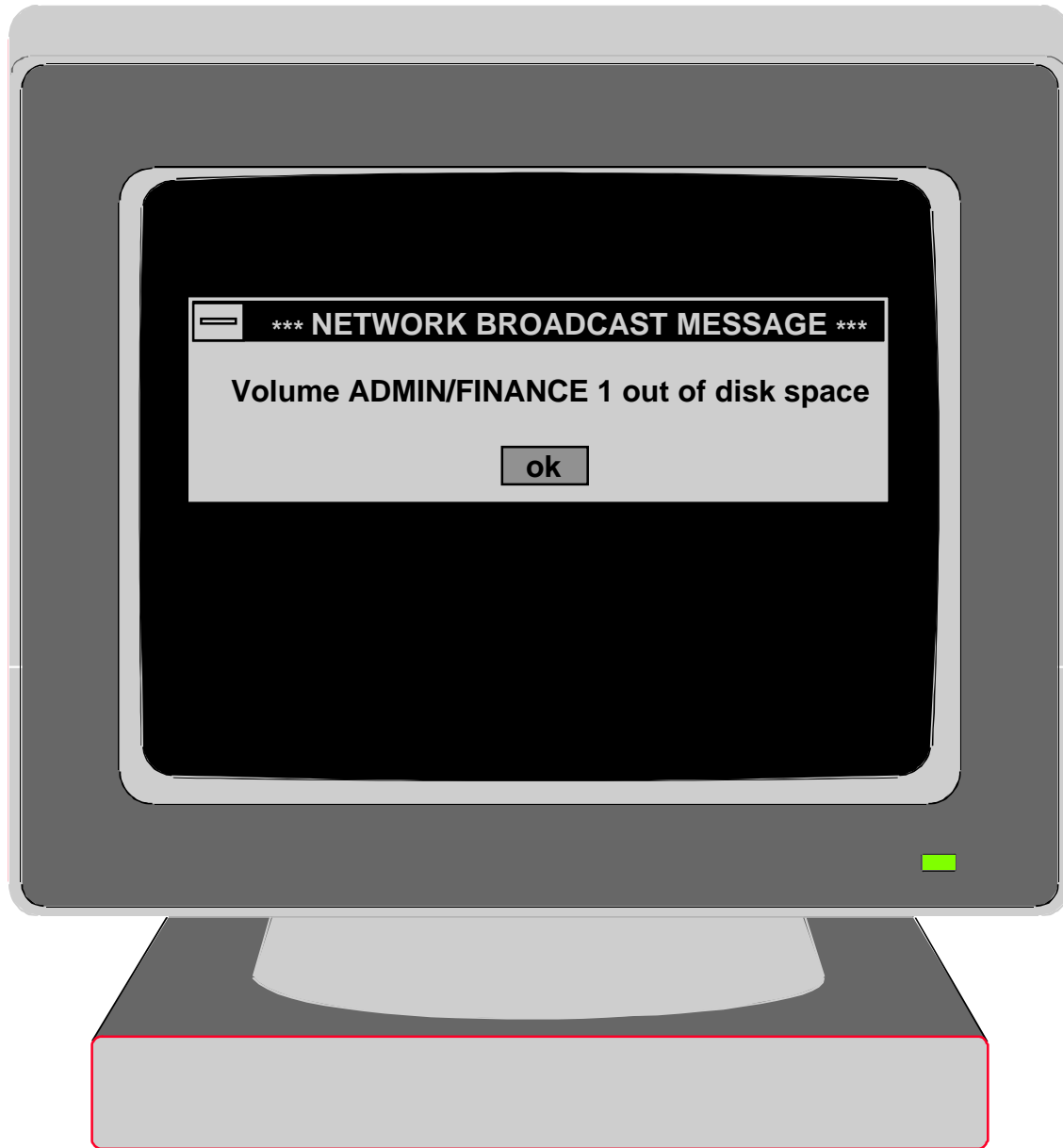


# **Examine Your Strategy, Weigh Your Options in Choosing Removable Storage**

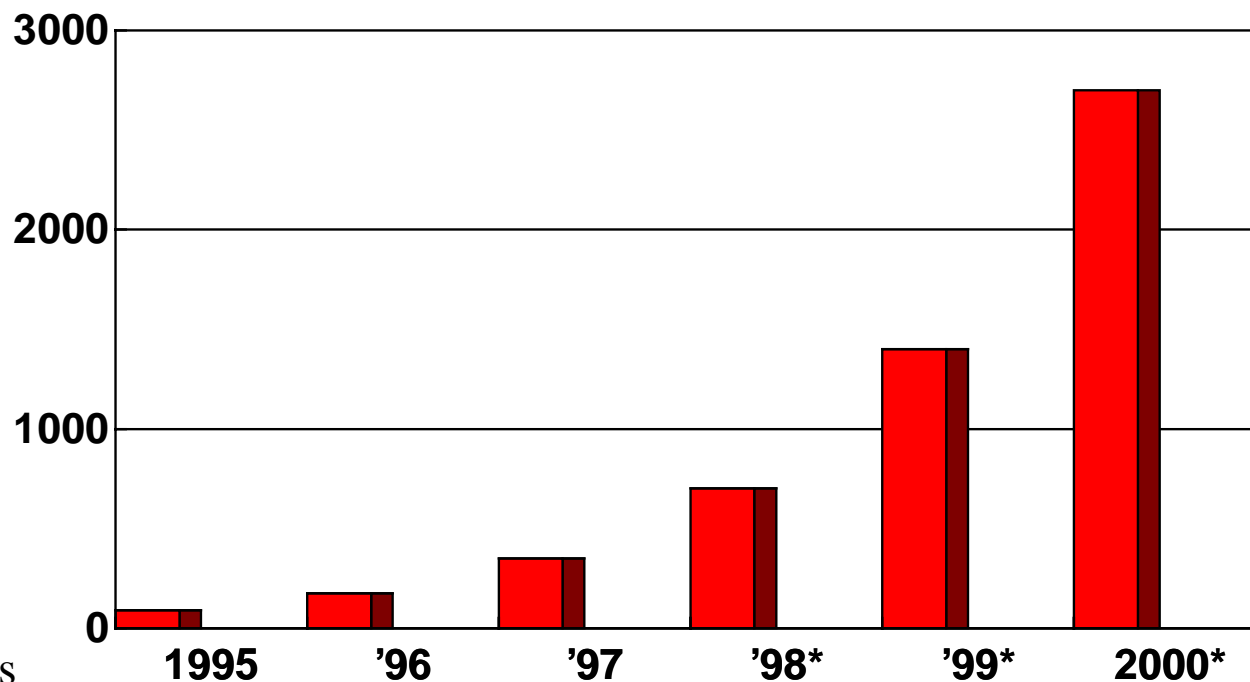
**Dave Holmstrom  
Associate Director of New Products  
Verbatim Corporation**

# Evaluating Storage Solutions

- What type of data is being stored?
- How much will you need to store?
- How quickly do you need to access the data?
- Will people need to share and distribute data with others?
- How reliable are the various storage media?
- Finally, how much are you willing to spend?



# Growing Storage Requirements (Petabytes Shipped)



\* Forecasts  
Source: IDC

A Petabyte = 1 quadrillion bytes of data

# Storage Equivalents

- **Text Storage**

- 1TB (terabyte) = 500 million text pages
- 1PB (petabyte) = 500 billion pages
- 1EB (exabyte) = 500 trillion pages
- 1GB (gigabyte) = 500,000 text pages
- 1MB (megabyte) = 500 text pages

- **Still Video Storage**

- .9MB = 300 dpi 8x10 B/W image
- 38MB = high-res color photo
- .31MB = 256 VGA computer screen

- **Full-Motion Video Storage**

- 120GB = 90-min. movie

# Storage Options

Tape

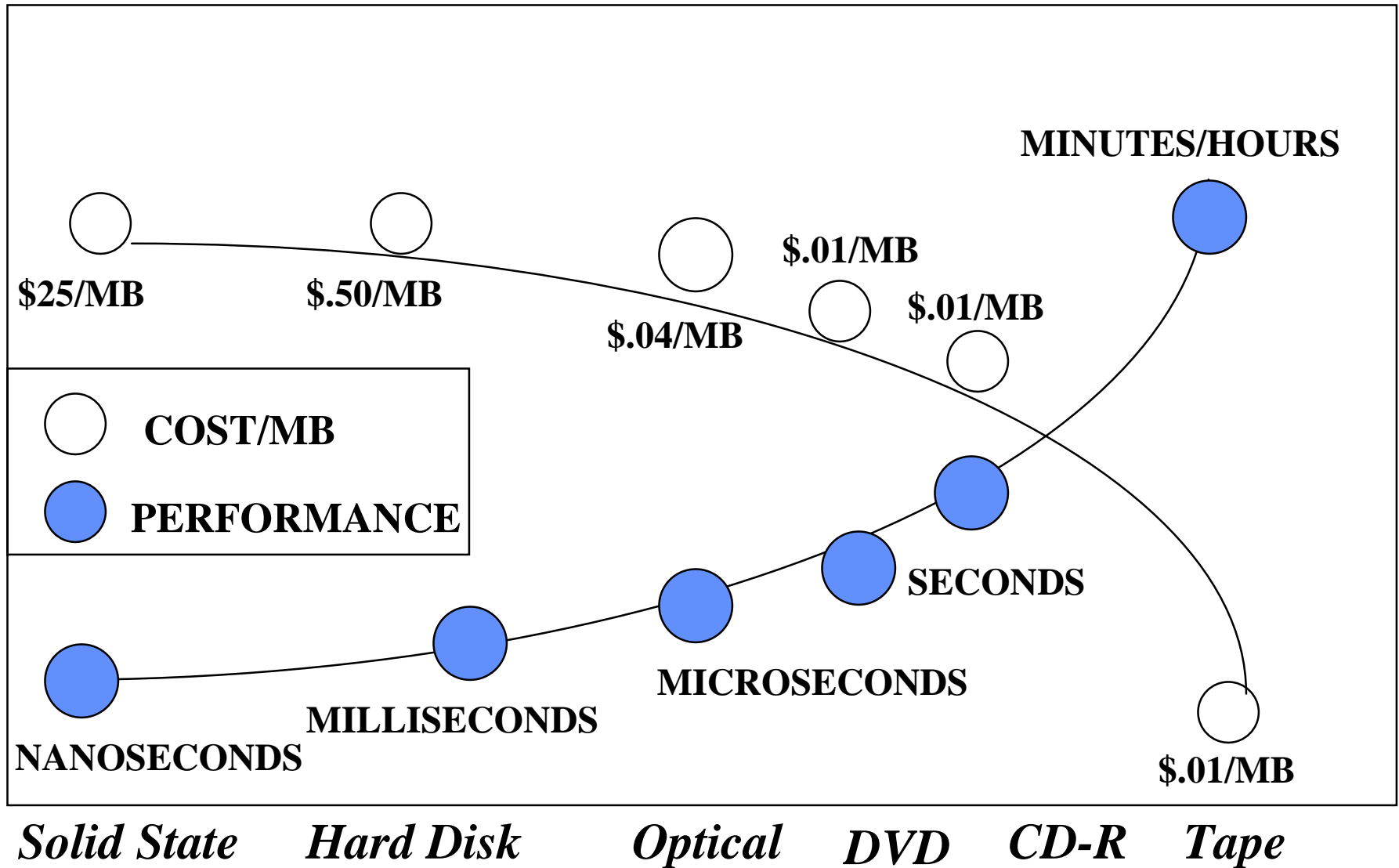
Hard Drives

CD-ROM

MO

DVD

# Storage Price/Performance Solutions

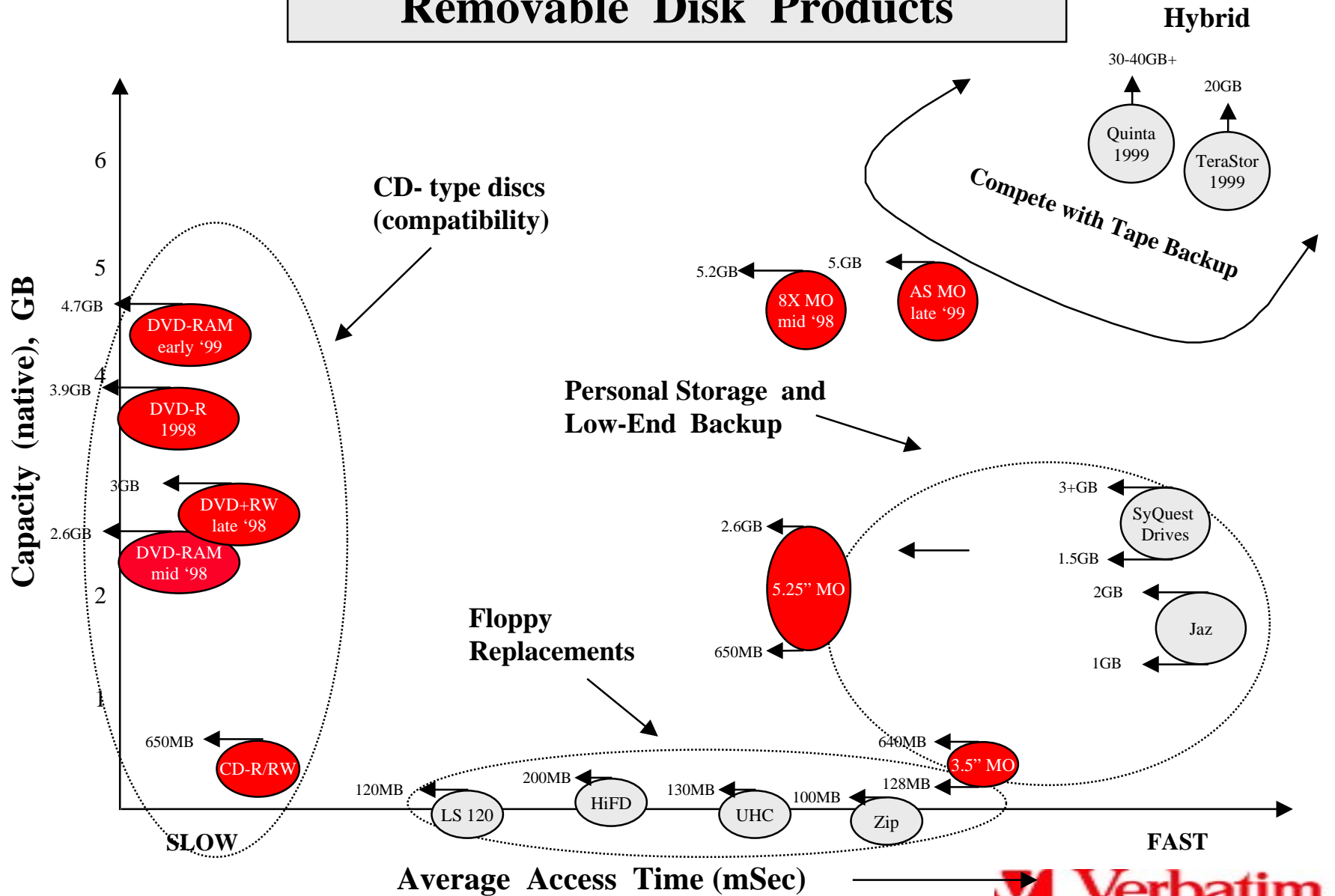


(Only Part of the price/performance equation)

# Media CPM

\$.005	Tape
\$.005	CD-R
\$.03	CD-RW
\$.011	DVD Rewritable
\$.003	Floppy Diskette
\$.3	Hard Disk
\$.04	2.6GB MO
\$.12	ZIP, JAZ, Syquest
\$25	RAM

# Disk Capacity and Access Time Removable Disk Products



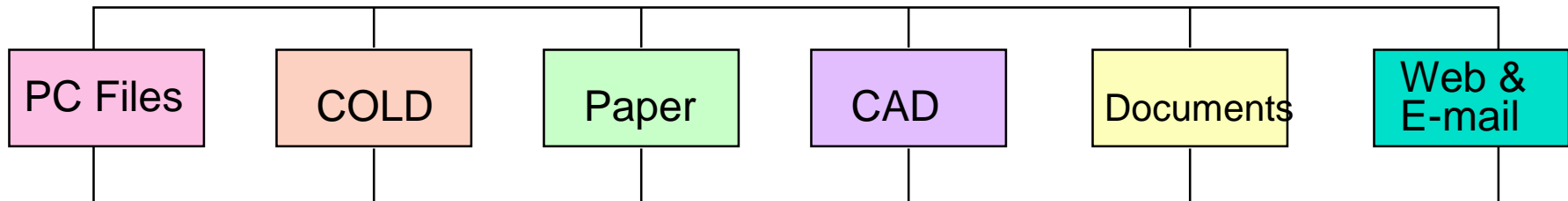
# CD Data Storage Strategy



Massive Amounts of Diverse Business Information



Application-specific Storage Management Software Modules

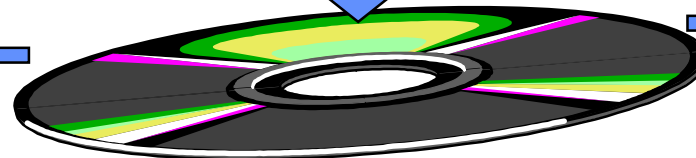


## Content Management

Indexing, Search/Retrieval of CD Discs & Libraries



Portable Resource  
for Information Access



Network Resource for  
Shared Information  
Access

Universal Access to Any Information



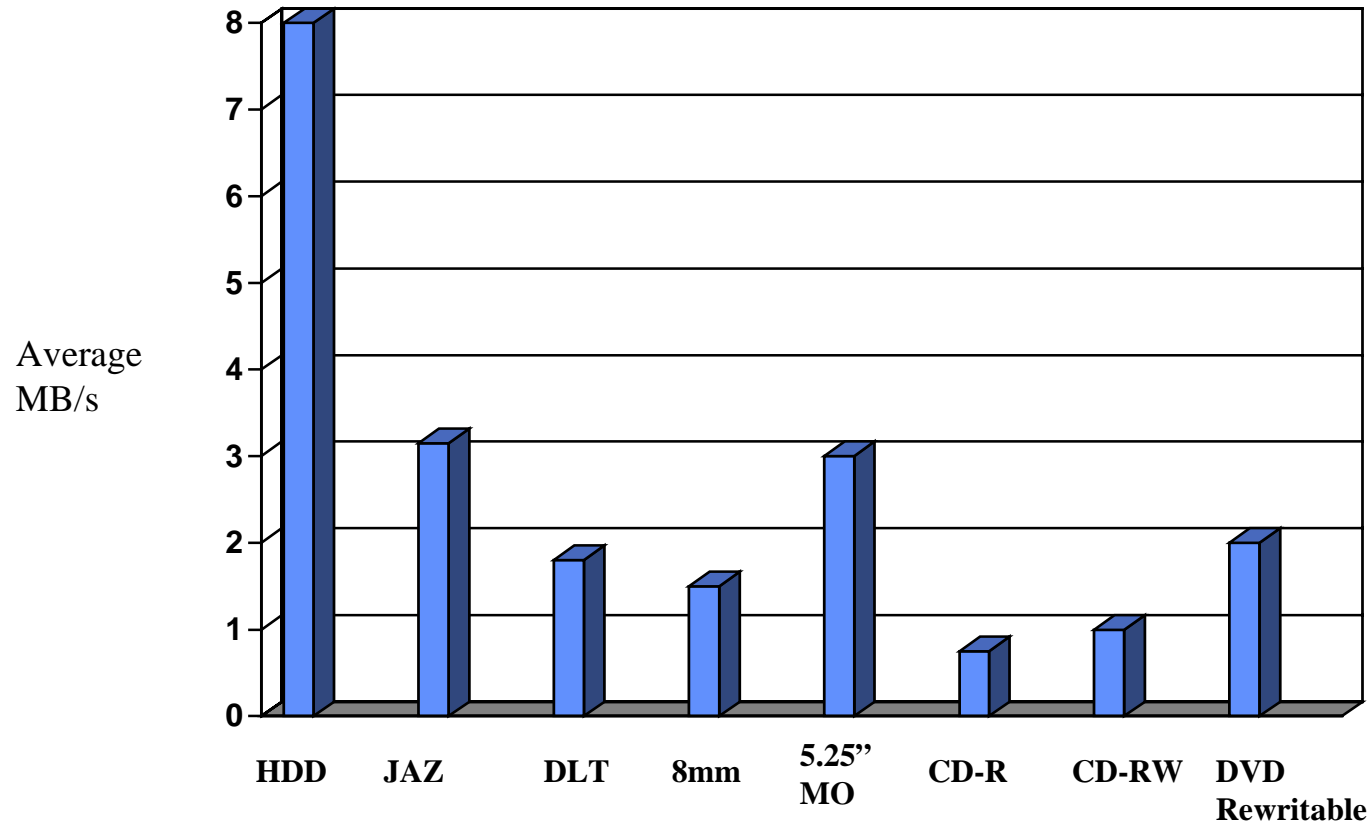
# Optical Disk Technologies

Technology	Key Characteristics	Street Price	Availability	Media	
5-25" MO	<ul style="list-style-type: none"> <li>• 5.2GB rewrite</li> <li>• 10.4GB rewrite</li> </ul>	\$1,200	now	\$80	
		\$1,200	late '99	TBD	
CD	<ul style="list-style-type: none"> <li>• 650MB write-once</li> <li>• 650MB rewritable</li> </ul>	\$ 400	now	\$1-2	
		\$ 500	now	\$10-12	
DVD	<ul style="list-style-type: none"> <li>• 2.6GB</li> <li>• 4.7GB</li> </ul>				
		read-only (DVD-ROM)	\$ 129	now	---
		write once (DVD-R)	\$12,000	now	\$50
rewritable (DVD-RAM)		\$ 700	now	\$25	

# Comparing Removable Storage Choices

	5.25" MO	Jaz	DLT	CD-R	CD-RW	DVD
Scalability	High	Low	High	High	Moderate	High
Reliability	High	TBD	High	High	Moderate	Moderate
Write Speeds	Fast	Fast	Fast	Slow	Slow	Moderate
Cost of Retrieval	Low	Moderate	Moderate	Low	Low	Low
Cost of Media (\$/MB)	<.04	>.10	<.01	<.001	>.01	.008
Ease of Use	Easy	Easy	Easy	Moderate	Moderate	Easy
Multiple Sources	Yes	No	No	Yes	Yes	Yes
Availability	NOW	NOW	NOW	NOW	NOW	NOW

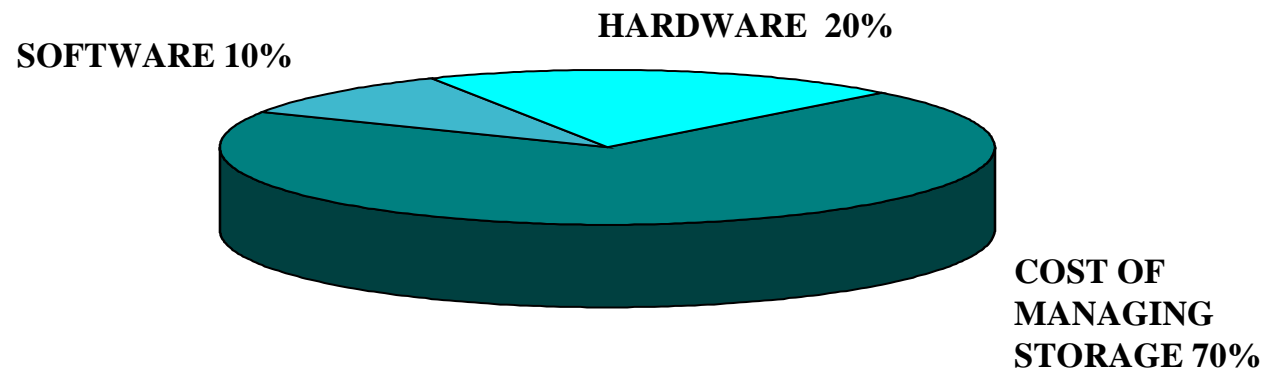
# Comparison-Sustained Write Transfer Rates\*



\* Uncompressed

## Removable Technologies

# Storage & Storage Management Expenses



Source: Giga Information Group

# Initial Optical Selection Criteria

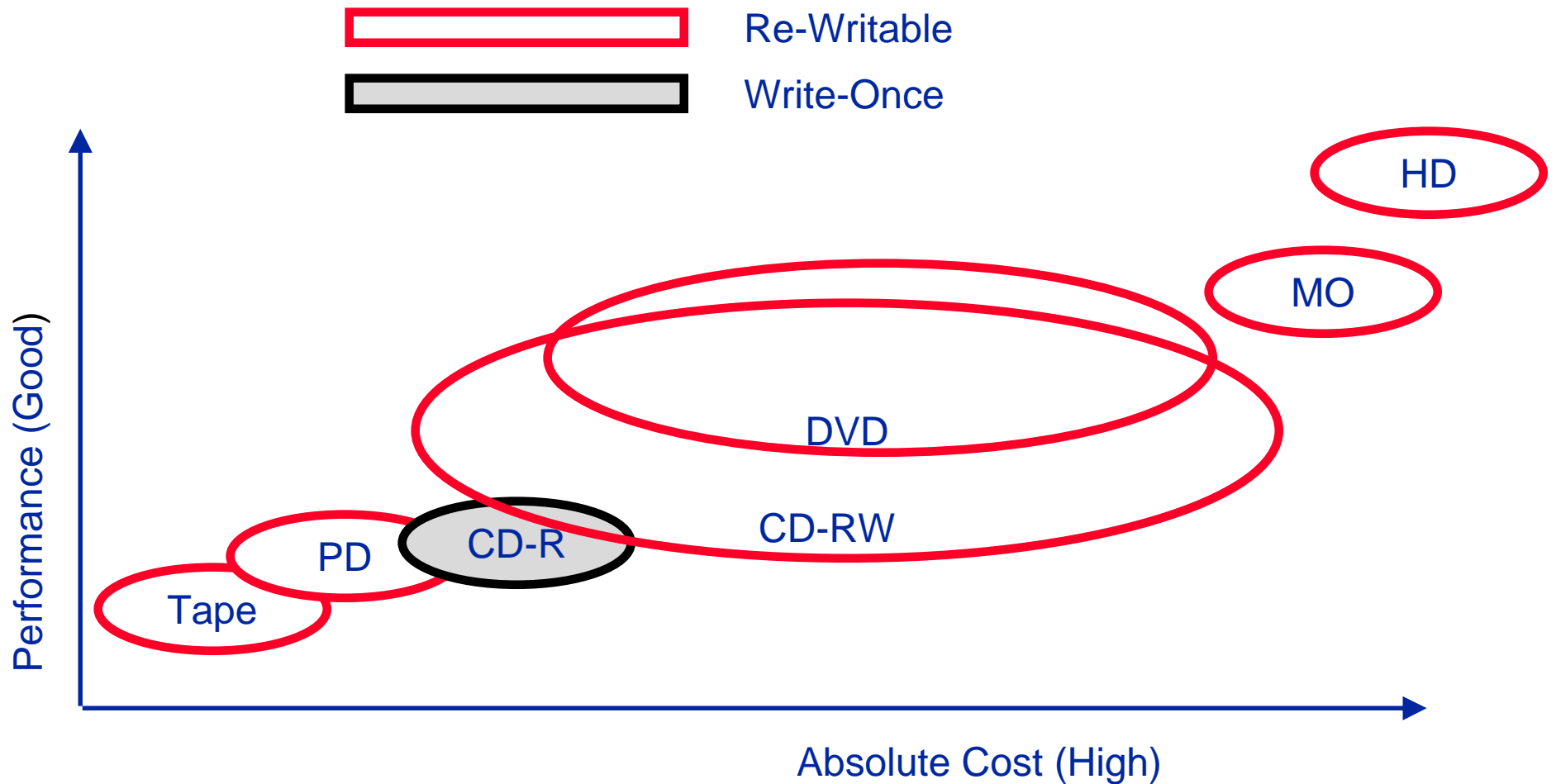
*Storage Requirements* =

**Number of documents per year X .00005**  
**(scanned compressed image in GB)**  
**X years on-line**  
**X annual growth rate**

# Mix, Match Your Selection

- Determine “value” of online, near-online, off-line storage/access
- Determine Length of Access Period, Storage Period
- Choose scalable, long-term solutions
- Develop integrated, automated solution

# Positioning of Removable Technologies





## Applications for CD-R

- Distribution
- Audio (personal & professional)
- Archiving
- Short-run production
- Prototyping, testing
- Pre-mastering for replication



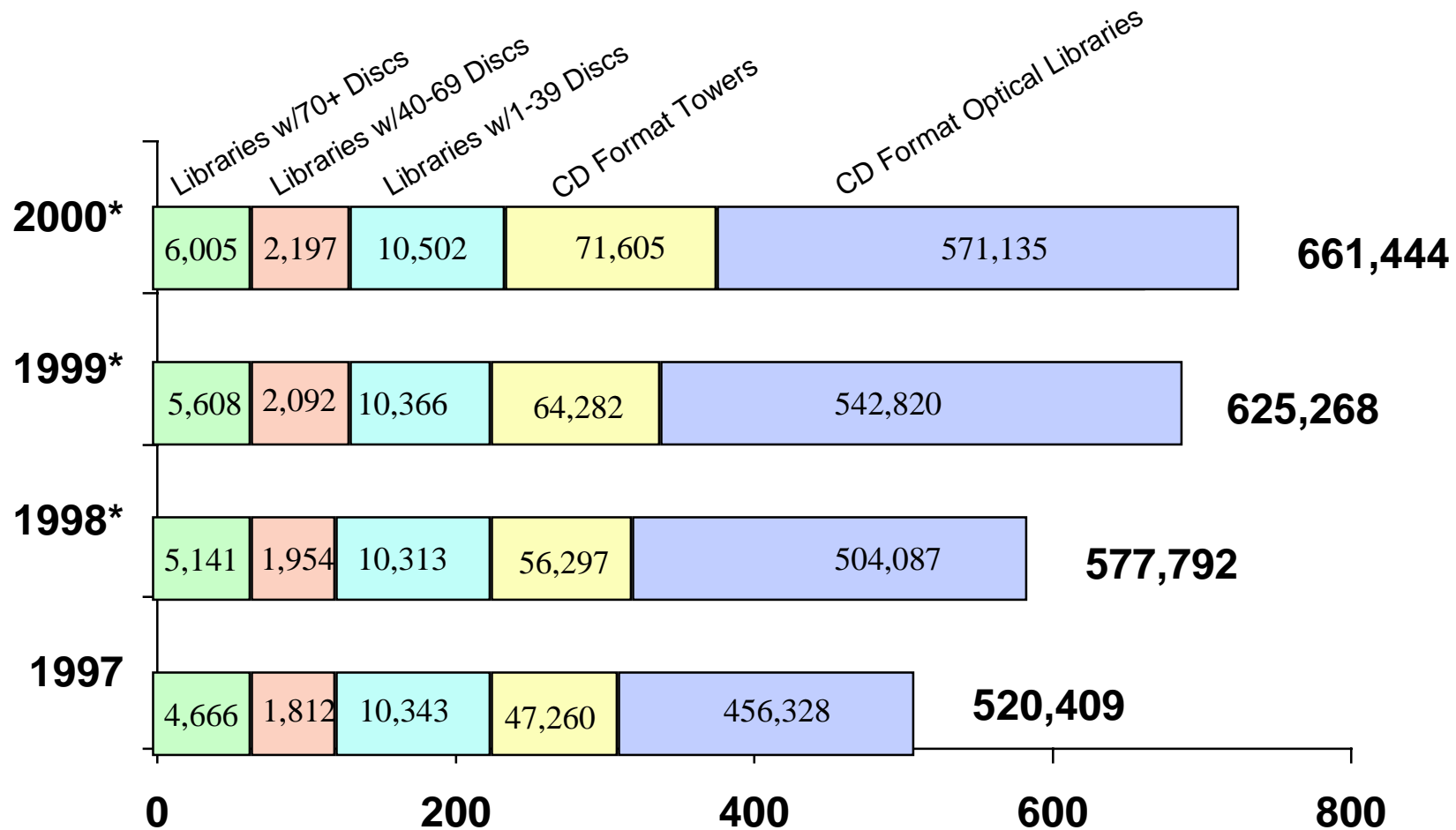
## Applications for CD-RW

- Back-up
- Personal/Enterprise Storage
  - Replacement for Syquest, Zip Drives, Magneto-Optical
- Prototyping
  - Software, multi-media, games, works in progress

# CD-RW vs. Zip/Jaz

- **CD-RW has a higher capacity (650MB vs. Zip 120MB)**
- **CD-RW is a standard, Zip is a proprietary format**
- **CD-RW has a lower cost per MB (4 cents vs. 11 cents)**
- **CD-RW lifetime is 30 years (optical), Zip is 5 years (magnetic)**

# Worldwide Optical Disk Library Unit Shipments (in Thousands)

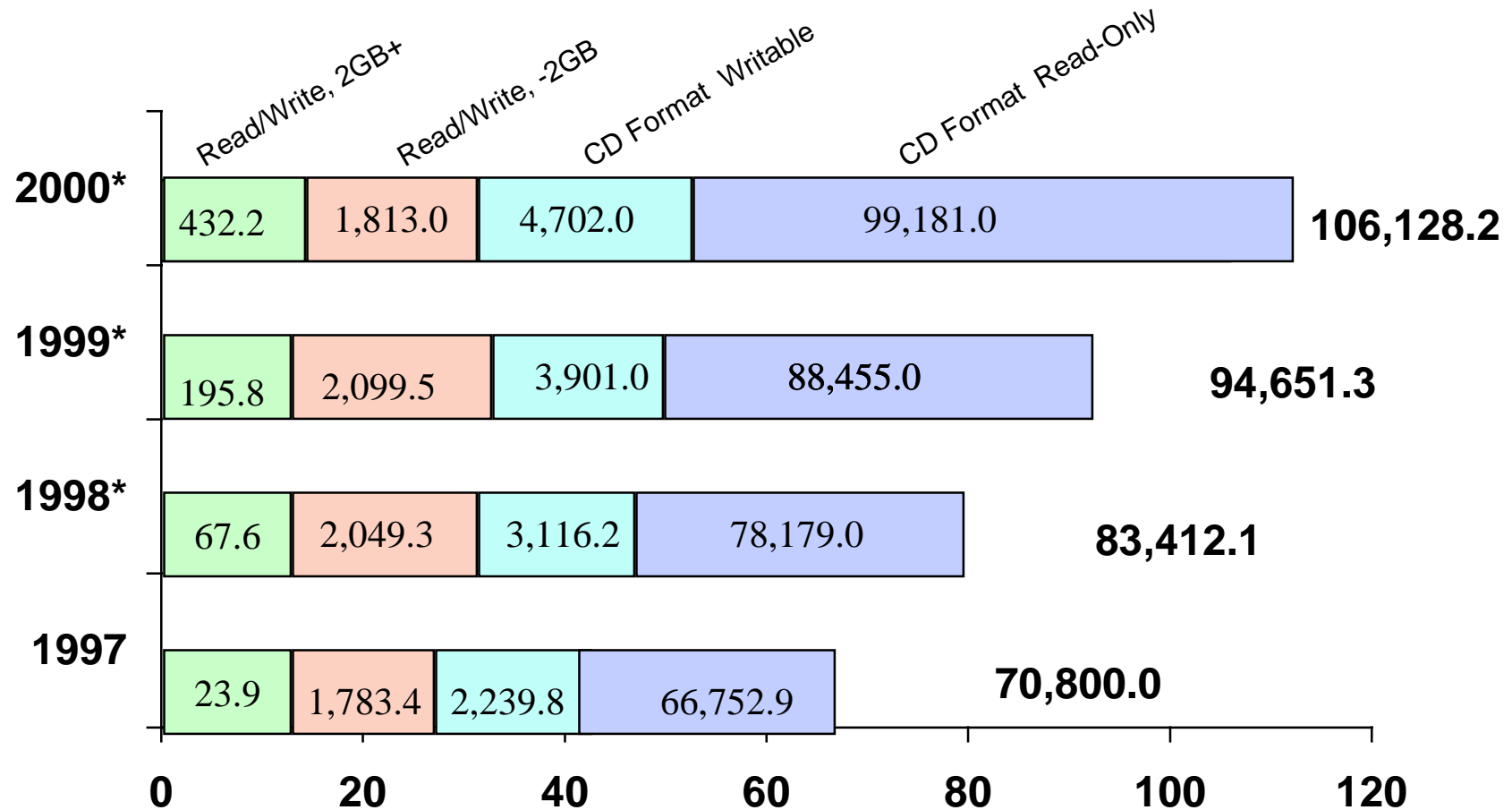


\* Projected

Source: DISK/TREND, Inc.



# Worldwide Optical Disk Drive Unit Shipments (in Thousands)



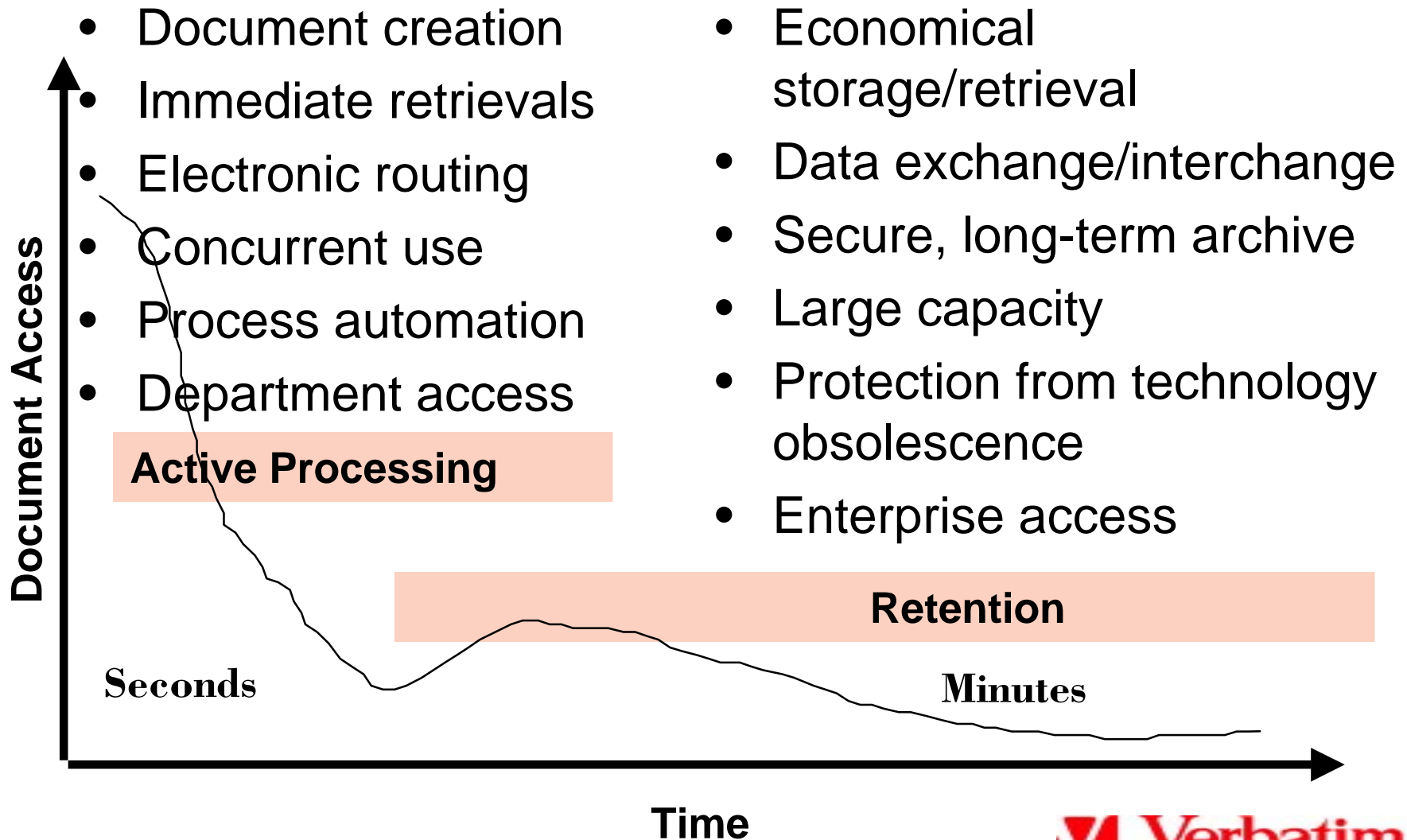
\* Projected

Source: DISK/TREND, Inc.



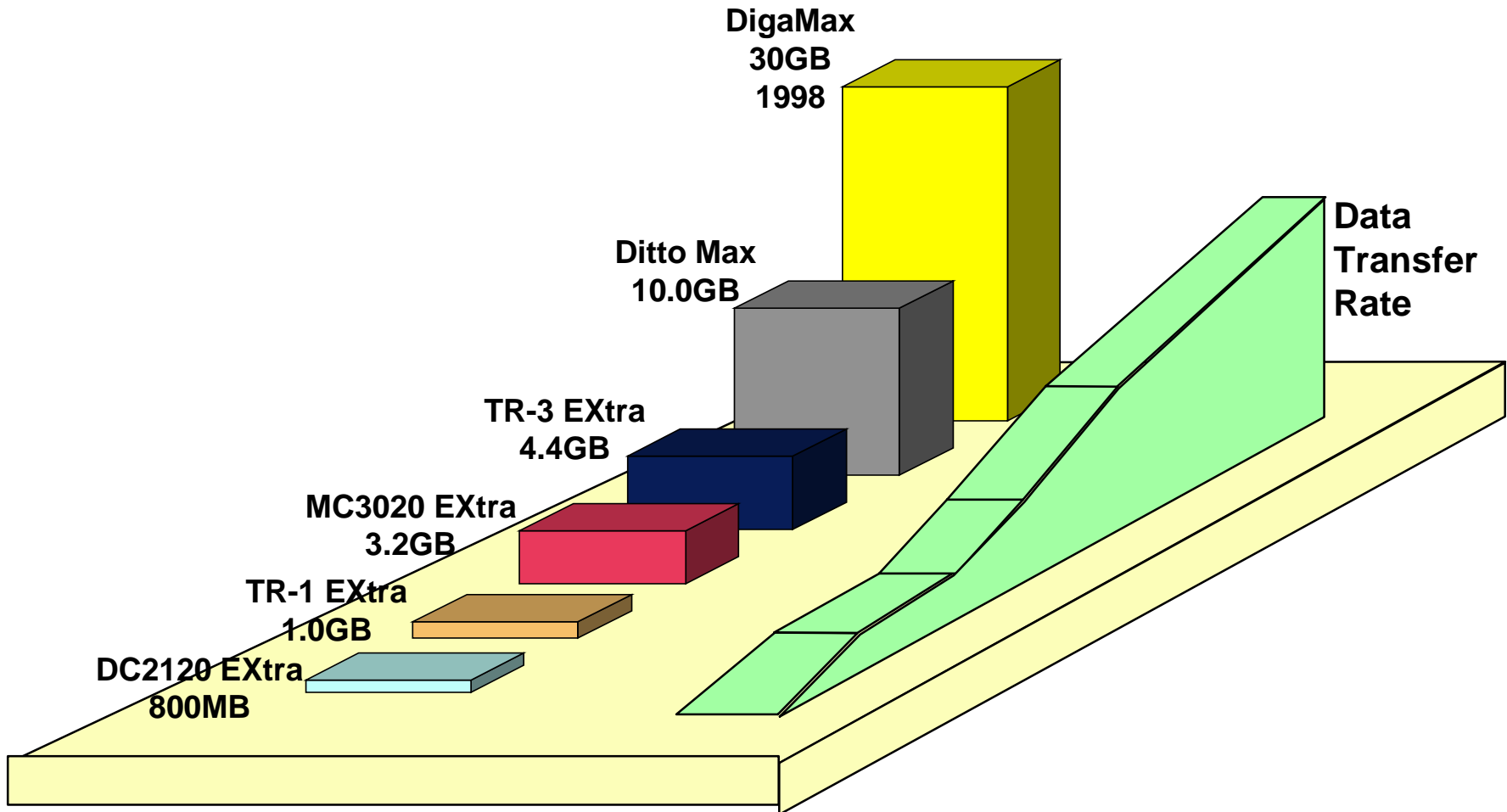
# Storage Lifecycle

## Evolution of Storage Requirements



Source: Strategic Research Corp.

# Tape Technology



# Recovery Principles

- **Recovery is a Complex Art: Plan for it, Test in Advance**
- **Know Your Operating Requirements**
  - **How much data can you afford to lose?**
  - **How long can your applications be offline for backup or recovery?**
  - **How quickly can you recover?**
  - **Are the capabilities to reverse changes needed?**
  - **What resources are available for recovery?**
- **Can your recovery system reliably respond in the time required?**
  - **Requires high data integrity, rapid access and performance**