Corruption Sources

Google Recovered Thousands of Corrupted Email Accounts Using Tape

Google “Data Center Tour” for YouTube video

#2 Tape is Decoupled From Corruption Sources

Web Hosting Company Fails to Recover from 30 Minute Hack Attack

smh.com.au
The Sydney Morning Herald

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4800 Aussie sites evaporate after hack

June 21, 2011 Comments 106 Read later

Asher Moses

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Top 10 Golf Swing Killers www.RevolutionGolf.com
Four Time Golf Teacher of the Year Discovers Your #1 Swing Flaw (Free)

At least 4800 Australian websites have been lost with no chance of recovery following a break-in at Australian domain registrar and web host Distribute.IT.

The hack attack caused so much damage that four of the company's servers were "unrecoverable", the company said, leaving thousands of website owners in the lurch.

"I think I'm in shock ... I have lost everything .... I couldnt possibly replicate all those years of work again."

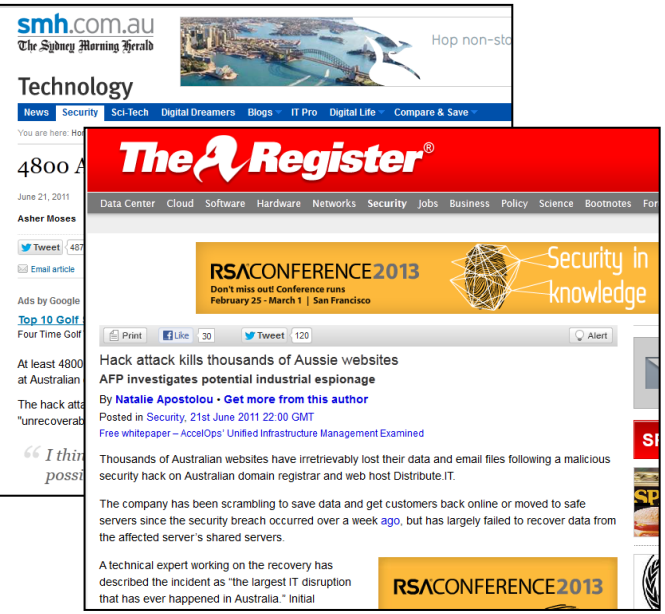
At least 4800 Australian websites have been lost with no chance of recovery following a break-in at Australian domain registrar and web host Distribute.IT.

Sydney Morning Herald
June 21, 2011

http://www.smh.com.au/technology/security/4800-aussie-sites-evaporate-after-hack-20110621-1gd1h.html
http://www.theaustralian.com.au/australian-it/netregistry-group-bails-out-distributeit-after-4800-website-accounts-were-hacked/story-e6frgakx-1226080699559
http://www.theregister.co.uk/2011/06/21/hacks_wipe_aus_web_and_data/

#2 Tape is Decoupled From Corruption Sources

Web Hosting Company Fails to Recover from 30 Minute Hack Attack



"Our greatest fears have been confirmed that not only was the production data erased during the attack, but also key backups, snapshots and other information that would allow us to reconstruct these Servers from the remaining data," the company said in its last blog post.

The Register
June 21, 2011

http://www.smh.com.au/technology/security/4800-aussie-sites-evaporate-after-hack-20110621-1gd1h.html
http://www.theaustralian.com.au/australian-it/netregistry-group-bails-out-distributeit-after-4800-website-accounts-were-hacked/story-e6frgakx-1226080699559
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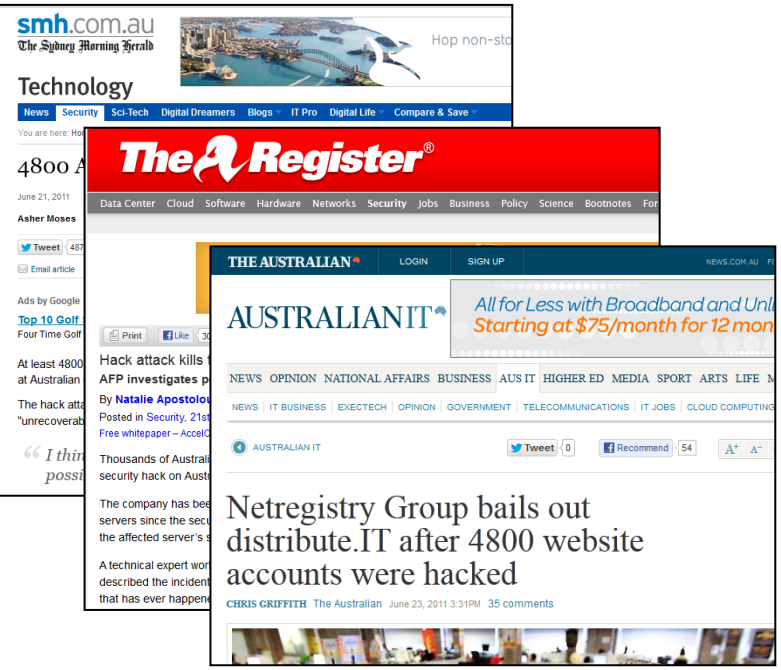

The Netregistry Group's chief executive, Larry Bloch, told The Australian that Distribute.IT's security was of a standard "equivalent to their peers in the industry".

The Australian
June 23, 2011

http://www.smh.com.au/technology/security/4800-aussie-sites-evaporate-after-hack-20110621-1gd1h.html
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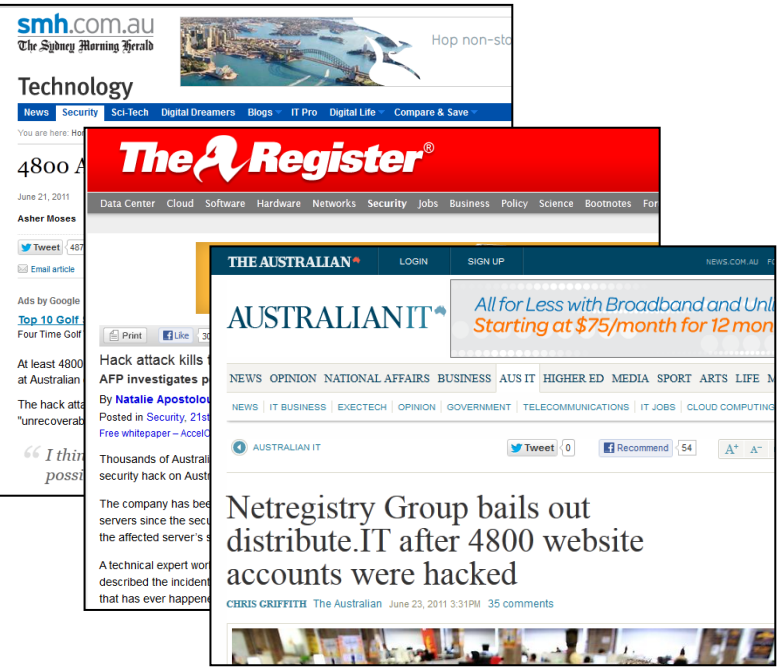

Tape Backups Could Have Saved the Day

http://www.smh.com.au/technology/security/4800-aussie-sites-evaporate-after-hack-20110621-1gd1h.html
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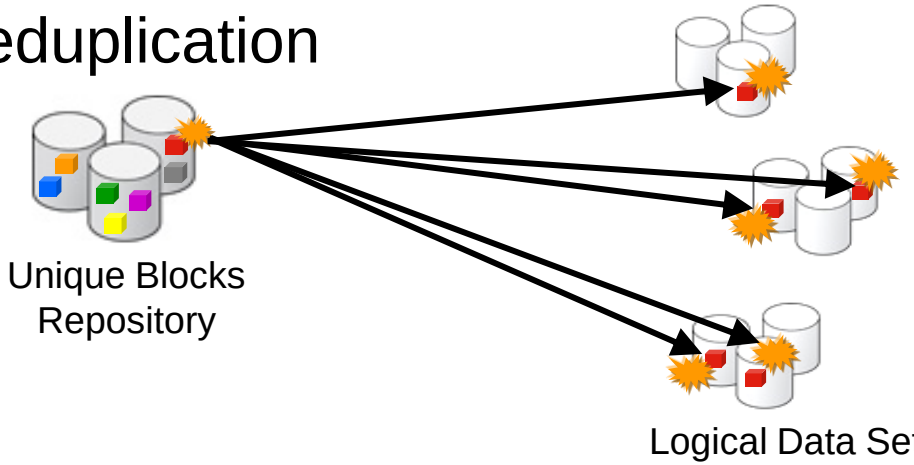
http://www.theregister.co.uk/2011/06/21/hacks_wipe_aus_web_and_data/

#3 Tape Does Not Deduplicate Data

Data Loss Events with Deduplication Can Be Catastrophic, Not with Tape

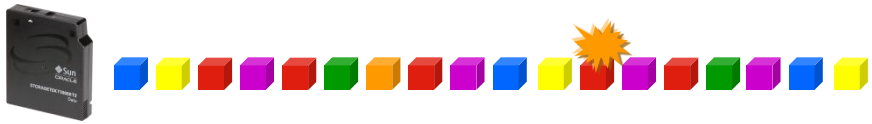
Deduplication



With Deduplication

One Error Can Create Many Errors

Tape



With Tape

One Error is One Error

#4 Tape is Environmentally Robust

Rest Easy Knowing Tape Data is Safe In Nearly Any Extreme Scenario

Safer from cooling outages

Safer from electrical surges

Safer from earthquakes

Safer to move quickly

#5 Data Integrity Is Easily Validated with Tape

Disk Systems Lack Simple Means of Validating Integrity of Backup Data

What is the integrity
of disk backups that are
weeks, months, or years old?

#5 Data Integrity Is Easily Validated with Tape

Disk Systems Lack Simple Means of Validating Integrity of Backup Data

Enterprise tape drives perform

data integrity validation,

providing reassurance that backup files are ready to restore.

Enterprise Tape Drives

CRC checks any file, any time

How many cartridges does it take to prove the reliability of tape?

This is what happened when NERSC read nearly

24,000 cartridges or

approximately 15 million meters of tape...

99.945%

of cartridges were read <u>100% error free</u>

Source: Mark Peters, ESG Technology Brief, http://www.oracle.com/us/corporate/analystreports/corporate/esg-nersc-case-study-202702.pdf

Tape Technology Marches Forward

Storage Capacity Then... and Now

10 TB in 1996

- 6000 carts
- Timberline 9490 – 1.6 GB

... and in 2011

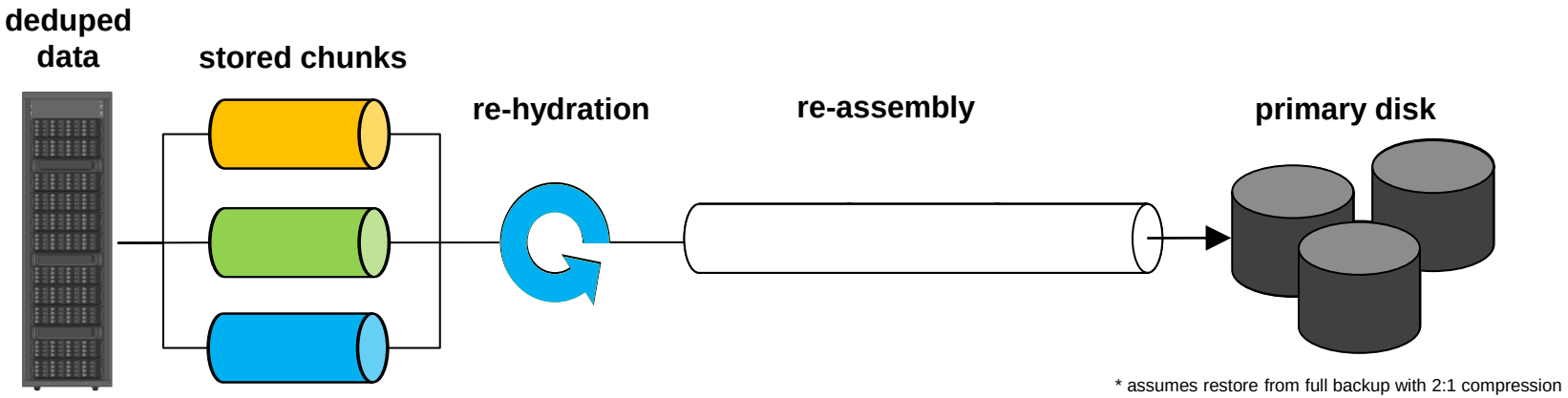
- 2 carts
- T10000C – 5.0 TB

#6 Massive Restores are Predictable With Tape

Tape Restores Are Not Slowed By Multi-Step Re-Construction Process

Restores from disk depend on:

- number of stored chunks
- actual dedupe ratio of data
- number of re-hydration nodes (usually one)
- additional workload on deduped disk
- disk storage utilization



* assumes restore from full backup with 2:1 compression

#6 Massive Restores are Predictable With Tape

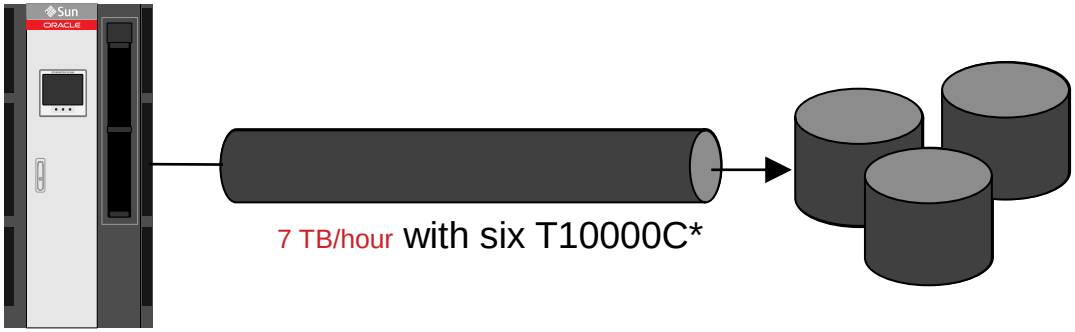
Tape Restores Are Not Slowed By Multi-Step Re-Construction Process

Tape delivers

predictable restores

by streaming a complete backup

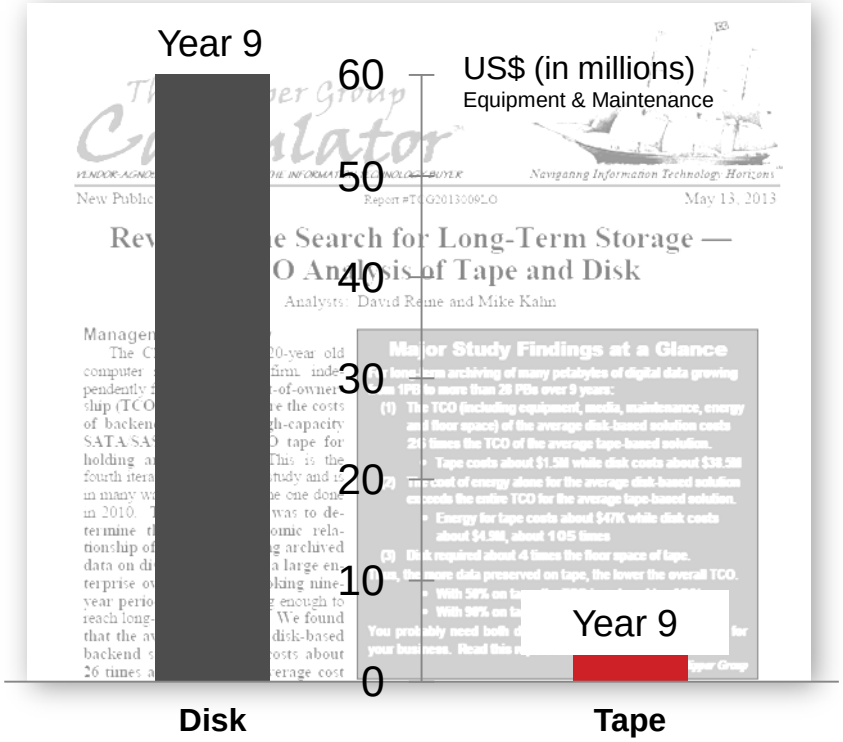
complete
backup



* assumes restore from full backup with 2:1 compression

#7 Tape Systems Cost Less Than Disk Systems

NEW Study Concludes Disk Costs 26 Times More Than Tape Solution

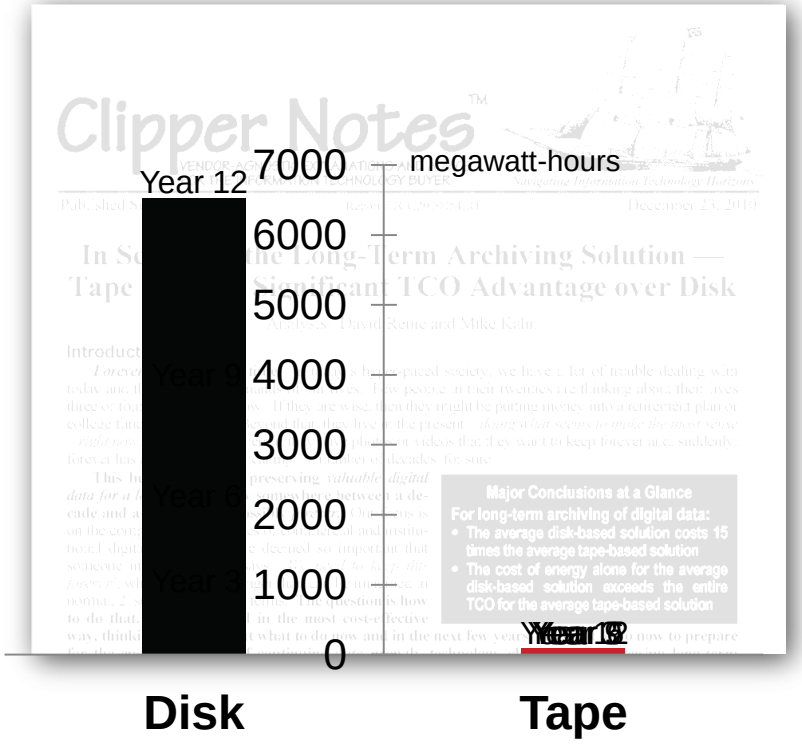


Source: The Clipper Group, http://www.oracle.com/us/corporate/analystreports/industries/clipper-tco-storage-2013-1959019.pdf

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

#8 Tape is Green

Study Concludes Disk Uses 75 Times More Energy Than Tape Solution



Source: The Clipper Group, http://www.oracle.com/go/?&Src=7011670&Act=123&pcode=WWMK10035489MPP034
Study compares a 3 PB archive growing at 45% annually for 12 years on disk and tape. Assumes 1:1 compression.

#8 Tape is Green

Study Concludes Disk Uses 75 Times More Energy Than Tape Solution

In 12 Years, tape solution saves over

6,000 megawatt-hours

of electricity

... eliminating more than

4,000 metric tons

of CO_2 emissions

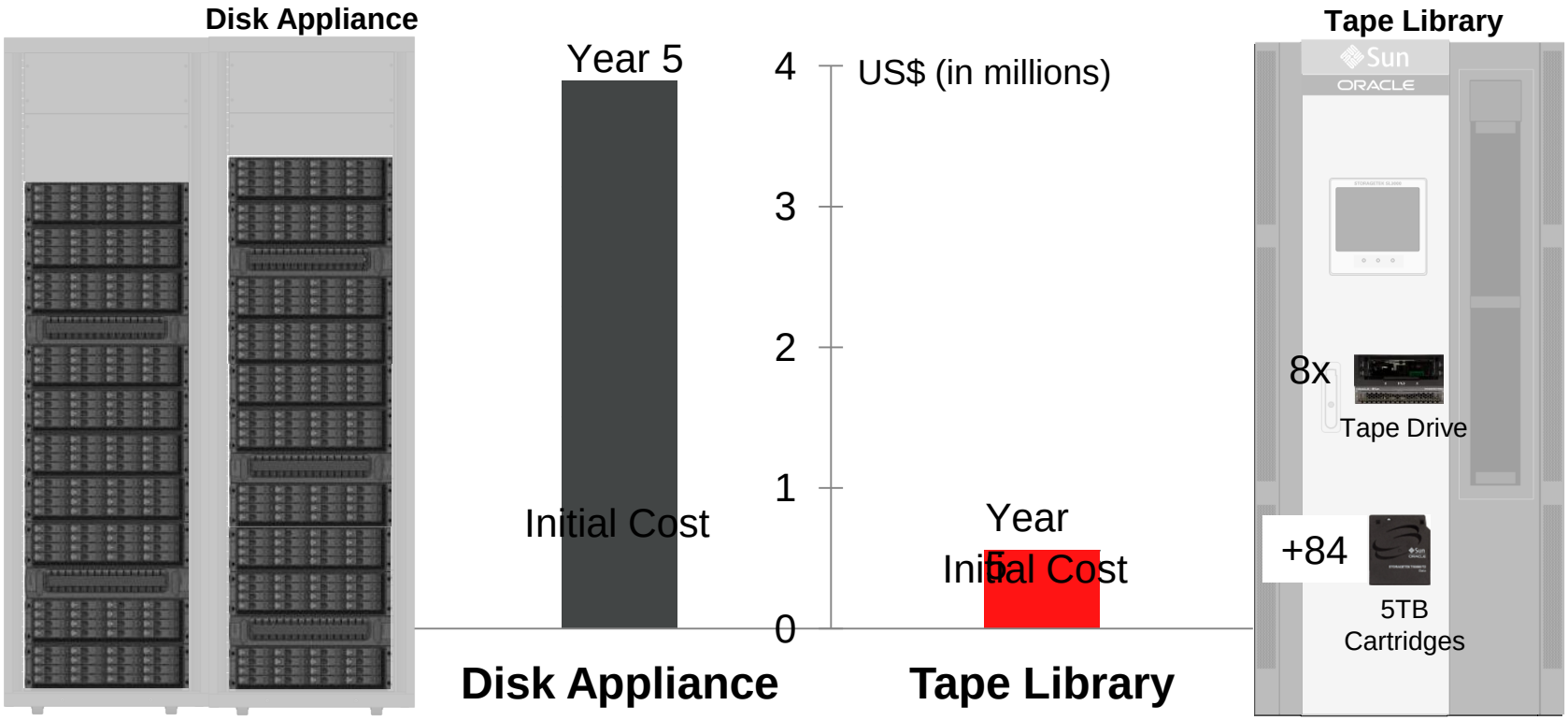
... saving more than

$4 Million

in electricity costs

#9 Tape Lowers Cost and Complexity of Growth

Tape Enables Huge Savings and Simplifies Capacity Scaling



Assumptions: 400TB in Year 1, 20% growth per year, full copy per year retained 5 years, 10 TB/hr backup and recovery, 6:1 dedupe ratio for disk, 2:1 compression ratio for tape. Based on list pricing for equipment and maintenance.

#9 Tape Lowers Cost and Complexity of Growth

Tape Enables Huge Savings and Simplifies Capacity Scaling

Capacity scaling with tape

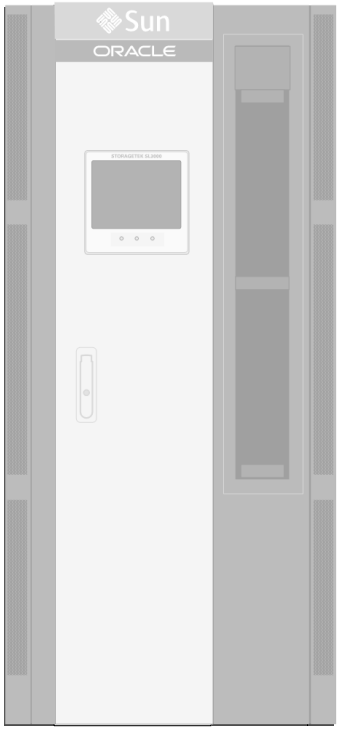
costs 93% less

...and adding tape cartridges is

much simpler

than adding more disk appliances

Tape Library



Assumptions: 400TB in Year 1, 20% growth per year, full copy per year retained 5 years, 10 TB/hr backup and recovery, 6:1 dedupe ratio for disk, 2:1 compression ratio for tape. Based on list pricing for equipment and maintenance.

On average, a single administrator can manage

100 terabytes of disk data

or

multiple petabytes *of tape data*

-Fred Moore, Horison Information Strategies, April 2012

Fred Moore, Horison Information Strategies, “Tiered Storage Takes Center Stage,” http://www.horison.com/OracleTieredStorageTakesCenterStage.pdf

#10 Rapid Disk Price Declines Have Ended

Consolidation and Impact of Floods Creates Greater Pricing Power

Market Share: 62%

Sources: Computerworld, June, 2012 http://www.computerworld.com/s/article/9227829/Hard_drive_prices_to_remain_high_until_2014
IDC Press Release, April 2012, http://www.idc.com/getdoc.jsp?containerId=prUS23414912

#10 Rapid Disk Price Declines Have Ended

Consolidation and Impact of Floods Creates Greater Pricing Power

Market Share:

85%

Due to the imbalance in supply and demand that resulted from
the Thailand floods,

HDD prices have moved higher.

Sources: Computerworld, June, 2012 http://www.computerworld.com/s/article/9227829/Hard_drive_prices_to_remain_high_until_2014
IDC Press Release, April 2012, http://www.idc.com/getdoc.jsp?containerId=prUS23414912

#10 Rapid Disk Price Declines Have Ended

Consolidation and Impact of Floods Creates Greater Pricing Power

Market Share:

85%

HDD vendors are taking advantage of this opportunity to

reset prices

and recover some of the excessive price erosion that began in 2009.

IDC Press Release
April 2012

Sources: Computerworld, June, 2012 http://www.computerworld.com/s/article/9227829/Hard_drive_prices_to_remain_high_until_2014
IDC Press Release, April 2012, http://www.idc.com/getdoc.jsp?containerId=prUS23414912

Let the data speak!

Classifying data into disk and tape tiers enables

lower risk of data loss,
faster access & restore,
and lower TCO

than either technology can offer on its own.

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Why Tape? Understanding the Top Ten Perils of Going Tapeless

Wendy Johnson
Oracle StorageTek Enterprise Data Protection and Mainframe Product Management

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