Tape Overview, Directions and Optimizations

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May 2013
Oracle StorageTek Tape Agenda

• Tape Strategy and Investment
• Portfolio Overview
• Recent Enhancements
• Statement of Direction
Customer Challenge: “Big Data” is Exploding!!!
50%/yr growth rate

- IT budgets and headcounts can’t keep up
  - Budget are projected to grow 2-3%/yr*
- Disk prices are not declining at this rate
- Customers can’t afford to just “put everything on disk”
- 80% of data is not accessed after 90 days

*Source: SearchStorage Magazine

Analysts: Digital Archive Market

Tape is the largest tier

- Storage for archive and retention is a $3B Market growing to over $7B in 2017
  - Use case for archive storage is becoming distinct from primary or backup use case
  - Tape is established as primary storage tier for long-term archive retention

Storage Technologies: Future Projections

Areal Density Trends Drive Lower Cost/TB...

Source: INSIC roadmap

*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 Usage is Predominant and Growing**

Data Protection and Archiving driving Tape Demand

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**Data Protection = Tape is Standard**

**78%**

of Enterprises use both Disk and Tape in Data Protection for a Tiered Solution

**Archive = Fastest Growing Use Case**

**52% Tape CAGR**

Majority of data stored on tape

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2 Horizon, Inc. The Era of Colossal Content Arrives
Value of Tape for Long-Term Storage

Tape is the most scalable, cost effective storage. In world of explosive data growth, tape is a staple in the enterprise data center for z/OS, open systems archive and data protection.

• Best TCO
  − Tape is less than $1/15^{th}$ the cost of disk*
  − Tape is less than $1/100^{th}$ the power/cooling of disk*

• Best Availability
  − Uncorrected bit error rate of tape is 10,000 times better than disk
    − 1 in 1,110PB with tape vs. 1 in 0.1PB with disk

• Best Scalability
  − Tape is over 30x max capacity of disk

* The Clipper Group
Oracle StorageTek Tape Strategy

• Extend our leadership market position in tape by focusing on technology innovation for tiered storage for heterogeneous environments, including mainframe and open systems
  – Target Growth Areas: Digital Archiving, Media/Entertainment, Cloud, Internet, HPC

• Integrate with Oracle applications to deliver tiered storage business ready systems

• Accelerate product development and innovation
  – Extend our leadership in scalability, availability/reliability, and TCO
Oracle Investment in Tape R&D

RESOURCES

• State-of-the-art engineering storage lab
  • 239,000 sq. ft (over $70M facility)
• Only dedicated tape head wafer fab operation
  • > 60% of mid-range drives include Oracle heads
• Upgrade of MVS capabilities
• Large engineering team
## Oracle Tape Portfolio Investment

### New Products

<table>
<thead>
<tr>
<th>Product</th>
<th>z/OS</th>
<th>Open</th>
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<tbody>
<tr>
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<td>VSM6</td>
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<td>StorageTek Tape Analytics</td>
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<td>Virtual Library Extension (VLE)</td>
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<td>LTFS for IBM LTO5, HP LTO5 and T10000C</td>
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### Portfolio Enhancements

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<th>Enhancement</th>
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<tr>
<td>Storage Archive Manager v5.3 with DIV integration</td>
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<tr>
<td>SL8500 Enhanced Partitioning</td>
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<td>Multi View SLC</td>
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<td>SL8500 Exabyte Scalability</td>
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<td>Redundant Electronics for SL8500 and SL3000</td>
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<tr>
<td>ELS / ACSLS Updates</td>
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<td>OKM Updates</td>
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</table>
Why Oracle StorageTek

✓ Best TCO and Investment Protection
✓ Highest Availability
✓ Best Scalability

SL150  LTO  T10000  VSM  SL3000  SL8500
"For calendar year 2011, Oracle StorageTek is #1 in total worldwide factory-out automation revenue for tape libraries over 1,000 cartridge slots. StorageTek has the #1 market position on the strength of its SL3000 and SL8500 midrange and enterprise automation."

Source: IDC Worldwide Tape QView Q4CY11, April 2012
Oracle StorageTek Tape Agenda

• Tape Strategy and Investment
• Portfolio Overview
• Recent Enhancements
• Statement of Direction
## StorageTek Tape Drives

### Enterprise: StorageTek T10000C
- Lowest total cost of ownership
  - Fewer drives, libraries, and media do the same job with the world’s fastest throughput and highest capacity StorageTek T10000C
- Unprecedented performance
  - Fastest throughput and StorageTek Accelerator features maximize efficiency
- Best in class data availability
  - Enterprise design and StorageTek Data Integrity Validation ensure access to data
- Simplified management
  - Less to manage and new management tools

### Midrange: LTO from HP and IBM
- Choice of drives from HP and IBM on the SL3000 and SL8500
- Investment protection through media reuse & backward compatibility
- Full-height drive conversion kits support movement between current and previous generation libraries
- Available across all StorageTek Library platforms, desktop to enterprise
StorageTek SL8500 Modular Library System

Highest Scalability, Performance and Availability

✓ Manage Growth
Accommodate rapidly growing data by off-loading storage requirements from primary storage to tape
  – Non-disruptive scalability up to 500PB of native storage

✓ Reduce Costs
Consolidate storage for multiple server and/or application environments and store at a much lower cost/TB
  – Save up to 33% on Total Cost of Ownership

✓ Minimize Risk
High availability options minimize downtime
  – Only vendor with redundant and hot-swappable robotics, electronics and pass-through ports

SL8500 Capacities
1,450-100,000 Cartridge Slots
1 to 500PB Native Capacity
1-640 Tape Drives
Up to 553TB / Hr Native Throughput
Limitless Scalability

The world’s 1st exabyte storage solution!

• RealTime Growth
  – In a single library, pre-install physical capacity to support future growth
  – Add capacity and performance by expanding to a library complex without disrupting library operations

• Buy exactly what you need
  – Capacity on Demand in 100, 250, 500 or 1,000 slot increments

* Assumes 2:1 Compression
Reducing Costs through Consolidation

The SL8500 was designed for tape consolidation with partitioning and mixed environment support

• Physical partitioning supports multiple applications
  – Flexible partitioning scheme supports up to 8 physical partitions with non-contiguous boundaries and down to the array level slot assignments

• Any Cartridge Any Slot Technology
  – Simultaneous support of multiple technologies
  – Any tape drive to any drive bay
  – Any tape cartridge to any slot

• Investment Protection: Leverage current drives and media
  – Use drive conversion trays to migrate tape drives from previous generation libraries, current SL-series libraries and some competitive libraries
StorageTek SL3000 Modular Library System

Enterprise-Class in a Midrange Footprint

✓ Manage Growth
Accommodate rapidly growing data by off-loading storage requirements from primary storage to tape
  – Scale non-disruptively almost 30x from 200 to just under 6000 slots

✓ Reduce Costs
Consolidate storage for multiple server and/or application environments and store at a much lower cost/TB
  – Save up to 33% on Total Cost of Ownership

✓ Minimize Risk
High availability options minimize both unscheduled and scheduled downtime
  – Only vendor with redundant and hot-swappable robotics and library electronics

SL3000 Capacities
200-5,925 Cartridge Slots
Up to 29.6PB Native Capacity
1-56 Tape Drives
Up to 48TB / Hr Native Throughput
Modular Growth to Scale Efficiently
Flexibility to help you scale in line with your needs

- **Cartridge Expansion Module**: Up to 620 Slots
- **Drive Expansion Module**: Up to 410 Slots, Up to 32 Drives
- **Base Module**: Up to 320 Slots, Up to 24 Drives
- **Cartridge Expansion Module**: Up to 620 Slots
StorageTek SL150 Modular Tape Library

Simplicity, Scalability and Savings

- Addressing the needs of today’s growing businesses
  - Simplicity
    - From out of the box installation through operations, upgrades, and service
  - Scalability
    - The only entry product that scales
  - Savings
    - Lowest cost scalability for capacity (slots) and performance (drives)
    - Investment protection – scales when needed
    - Best density of any scalable library and also saves on power

SL150 Capacities
30-300 Cartridge Slots
Up to 750TB Native Capacity
1-20 Half-height LTO Tape Drives
Up to 10TB / Hr Native Throughput
A New Standard for Entry Tape Automation

- **Base Module**
  - Robotics/Electronics
  - 30 slot base capacity
  - Up to 2 half-height LTO drives
  - Color, touch screen op panel
  - Mail slot

- **Expansion Modules**
  - Supports up to 9 expansion modules
Simplicity
Installation, Operation, and Servicing

• Easy Connectivity with USB
  – Connect expansion modules to any port on Base module
  – Auto discovery upon library reboot

• Simple Customer Replaceable Units
  – Limited number of parts makes ordering and support simple
    – Only 9 parts!
  – Hardware and software work together to identify library needs
StorageTek Software
Seamlessly integrate tape and make it easy to manage

Manage
Storage Archive Manager
• File system with integrated tiered storage, archiving and data protection
• Sustainable access to business information throughout the data lifecycle
• Gain control and simplify tiered storage management

Control
ACSL / ELS
• Manage multiple libraries and interface with multiple host applications
• Enhances performance through parallel operations
• Protection from unplanned outages with queuing support
• Dynamic hardware configuration updates

Monitor
StorageTek Tape Analytics
• Simplify tape storage management by proactively eliminating library, drive, and media errors
• Oracle’s algorithms provide proactive health indicators that can be trusted
• Monitor multiple globally dispersed libraries from a single interface
StorageTek Software

LTFS

• Linear Tape File System (LTFS) is an open source specification for writing files to tape in a self-describing format
  – Cartridge contents are self-describing
  – Enables users to access files on tape media just like a thumb drive
  – Enables Drag-and-Drop of files from tape to disk
  – Same software works for T10000C and LTO5
Recent Enhancements
## Recent Enhancements Overview

<table>
<thead>
<tr>
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<th>StorageTek SL3000</th>
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<tbody>
<tr>
<td>2011</td>
<td>LTO5 SAS Drive Release</td>
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<td>Drive Tray Serial Number Reporting</td>
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Record Cost Savings, Efficiency and Reliability
StorageTek T10000C with StorageTek Libraries

- Save 2-5x on floor space
- T10000C – 5TB, 252MB/s Throughput, Encryption, DIV
- Save 20-40% on total cost of ownership
- Up to 2.5x faster robotic performance
- Highest availability:
  Redundant and hot-swappable robotics, electronics and pass-through ports
SL500 and SL3000 Dual Fibre Channel Control

Redundant Paths to Support Higher Availability

• Improve availability with the dual fibre channel control card
  – 2 FC ports each with their own controller chip
  – Failover depends on backup or archive application support
  – Supports active/active paths when partitioned for use by multiple applications

• ISV Support of Dual Fibre Channel Failover
  – Full Support:
    – Symantec NetBackup 6.5 or higher
  – Manual Failover Support:
    – Tivoli Storage Manager
    – CA ARCserve
SL3000 Redundant Electronics

Failover and Replacement is Non-disruptive!

- **Redundant Control Cards**
  - Improves availability to 99.992%, >50x improvement over 9310
  - Removes the library control card as a single point of failure
    - A second set of library control cards (HBC / HBT cards) operating in an active / standby capacity

- **Transparent Failover with ACSLS or HSC/ELS**
  - ONLY available for ACSLS and HSC/ELS customers
  - Automatic or manual failover to standby cards is transparent to backup / archive applications
    - ACSLS or HSC/ELS queue commands during switch
  - Failed card can be serviced non-disruptively
SL8500 Partitioning Enhancement

The SL8500 was Designed for Tape Consolidation with Partitioning and Mixed Environment Support

- Flexible partitioning scheme for mainframe and open systems environments:
  - Supports up to 8 physical partitions
  - Non-contiguous boundaries
  - Down to the array level slot assignments
- Allocate resources to maximize library utilization
- Create partitions in 4 easy steps through the SLC
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ACSLS 8.1 and 8.2

GUI, Performance, and Availability Enhancements

• New GUI: leverages Oracle’s WebLogic industry-leading technology
  – Plus, Logical Library graphical user interface reporting enhancements

• Performance Enhancements:
  – for clients leveraging the Fibre Channel (FC) SCSI interface.
  – Performance optimization for StorageTek SL8500 Modular Library complexes connected by pass-thru-ports.

• ACSLS High Availability Enhancements:
  – Deployment flexibility with added support for x86 configurations
  – ACSLS High Availability customer installation guide
  – Note: Oracle still recommends Advanced Customer Services for this installations, but no longer requires their services.

• CAP Discovery Enhancements
• Toolkit now available
Multi-TCPIP and ACSLS 8.1+ Directed Requests

• **Improved performance:** ACSLS 8.1+ sends command directly to the library that will execute the command
  • Study by CSC found that just by implementing Multi-TCPIP and directed requests, library performance improved 50%!

• **Requires Multi-TCPIP:** Up to 15 connections to an SL8500 library complex
StorageTek Tape Analytics Software

Managing Tape Has Never Been So Simple

Simplify tape storage management, by taking a proactive approach to eliminate library, drive, and media errors

✓ Simplify Tape Management
  Tape Analytics monitors all your drives and media so you can focus your resources elsewhere

✓ Leverage Intelligent Analytics
  Oracle’s proprietary algorithms provide proactive health indicators that can be trusted

✓ Worry Free Deployment
  Tape Analytics gathers performance data through the library without ever entering your live data path

✓ Grow with Peace of Mind
  A monitoring application that scales to meet your needs, Tape Analytics supports monitoring multiple globally dispersed libraries from a single interface
A First Look at the StorageTek Tape Analytics Interface

Simple User Interface

Quickly Identify Suspect Devices

Proactive Health Indicators
StorageTek Tape Analytics
Exclusively Supporting Oracle StorageTek Libraries

Hardware Supported

Oracle StorageTek Libraries
- SL8500
- SL3000
- SL500 and SL150

Oracle StorageTek Drives & Media
- T10000A/B/C
- T9840/C/D
- LTO3/4/5* (HP & IBM)

Software Deployment

- Oracle Linux
- Browser Based UI
- Standalone Software Bundle
  Available through Oracle’s eDelivery Website
- Tape Analytics Application
- Oracle’s MySQL DB
- Oracle’s WebLogic
- Advanced Customer Services (ACS)
  Installation Option

*For detailed library, drive and media support please reference the product support in the product documentation
Midrange Tape Drives: LTO6 Support

LTO Tape Drives from HP and IBM

• LTO 6 Specifications:
  – 2.5 TB native capacity (new LTO 6 media)
  – 160 MB/sec native throughput
  – 8 Gb FC interface, 6 Gb SAS interface
  – OKM encryption capable
  – 2.5:1 compression possible

• Oracle offers a choice of HP or IBM LTO in the SL3000 and SL8500

• HP LTO drives for SL500

• HP LTO half-height drives in SL150
Future Direction
Tape Automation Future Direction

Areas of Interest

- Integrated Management
- Improved Serviceability
- Increased Scalability
- Faster Performance
- Higher Availability
Statement of Direction

• Since Oracle acquisition, increases in:
  – Engineering
  – Product Management
  – Sales

• Next 12 months:
  – Library enhancements
  – z/OS virtual enhancements
  – New drives
  – New software
Hardware and Software

Engineered to Work Together