

## Using Track-Following Servos on Next Generation Tape Drives

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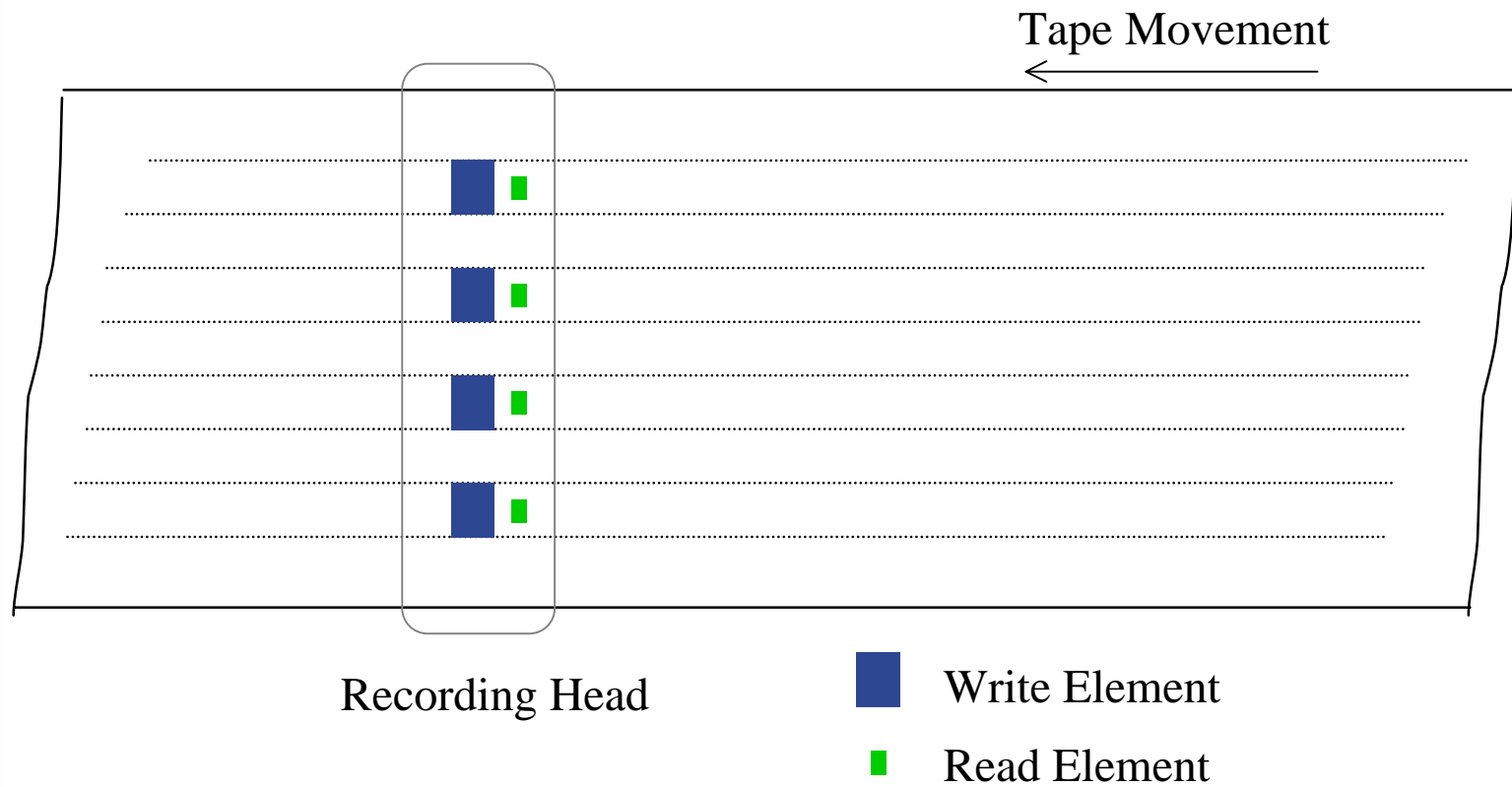
[www.fcpa.com](http://www.fcpa.com)

# Fujitsu Limited

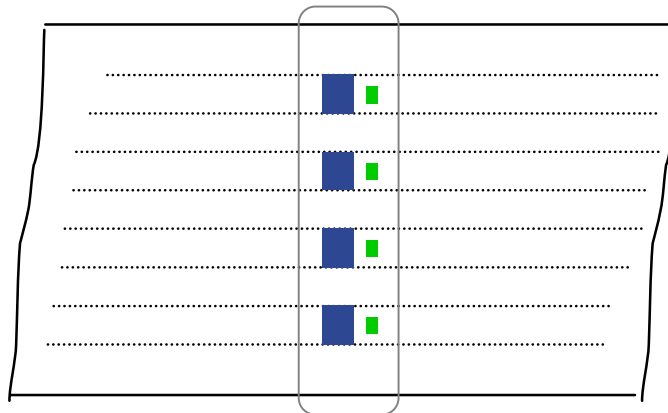
- ◆ Among the top five largest computer companies
  - Japan - Fujitsu Ltd
  - USA - Amdahl
  - Europe - ICL Group
- ◆ More than \$37.7 billion in sales
- ◆ Employs 180,000 people
- ◆ Operations in over 100 countries



# Linear Tape Recording Basics

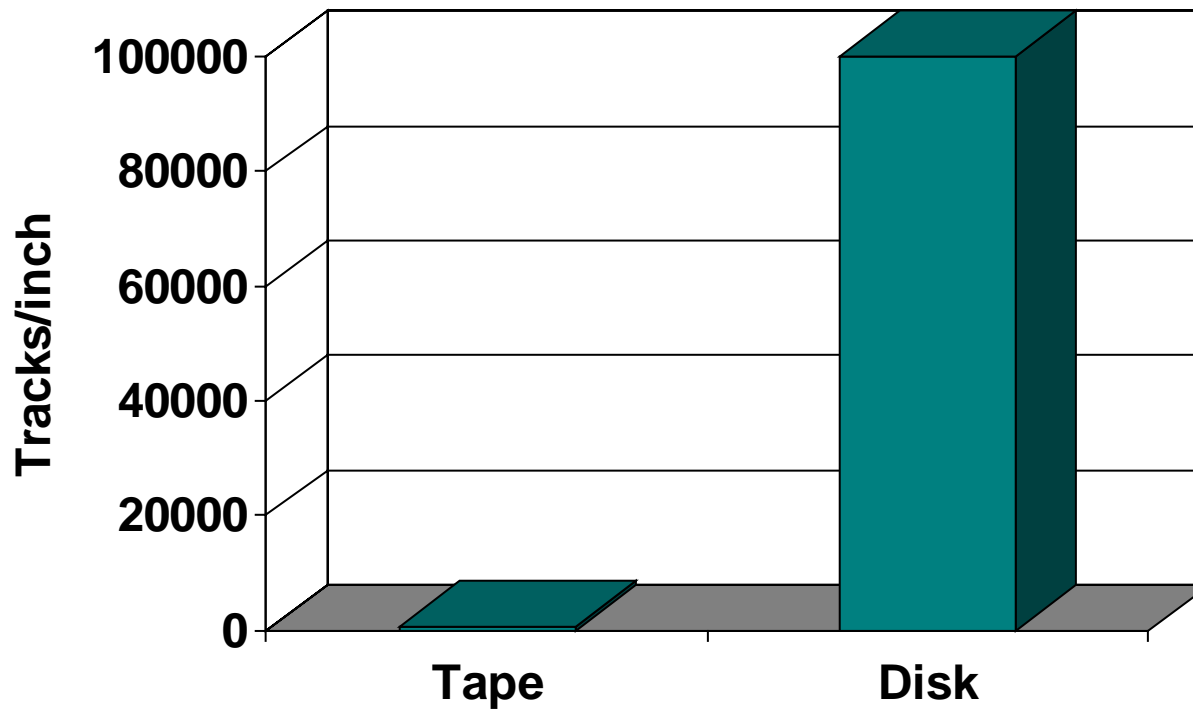


# Needed Improvements in Tape Technology



- ◆ Greater media area
  - Thinner tape
- ◆ Higher bit density
  - Higher coercivity media
  - Improved modulation codes
  - "Predictive" signal decoding
- ◆ Higher track density
  - Servo Track-following

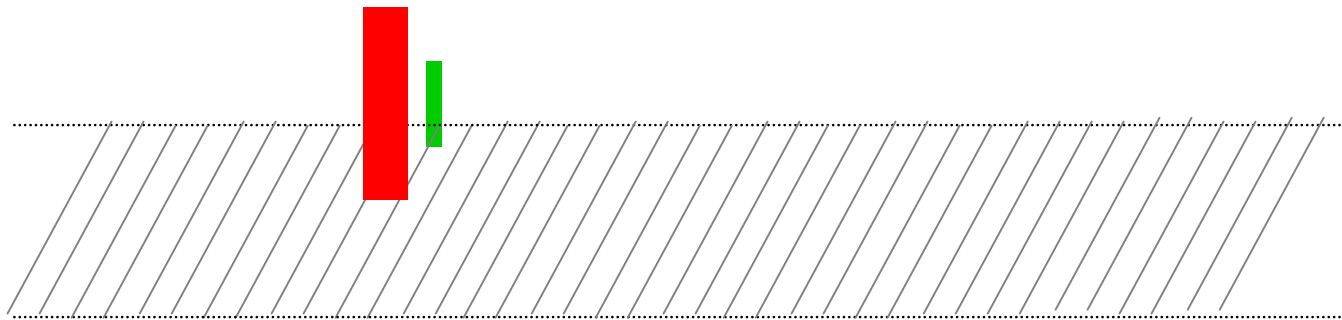
# Track Density Comparison



**Large Potential Capacity Growth Enabled by Increasing Track Density**

# Challenge to Increasing Track Density: Vertical Tape Movement

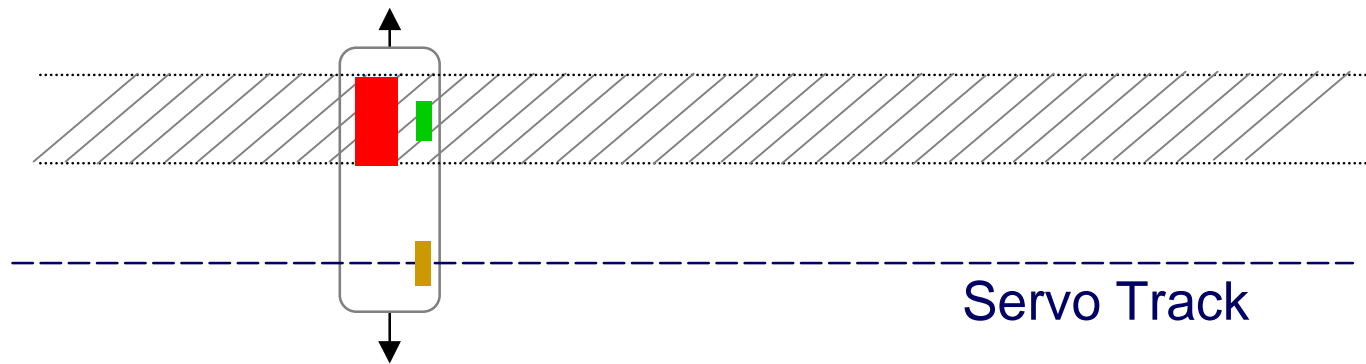
Recorded Track Below Read Head



Poor Data Recovery

- Write Element
- Read Element

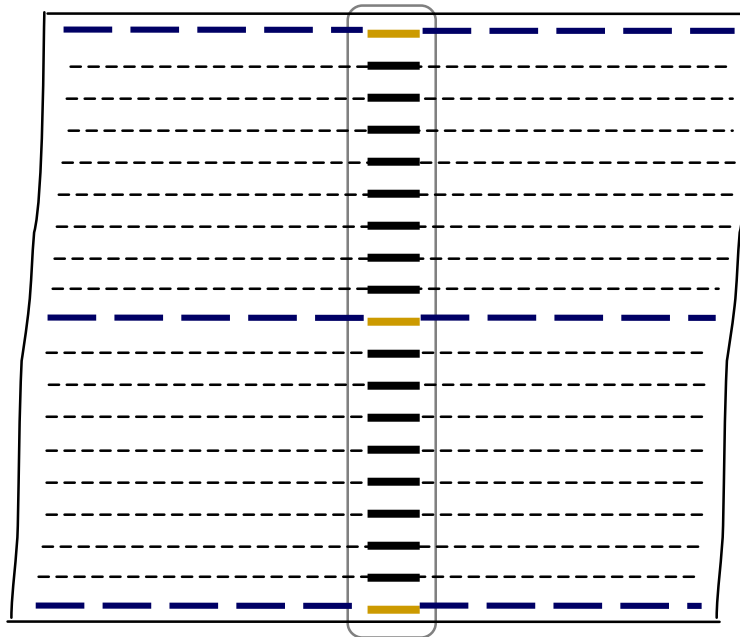
# Track-following Technology



**Head Moves to Follow Servo Track**

- Write Element
- Read Element
- Servo Element

# 3590 Magstar™



**3 Redundant Servo Tracks**

## Fujitsu M8100

- ◆ 10GB Capacity
- ◆ 13.5 MB/sec



Magstar is a trademark of IBM



# Linear Tape Open



- ◆ High Performance Tape Format
  - Announced November '97
    - Formed by HP, IBM, and Seagate
  - Open format specification
    - Compliance tested
  - Evolutionary technical roadmap
    - Products available this year
  - More information:
    - [www.lto-technology.com](http://www.lto-technology.com)



# Linear Tape Open



## Ultrium Roadmap

		<u>Generation 1</u>	<u>Generation 2</u>	<u>Generation 3</u>	<u>Generation 4</u>
<b>Capacity</b>	Native	100GB	200GB	400GB	800GB
	Compressed*	200GB	400GB	800GB	1.6TB
<b>Transfer Rate</b>	Native	10-20MB/s	20-40MB/s	40-80MB/s	80-160MB/s
	Compressed*	20-40MB/s	40-80MB/s	80-160MB/s	160-320MB/s
<b>Recording Method</b>		RLL 1, 7	PRML	PRML	PRML
<b>Media</b>		MP	MP	MP	Thin Film

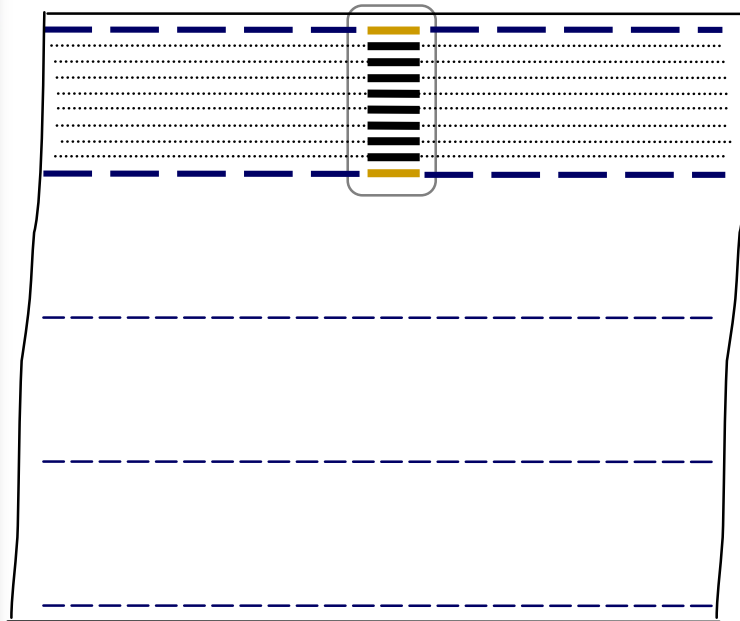
\*Assumes 2:1 compression ratio



FUJITSU COMPUTER PRODUCTS OF AMERICA, INC.



# Linear Tape Open



2 Redundant Servo Tracks

## Ultrium

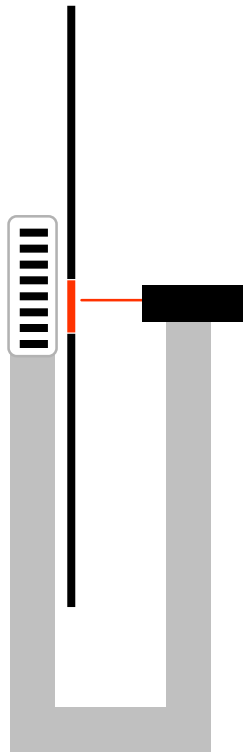
- ◆ 384 tracks
- ◆ Time-base Servo
- ◆ Powerful ECC
- ◆ Dynamic Rewrite
- ◆ Cartridge Memory



# SuperDLT

## SDLT

- ◆ 100GB Capacity
- ◆ Revolutionary Technical Roadmap
  - Pivoting Optical Servo
  - PRML
  - Reflective-bonded Media
- ◆ ? Servo Redundancy
- ◆ More information:
  - [www.dlftape.com](http://www.dlftape.com)



# Choosing Next Generation Tape

- ◆ Look for:
  - Most tape area
    - Widest and longest tape
  - Track-following Servo
    - Redundant servo sensors
  - Evolutionary Technical Roadmap
    - Lower risk of reliability problems
  - Multiple manufacturers
    - Ensure competitive pricing

