Exabyte Tape Drives: Mammoth Technology

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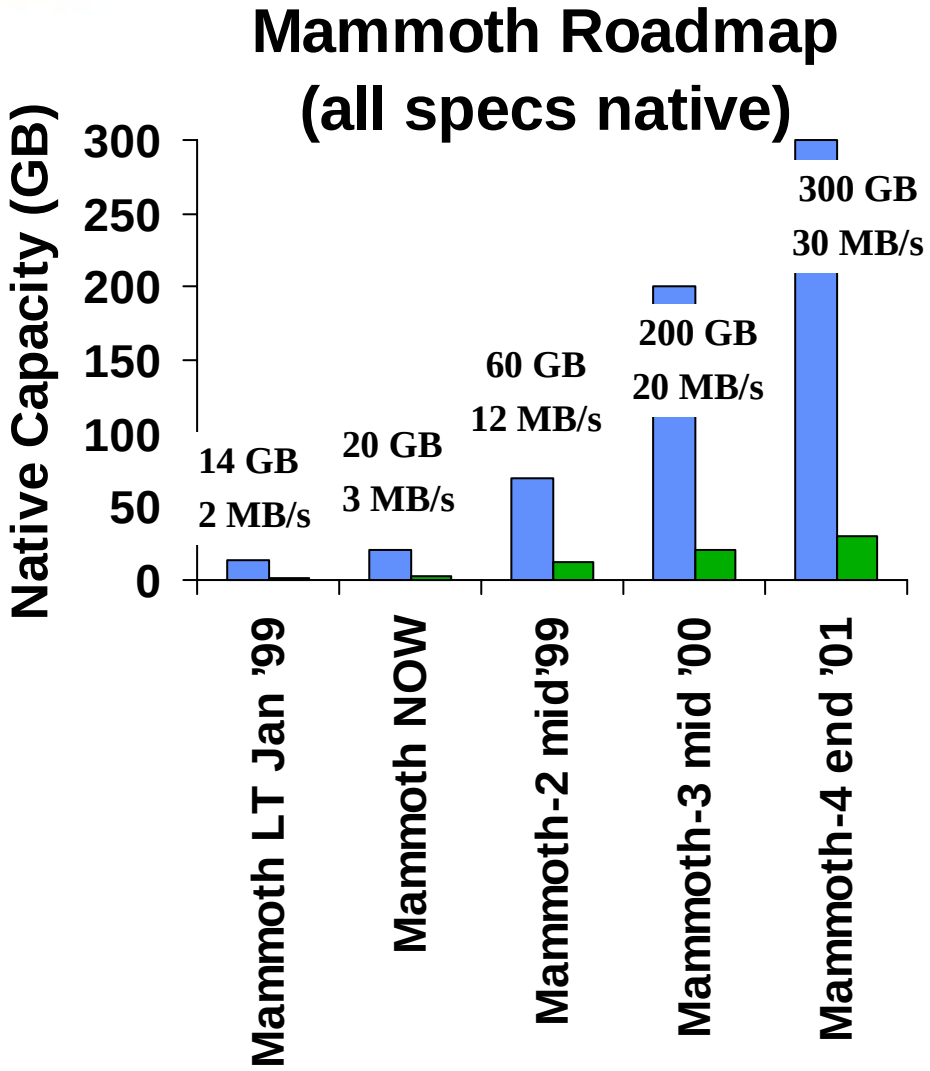
Mammoth Technology



"The Mammoth technology roadmap is one of the strongest we've seen in the midrange tape market."

Fara Yale

Storage Analyst, Dataquest.

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Mammoth Technology Foundation - Technology Revolution

- Capstanless tape path (Precision, Reel to reel, Servo system)
- Industry-grade scanner/head assembly
- Dynamic head cleaner
- Advanced metal evaporated media (AME)
- Adaptive data buffer (ADB)
- LCD Display
- TapeAlert

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Capstanless tape path - Precision Reel to Reel Servo System

- High performance servo delivers fast start-stop and tape repositioning
- Maintains low tape tension throughout all of the tape motions
- Increases tape life and dramatically increases the head life
- Handles thinner and longer tapes

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Industry-grade oversized scanner/head assembly

- 47 mm diameter scanner replaces 40 mm consumer scanner
- Record on an additional 18% of the tape area
- Provides almost 40% more area on which to mount additional heads and electronics

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Dynamic Head Cleaner

- Integrated, self-cleaning device
- Small, cloth, mechanical wheel
- Cleans heads at each tape load and unload
- Reduces head contamination and increases life of heads
- Reduces number of soft errors
- Assists in extending the manual cleaning interval

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Advanced Metal Evaporated Media (AME)

- AME diamond like coating is abrasion resistant resulting in less head wear
- Higher density and superior signal output
- Thinner magnetic layer which yields longer media and higher capacity

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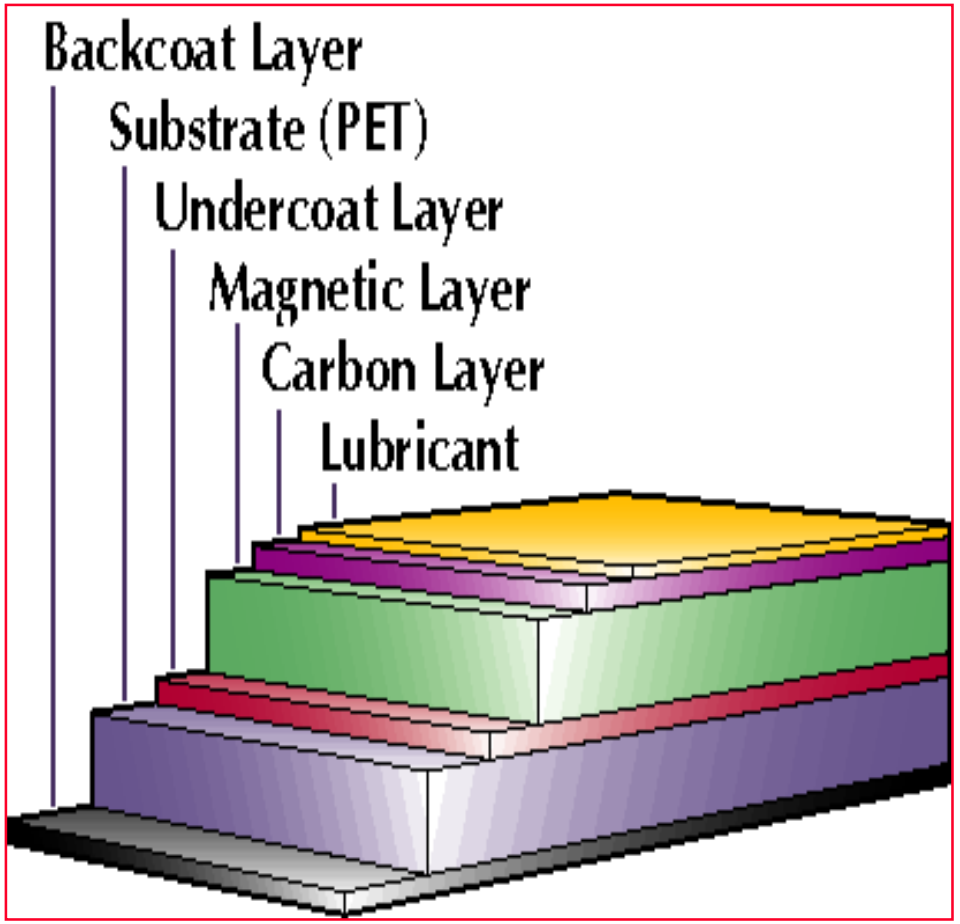
AME media

(Advanced Metal Evaporated)

- highest performance media available
- supports > 6000 ftpmm bit density
- Best energy to output ratio
- AME is very smooth - reduces head wear
- Lifetime warranty
- decreased thickness of next generation AME media will increase tape length by 30%



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Adaptive Data Buffer (ADB)

- Scalable performance no matter what transfer rate capability of the application
- 32 MB buffer allows for long streaming motion regardless of data rate

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Mammoth LCD Display

"The tape drive that talks to you"

- Unique in this form factor
- Multilingual
- Drive status information
  - READY-NOTAPE
  - LOADING...
  - READY-TAPE
  - READ + ====
  - WRITE + ====
  - >> SEARCH
  - << REWIND
- Reset messages
  - MODEL:
  - SN:
  - CODE:
  - LAST CLN: *nn* hrs
  - COMPRESS: ON/OFF
  - CONFIGURATION
  - SCSI ID:
- Cleaning Messages
  - CLEAN SOON
  - MUST CLEAN
  - CLEANING...

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TapeAlert

- Industry standard monitoring, messaging and preventative diagnostic tool
- Must be resident in drive firmware and the backup application
- Constantly monitors drive hardware and media checking for errors and potential problems
- After a completed backup, the backup app screens the drive and logged messages are displayed on the user display

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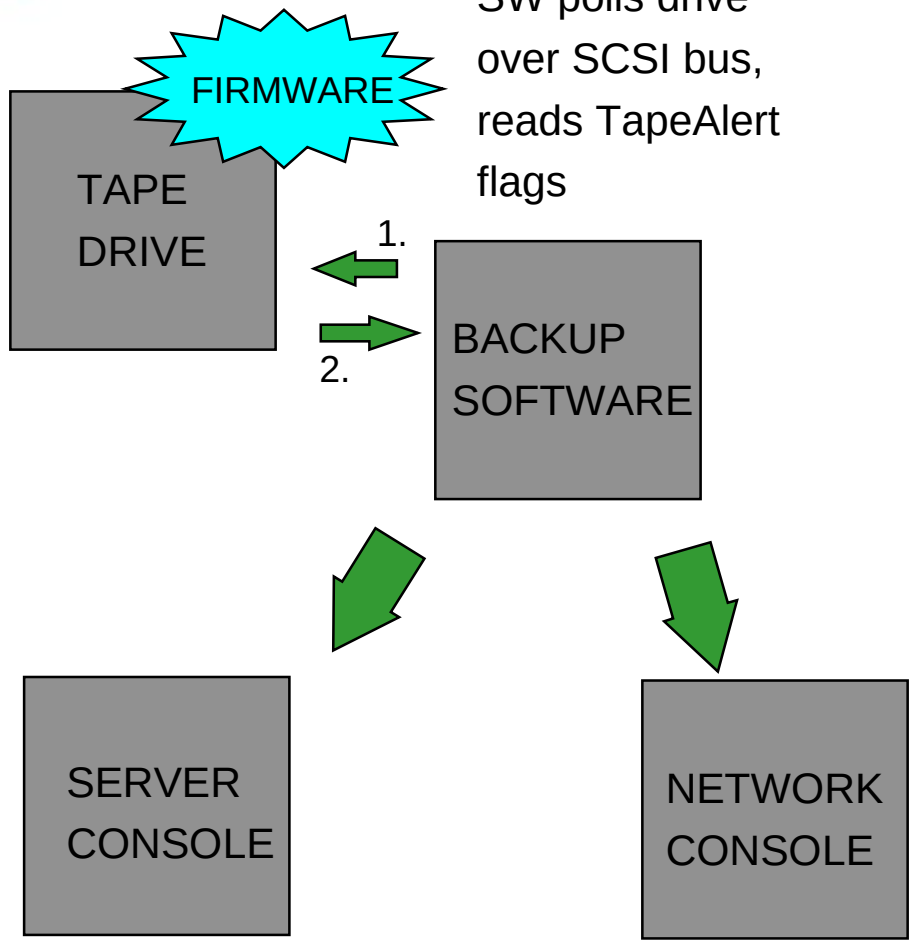
TapeAlert (con't)



Color coded messages indicate severity of problem:

- Blue - informational only
- Yellow - data may be at risk
- Red - critical, immediate corrective action required

Message displayed to user: Problem explanation and recommended solution

Message sent over network allowing network admin. to remotely manage tape drives

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Mammoth 2
Technology Evolution

- Improved scanner and heads
- Power-on Rotor
- Enhanced Partial Response Read Channel
- Three level ECC
- ALDC Compression

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Scanner/head assembly improvements

- Double the number of heads from four to eight
  - Read while Write
- Heads designed and manufactured by EMG in Germany

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Power-on-rotor

- Write drivers and preamps ICs will “fly” on the rotating part of the scanner with direct connections to the heads.
  - Read signals are amplified before passing through rotary transformer - improved signal to noise ratio
  - Increased channel bandwidth due to higher bit density
  - The location of the write drivers near the heads will permit true read while write operation

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Enhanced Partial Response (ERP4) channel

- EPR4 read channel improves performance through efficient utilization of available bandwidth
- Current standard for the disk industry

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Third Level Error Correction Code (ECC3)

- Increases error correction to correct two tracks of data
- Significantly enhances data reliability
- Allows for further recording density improvements

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ALDC Compression

- New industry standard for compression
- Better compression ratio 2.7:1
- Support IDRC as well for backward compatibility

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Interfaces

- Interface
  - Ultra 2
    - LVD
    - SN
    - SW
  - Native Fiber

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New SCSI Interface: LVD

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What is LVD ?

- LVD is the newest physical interface in the SCSI roadmap
  - The physical interface deals w/ max. bus length, termination requirements, # of devices supported, cabling, etc.
  - Other physical interfaces for SCSI include single-ended and high voltage differential (HVD, a.k.a. differential)
- LVD provides improved signal integrity

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What is LVD ?

- Maximum bus length of up to 12 meters
- Up to 16 devices
  - 1 initiator & 15 targets

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What is LVD ?

- LVD is “multi-mode” capable
  - It is fully compatible with single-ended
  - An LVD device will autosense down to single-ended if attached to a single-ended host bus adapter
  - If an LVD device and a single-ended device are attached to the same LVD host bus adapter, both devices operate as single-ended devices

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What LVD is ***NOT***

- LVD is not a SCSI signaling protocol
  - SCSI protocols define message system requirements, bus speeds and max. data transfer rates
  - SCSI-1, Fast SCSI, Ultra and Ultra2 are SCSI protocols (“wide” is a subset)
- LVD and Ultra/Ultra2 are not the same thing!
  - *But,* Ultra2 devices use only the LVD interface

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LVD Basics

- Do not mix LVD (or SE) with High Voltage Differential (a.k.a. “differential”)
  - Potential exists to damage the HBA and/or the drive
- If you need to mix HVD devices with LVD (or SE) devices converters are available several companies
  - Ancot (www.ancot.com)
- LVD requires a new terminator
  - AMP 796073-1 (SE/LVD multi-mode)

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LVD Basics

- If you need more information on SCSI go to the SCSI Trade Association web site at www.scsita.org

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Key Point of LVD

- If you put a tape drive with LVD interface on the same bus with Ultra2 disk drives (or other Ultra2 devices, like Mammoth 2), you will not drag down the performance of the Ultra2 devices

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SCSI Compatibility

	My SCSI bus is…		
My tape drive is…	*SE*	*Differential*	*LVD*
SE	**SE**	**Dead**	**SE**
Differential	**Dead**	**Differential**	**Dead**
LVD	**SE**	**Dead**	**LVD**

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SCSI Reference Table #1

SCSI Technology	Maximum Devices Supported	Maximum Bus Length (meters)		
		SE	HVD	LVD
SCSI-1	7	6	25	(1)
Fast	7	3	25	(1)
Fast Wide	15	3	25	(1)
Ultra	7	1.5	25	(1)
Ultra	3	3	25	(1)
Ultra Wide	15	-	25	(1)
Ultra Wide	7	1.5	-	-
Ultra Wide	3	3	-	-
Ultra2	7	NA	NA	12
Ultra2 Wide	15	NA	NA	12

(1) If all devices support LVD, 12m is possible. If any device is SE, then entire bus switches to SE distances.

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SCSI Reference Table #2

SCSI Technology	Transfer Rate	Interface Supported		
		SE	HVD	LVD
SCSI-1	5	#	#	#
Fast	10	#	#	#
Fast Wide	20	#	#	#
Ultra	20	#	#	#
Ultra Wide	40	#	#	#
Ultra2	40			#
Ultra2 Wide	80			#

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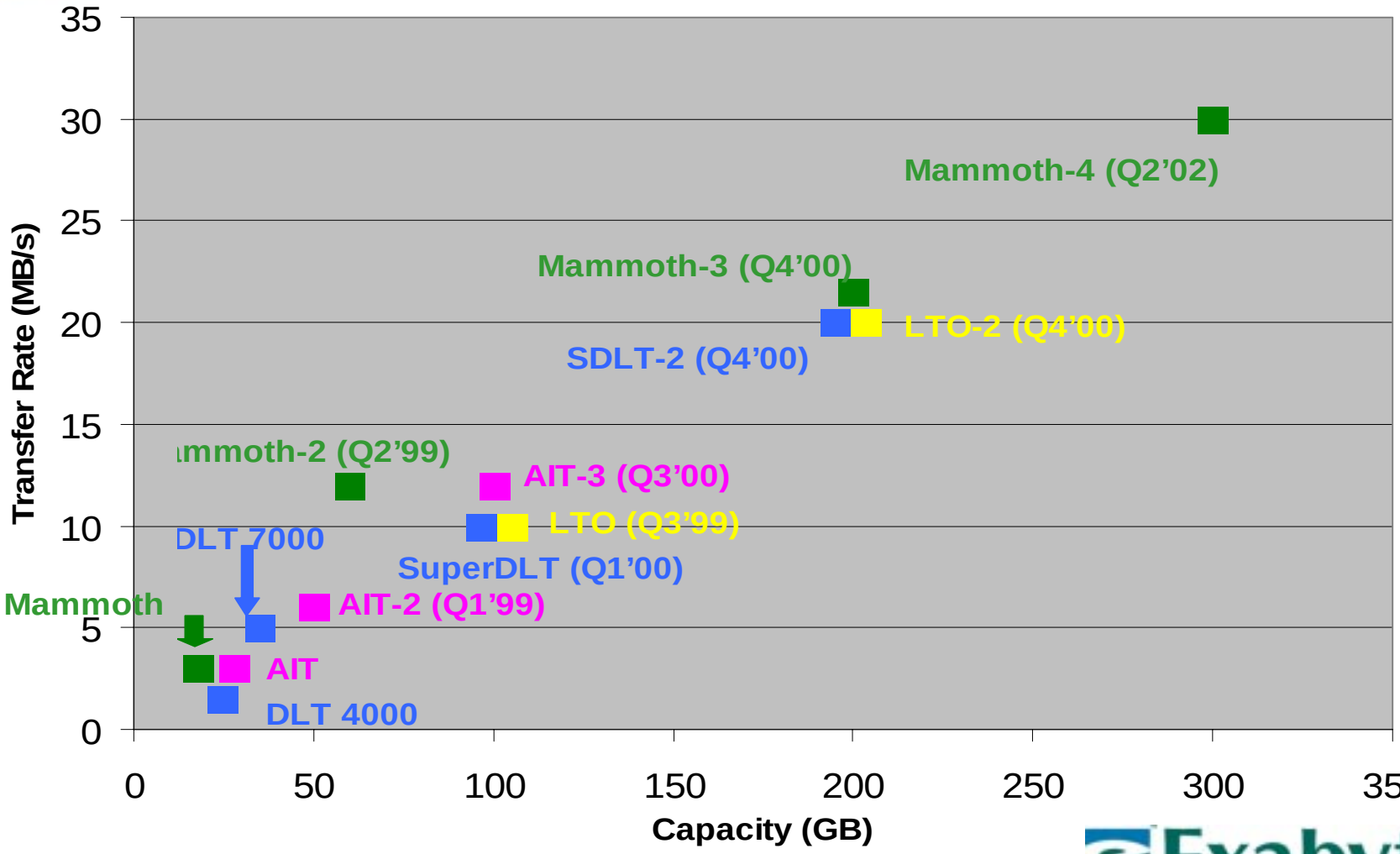
Competitive Roadmaps



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