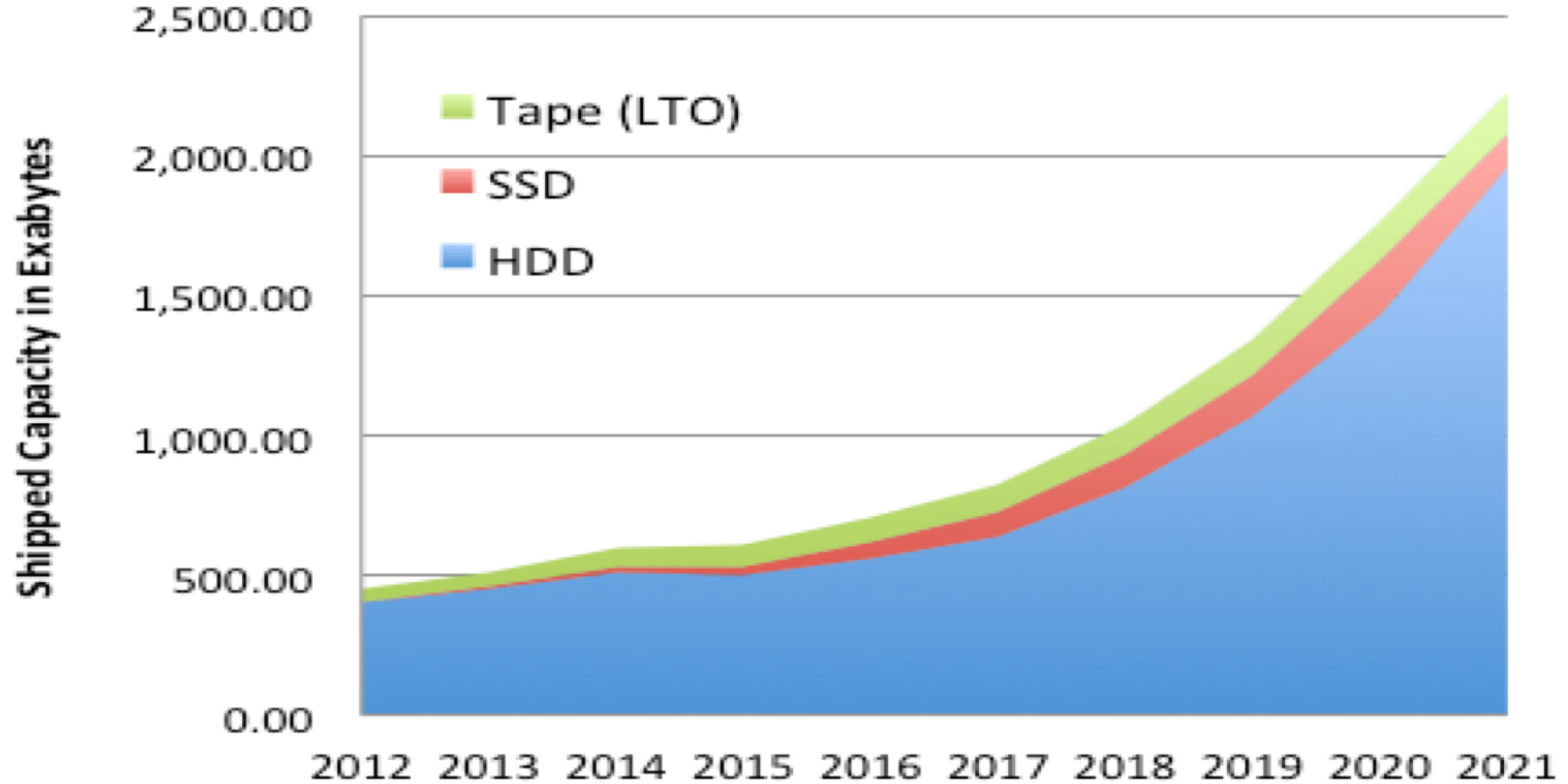




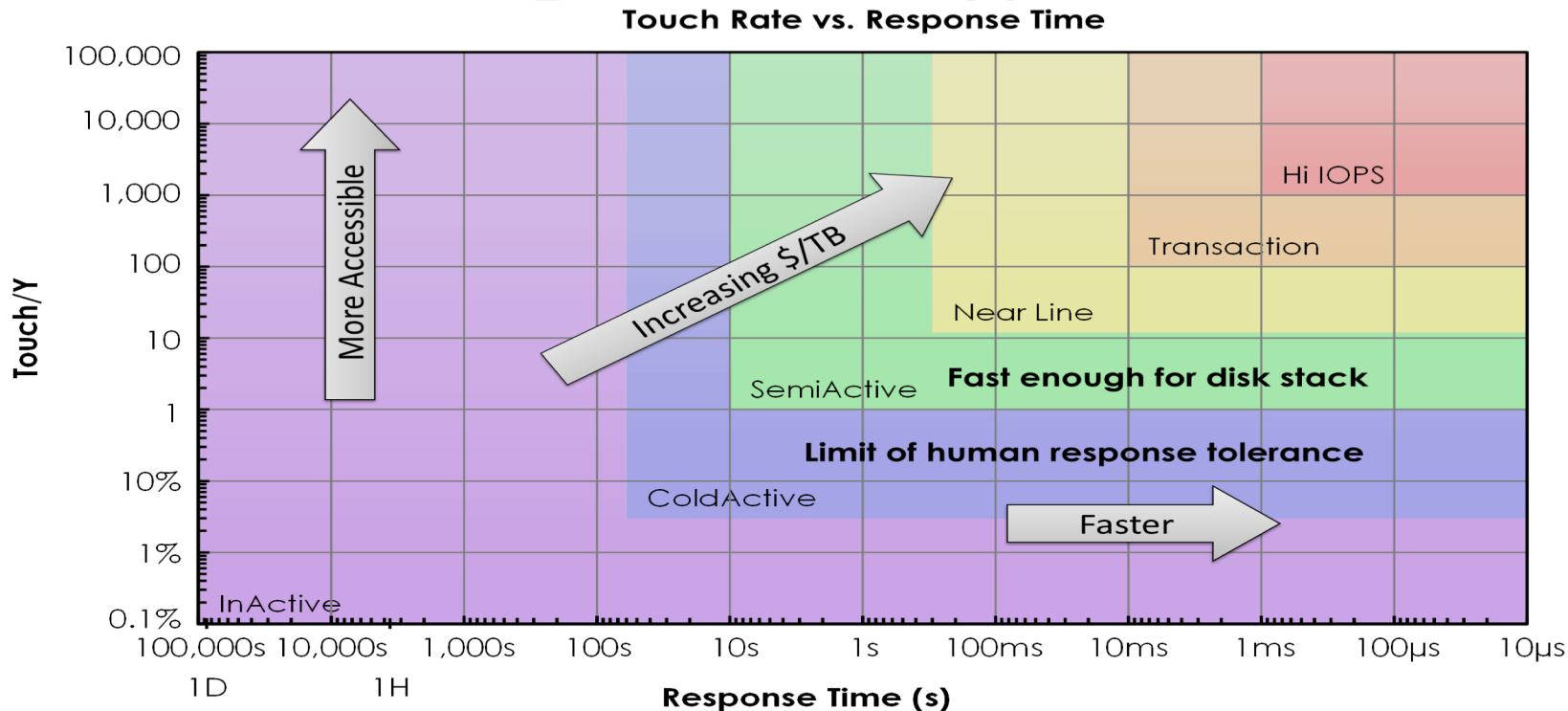
Reckoning with the Realities of Storage

Tom Coughlin
President, Coughlin Associates
www.tomcoughlin.com

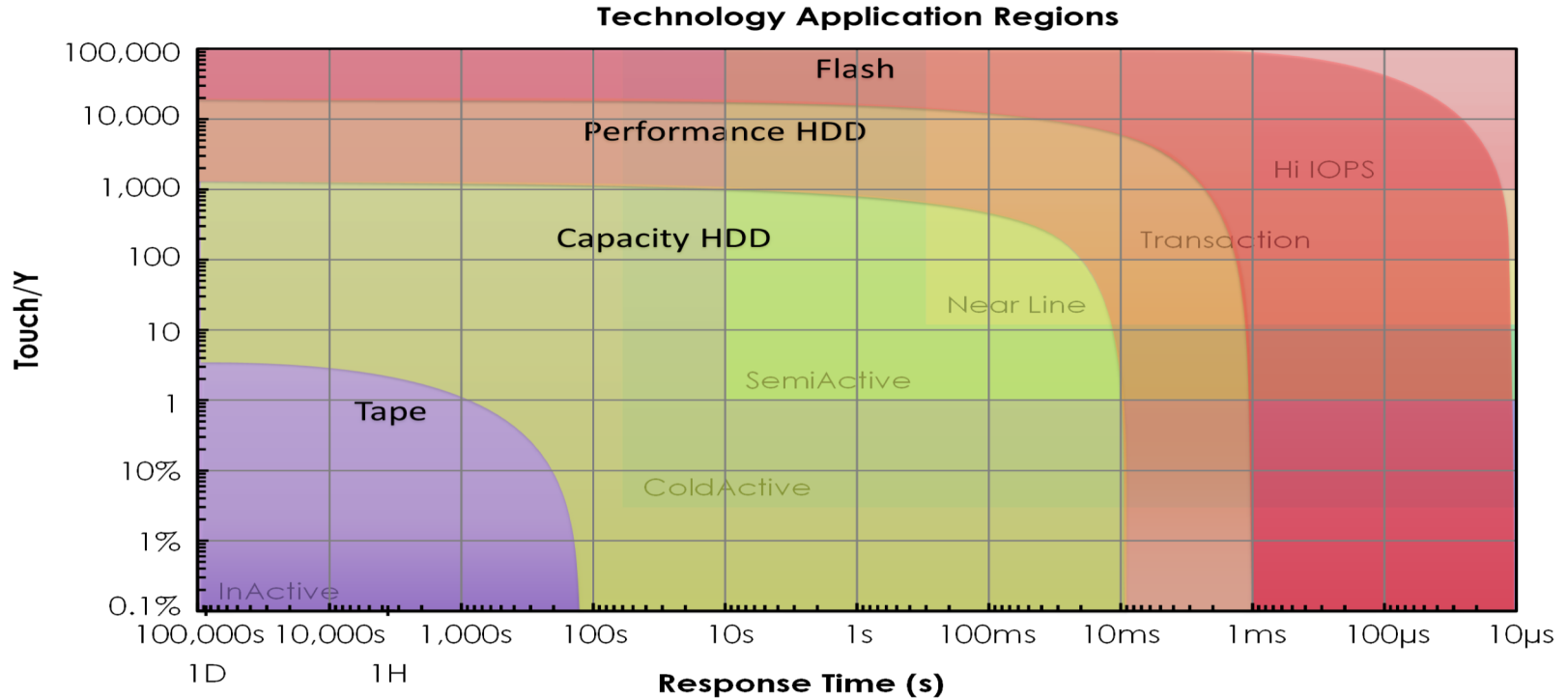
Storage Shipment History and Projections



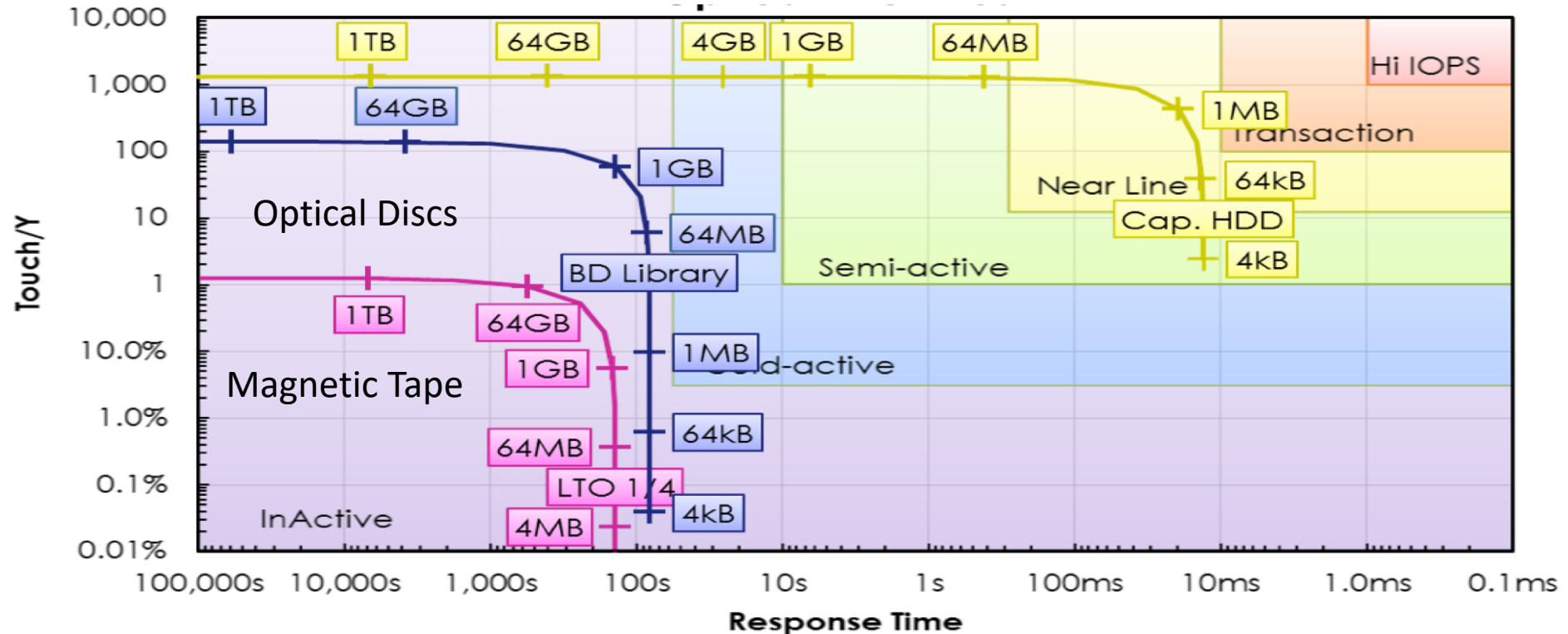
Touch rate versus response time indicating various types of uses



Digital storage technologies regions overlaid on the Touch Rate/Response Time chart



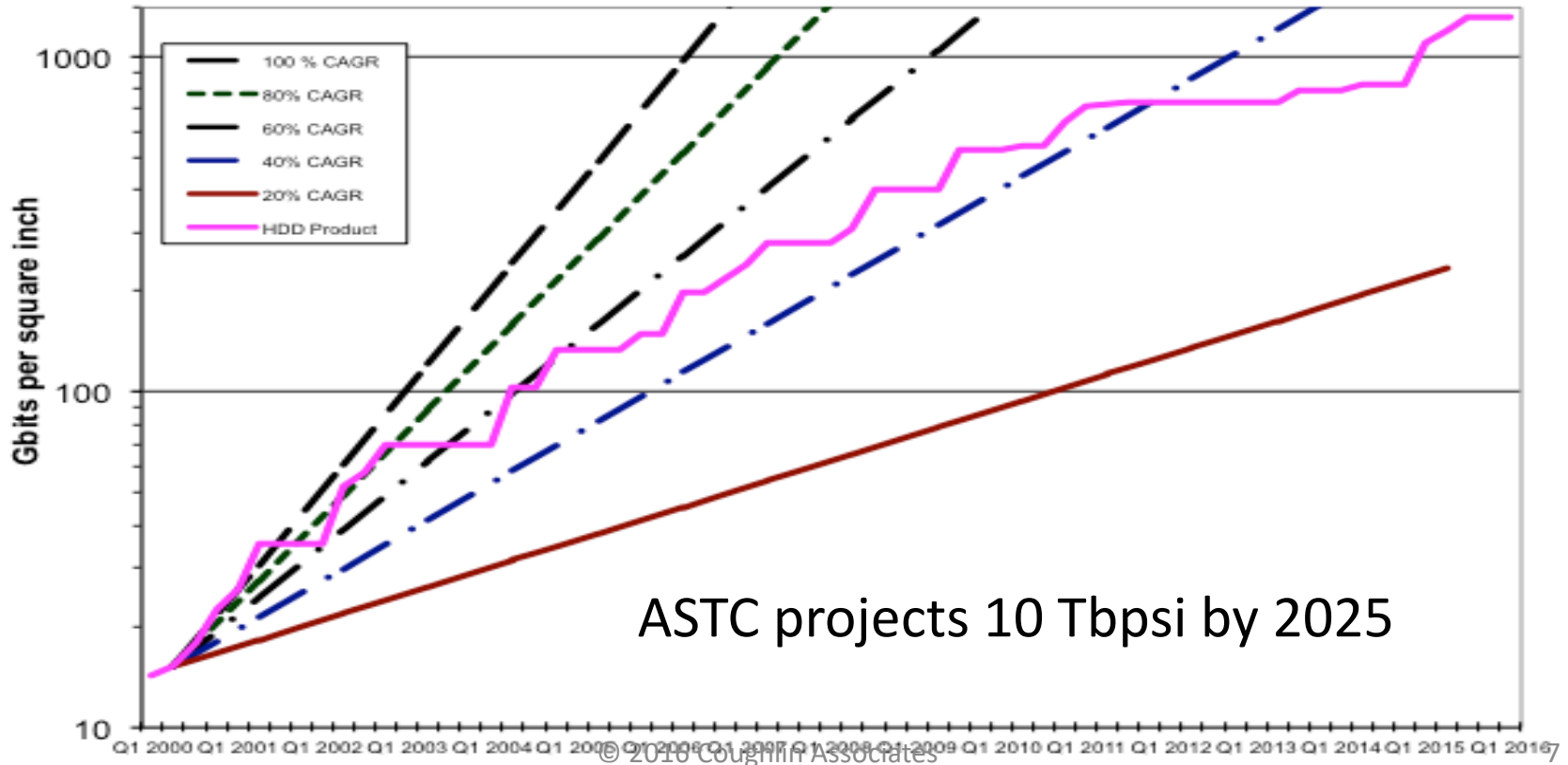
Comparison of archive storage



Archive

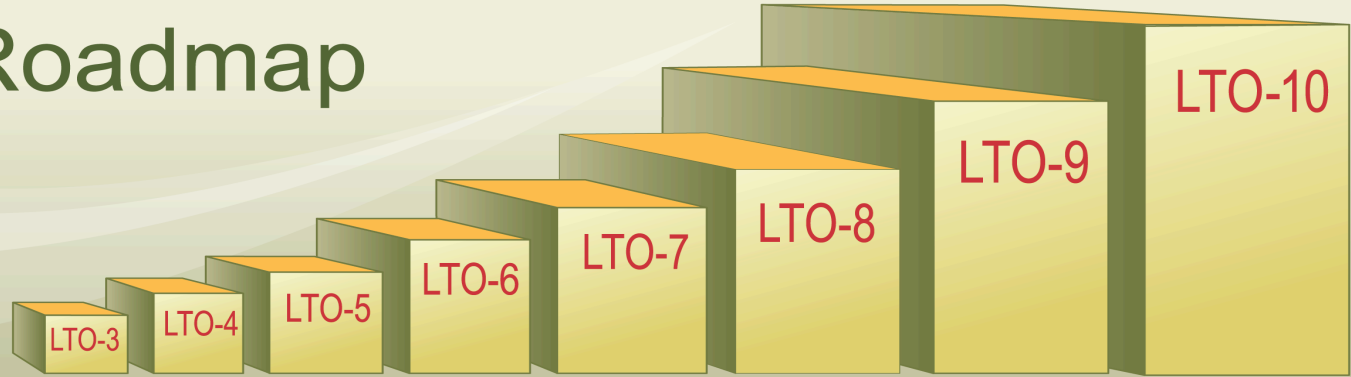
- Traditional archives are focused on digital preservation and content access is not a big focus
- Some people have “active archives” that act more like a long term content library and content access is important
- Digital archives may exist on your own storage, DAS/SAN/NAS or private cloud, or in a third party data center (the “public” cloud)

Actual HDD Product Introductions



Magnetic Tape (LTO) Roadmap

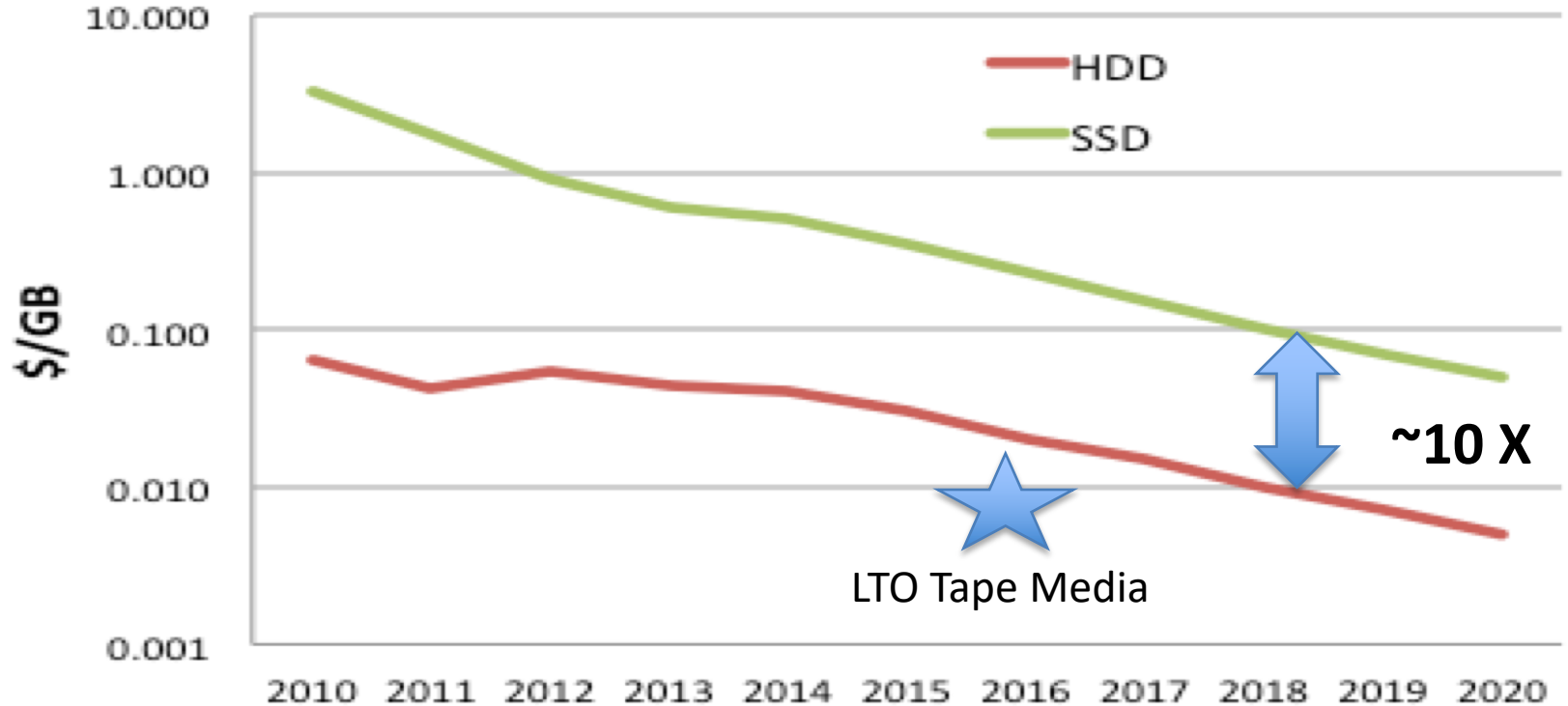
LTO Roadmap



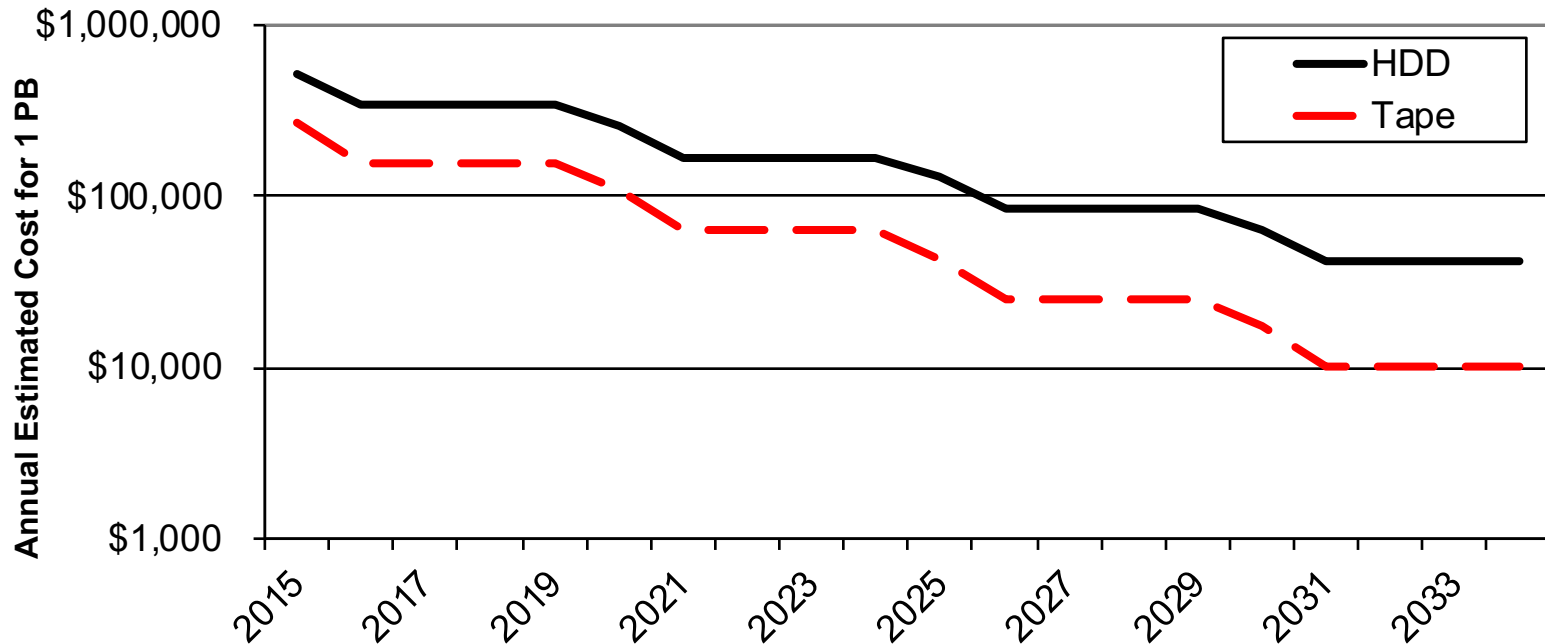
	LTO-3	LTO-4	LTO-5	LTO-6	LTO-7	LTO-8	LTO-9	LTO-10
Shipment Year	2005	2007	2010	2013	2015	TBD	TBD	TBD
Native Capacity	400GB	800GB	1.5TB	2.5TB	6.0TB	Up to 12.8TB	Up to 25TB	Up to 50TB
Compressed Capacity	800GB	1.6TB	3.0TB	6.25TB	15TB	Up to 32TB	Up to 62.5TB	Up to 125TB
Native Transfer Rate	80 MB/s	120 MB/s	140 MB/s	160 MB/s	300 MB/s	Up to 472 MB/s	Up to 708 MB/s	Up to 1100 MB/s
Compressed Transfer Rate	160 MB/s	240 MB/s	280 MB/s	400 MB/s	750 MB/s	Up to 1180 MB/s	Up to 1770 MB/s	Up to 2750 MB/s

LTO-7 tape cartridges now less than one cent per GB!

\$/GB Trends

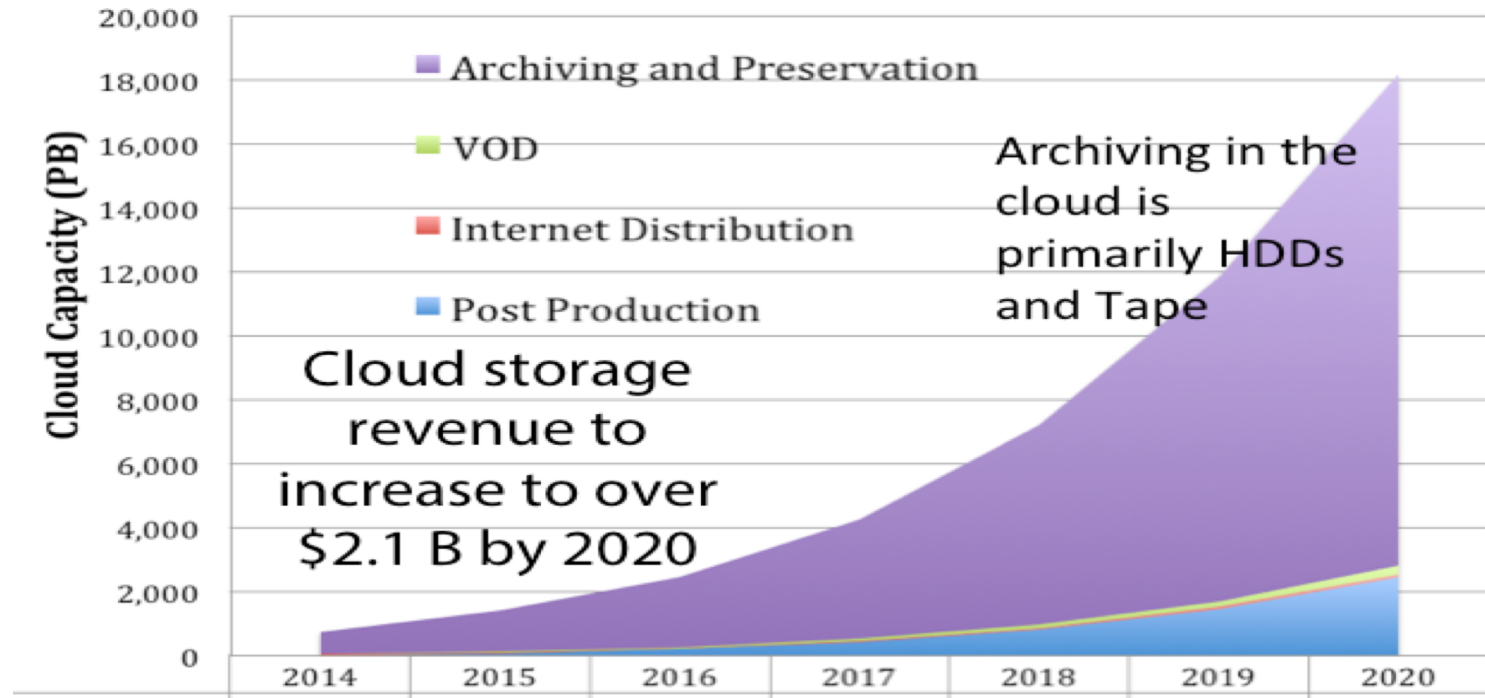


Comparison of estimated annual cost to save 1 PB for 20 years



- Tape about 2.5 X less expensive than HDDs over the 20 years
- Depends upon assumptions, IBM had 13 X, Clipper Group had 6 X

Growing use of cloud storage in M&E

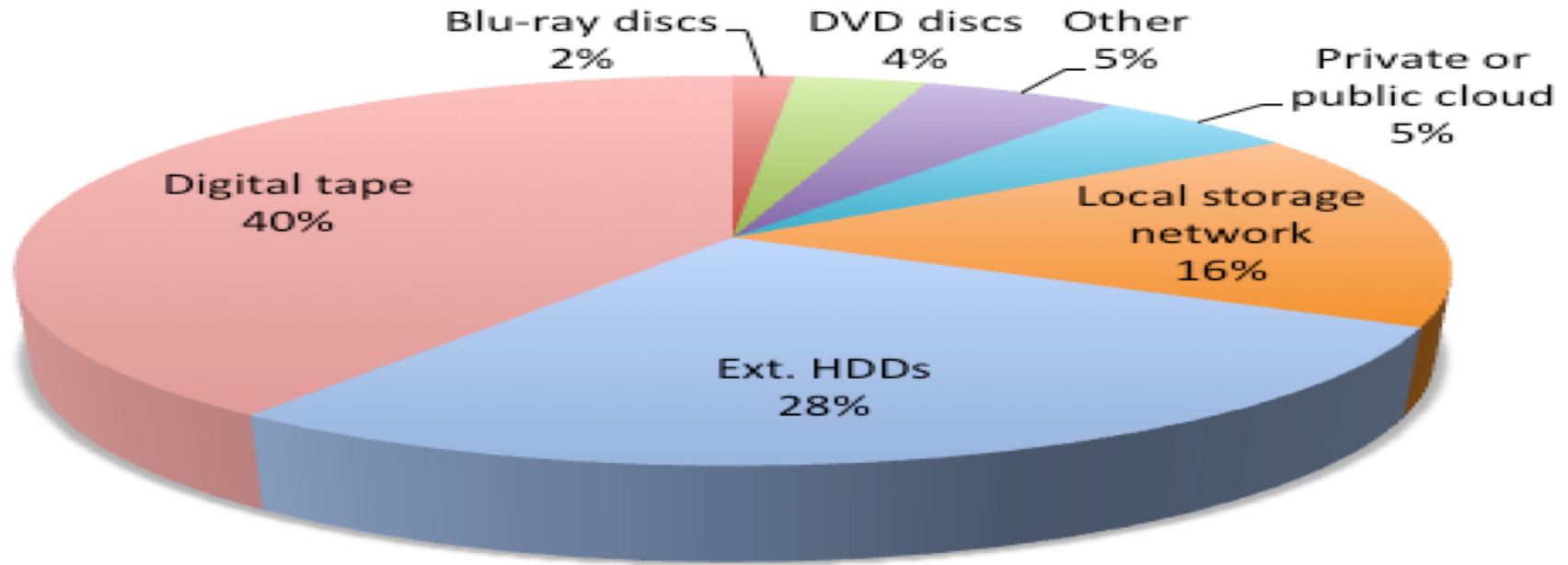


2015 Digital Storage in Media and Entertainment Report, Coughlin Associates, , <http://www.tomcoughlin.com/techpapers.htm>

Migration Speeds

- Loaded LTO 7 Tape Data Rate; 300 MB/s
- HGST 10 TB Helioseal HDD Data Rate: 249/237 MB/s (R/W)
- Tape data rate is faster when loaded but it may take several seconds to load a tape cartridge from a library, so total access time is much slower than HDDs
- Storage in the cloud may be on HDDs or tape

Percentage of digital long-term archives on various media



2015 Digital Storage in Media and Entertainment Report, Coughlin Associates, , <http://www.tomcoughlin.com/techpapers.htm>

References

- Touch Rate: A metric for analyzing storage system performance, Steven Heltzer and Tom Coughlin, 2015,
<http://www.tomcoughlin.com/techpapers.htm>
- **2015 Digital Storage in Media and Entertainment Report**, Coughlin Associates, ,
<http://www.tomcoughlin.com/techpapers.htm>

2016 Creative STORAGESM CONFERENCE

June 23rd 2016 at the DoubleTree Hotel, Culver City, California

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Conference Theme: **The Art of Storage**

11:00 AM - 12:00 PM: Registration and Networking
12:00 PM - 1:00 PM: Lunch
1:00 PM - 2:00 PM: Session 1: The Future of Storage
2:00 PM - 3:00 PM: Session 2: The Art of Storage
3:00 PM - 4:00 PM: Session 3: The Art of Storage
4:00 PM - 5:00 PM: Session 4: The Art of Storage
5:00 PM - 6:00 PM: Reception and Networking



6:00 PM - 7:00 PM: Dinner and Entertainment
7:00 PM - 8:00 PM: Keynote: The Future of Storage
8:00 PM - 9:00 PM: Keynote: The Art of Storage
9:00 PM - 10:00 PM: Keynote: The Art of Storage
10:00 PM - 11:00 PM: Keynote: The Art of Storage
11:00 PM - 12:00 AM: Reception and Networking

Come to the one-day Creative Storage Conference to make valuable connections and to understand and participate in the latest trends and requirements for digital storage to serve creative minds and create new and growing markets.

6 Sessions and 4 Keynotes Spread Over the Day Cover:

- **Tomorrow's Blockbusters: Changing Needs and Sources for Production Storage**
- **Storage for Artists: Challenges and Opportunities in Post Production Storage**
- **Content on the Move: Delivering Storage Content When and Where it is Needed**
- **Archiving: Don't Leave the Good Stuff Behind**
- **Accelerating Workflows: Solid State Storage in Media and Entertainment**
- **Conversation with Independent Storytellers**

A scenic photograph of a beach at low tide. In the background, blue waves with white foam break against a line of dark, jagged rocks. The water is a mix of blue and green. The foreground is a wide expanse of golden-brown sand, marked with gentle ripples. A long, dark shadow of a person stands on the sand, extending from the bottom left towards the center. The word "Thanks" is written in a white, elegant script font across the middle of the image, partially overlapping the shadow and the sand.

Thanks