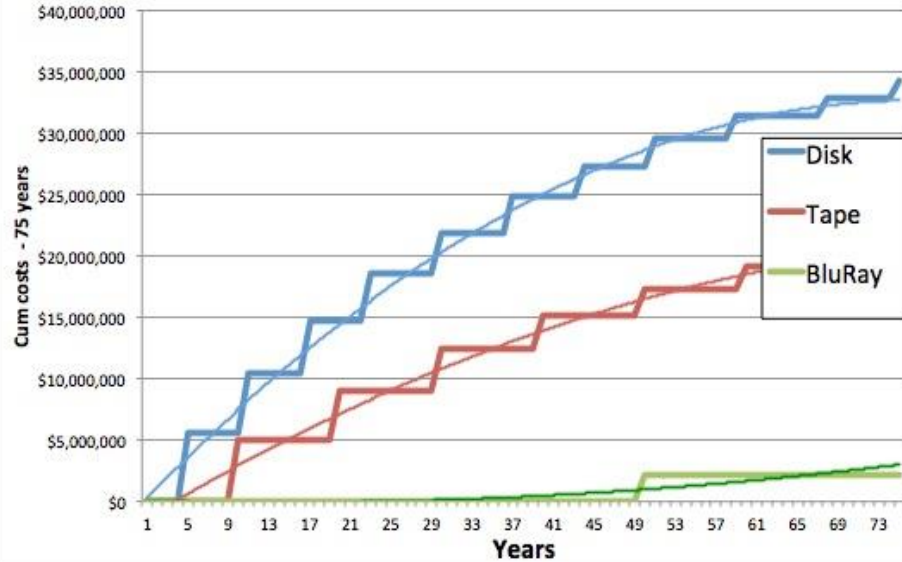




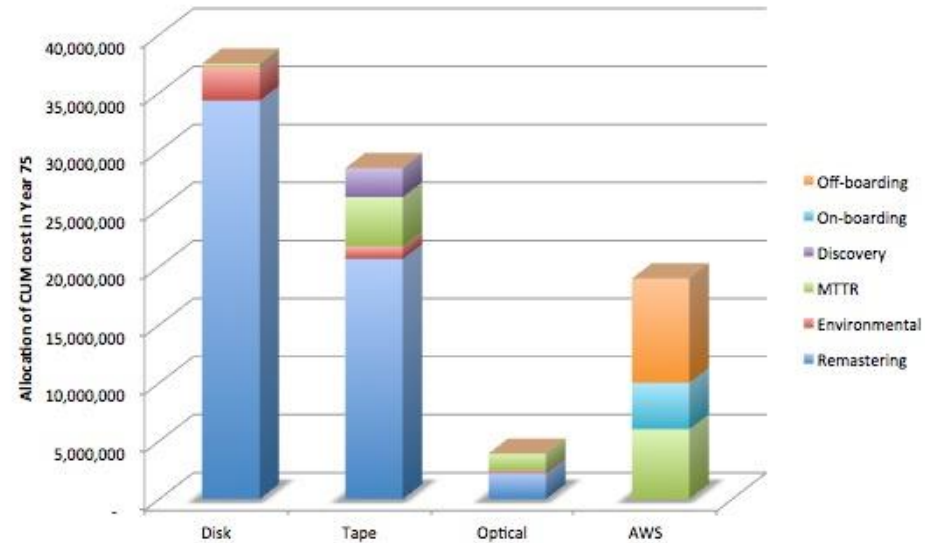
Hitachi Data System Michael Hay

Vice President & Chief Engineer
Global Office of Technology & Planning
Global Information Solutions Division

Migration/Remastering Costs of 5 PB
Cost of migration-event-erosion factored-in

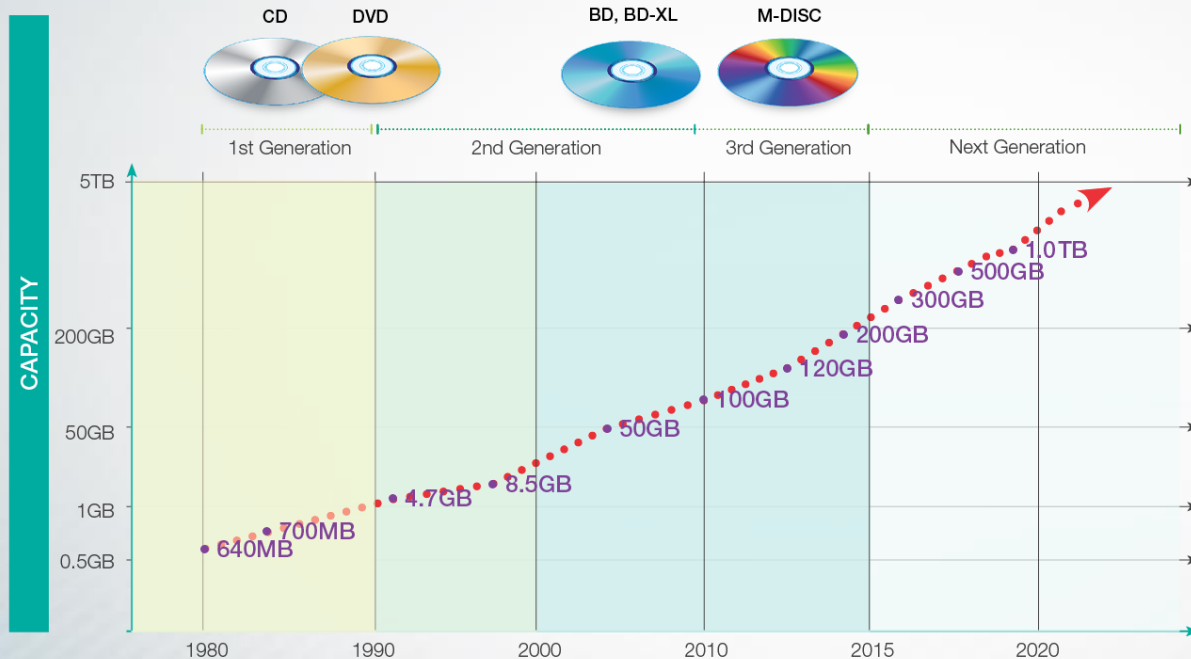


Breakdown of Costs for 5PB Stored for 75 years
Does not include media, capitalization, or subscription cost



- All analysis and charts by David Merrill
- Data from industry partners & HDS teams

Costs for 75 years	Disk	Tape	Optical
Migration/Re-mastering	High	Moderate	Low
Power	High	Low	Low
Mean-time to restore	Low	High	High



Today, you can buy new standard drives that are compatible with media written over 30 years ago. This trend will continue due to markets for consumer and distribution driven volume

Historical Casualties:



Laserdisc



Magneto-optical



Ultra Density Optical (UDO)



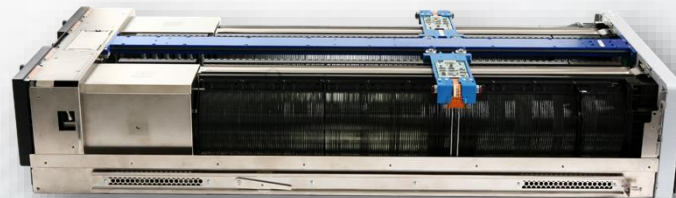
Ultra Media Disc (UMD)



HD DVD

- Overview

- Building block architecture
- 1 PB at 1 KW in one rack
- Throughput up to 2.1 GB/second per rack
- Ability to stripe across all optical disk drives in the rack for performance
- Offline management as media can be removed and stored offsite





□ Pros

- When looking at true long-term total costs Optical is Cheaper than both Disk and Tape, 16x and 10x respectively
- Does well with random access and in a system configuration reasonably well with streaming performance
- Proven readability across a time horizon of 30 years
- Certified media for 50 and 100 years

□ Cons

- CAPEX bit costs today are indeed higher, but dropping and maybe within the same order of magnitude soon of tape/disk
- The value chain is maturing and shifting from consumer to enterprise
- Object deletions, especially on WORM media are interesting, ISO27040