Storage in Media and Entertainment: The Flash Advantage

Tom Coughlin

www.tomcoughlin.com

Tom Coughlin,
President
Coughlin Associates

Presenter

Thomas M. Coughlin, President, Coughlin Associates is a widely respected storage analyst and consultant. He has over 30 years in the data storage industry. Dr. Coughlin has many publications and six patents to his credit. Tom is also the author of Digital Storage in Consumer Electronics: The Essential Guide, published by Newnes Press. Tom publishes the *Digital Storage Technology Newsletter, the Digital Storage in Media and Entertainment Report, and other reports*.

Tom is active with SNIA, SMPTE,, IEEE, and other professional organizations. He is Marketing Chair for the SNIA Solid State Storage Initaitive. He is VP of Future Directions for the IEEE Consumer Electronics Society as well as Director Elect for IEEE Region 6. He is serving his third term as a member of the CE Society BoG and was Vice President of Operations for three years. Tom is the founder and organizer of the Annual Storage Visions Conference, a partner to the International Consumer Electronics Show, as well as the Creative Storage Conference. He is the general chairman of the annual Flash Memory Summit.

Outline

- Digital storage for professional media and entertainment
- Drivers for video content
- Digital storage in media workflows
- Digital storage in M&E Summary

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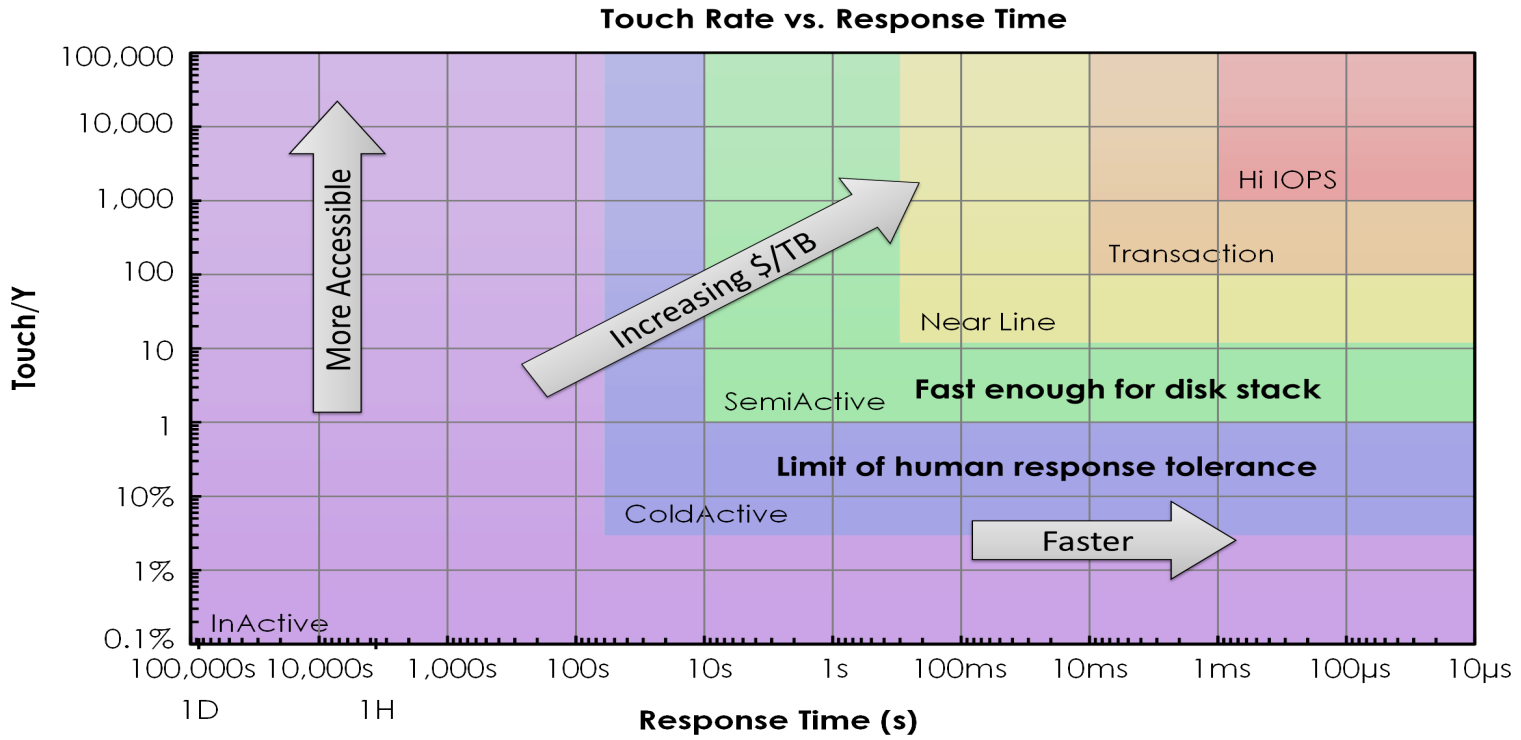
Touch rate versus response time indicating various types of uses



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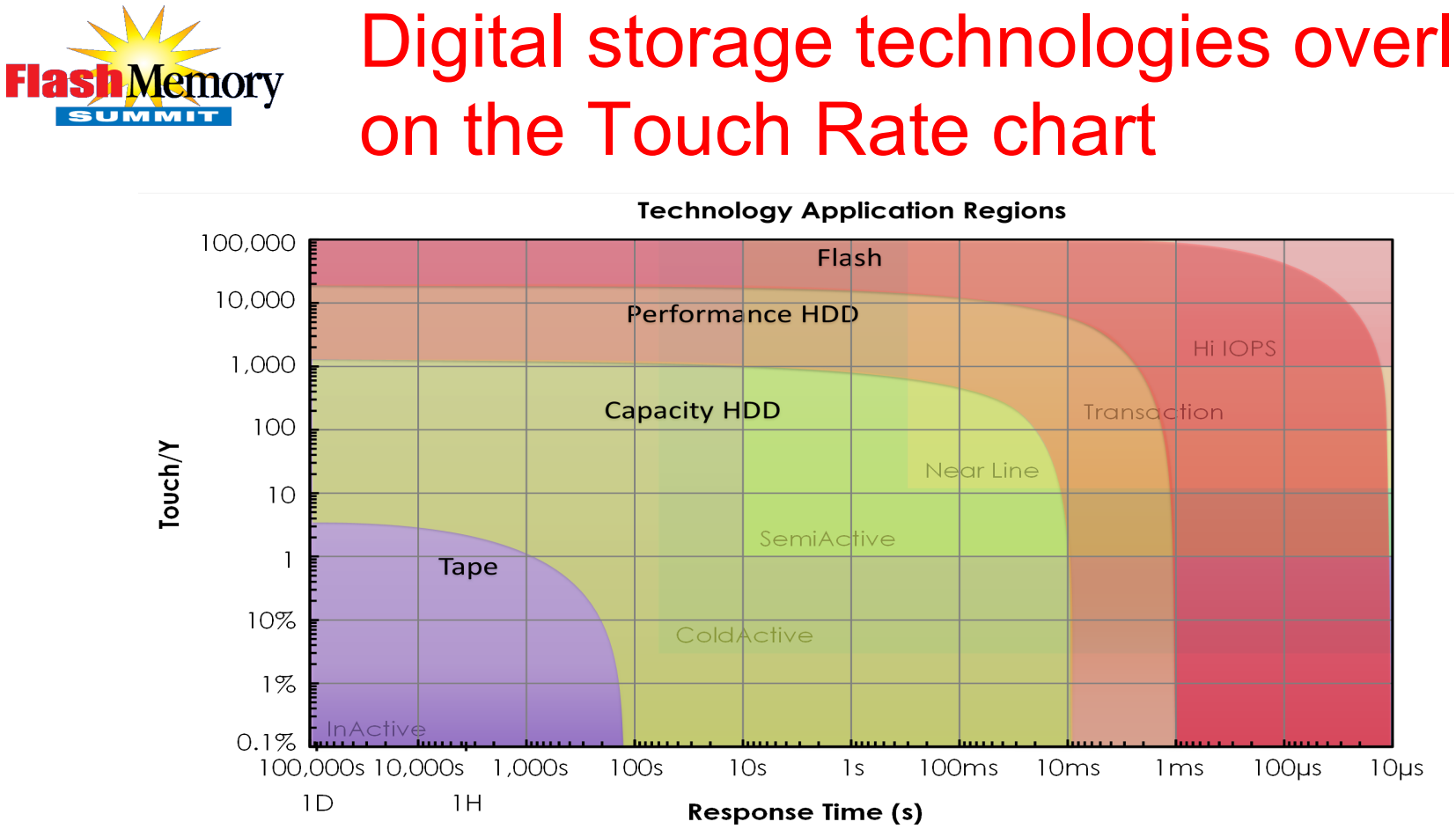

Digital storage technologies overlaid on the Touch Rate chart

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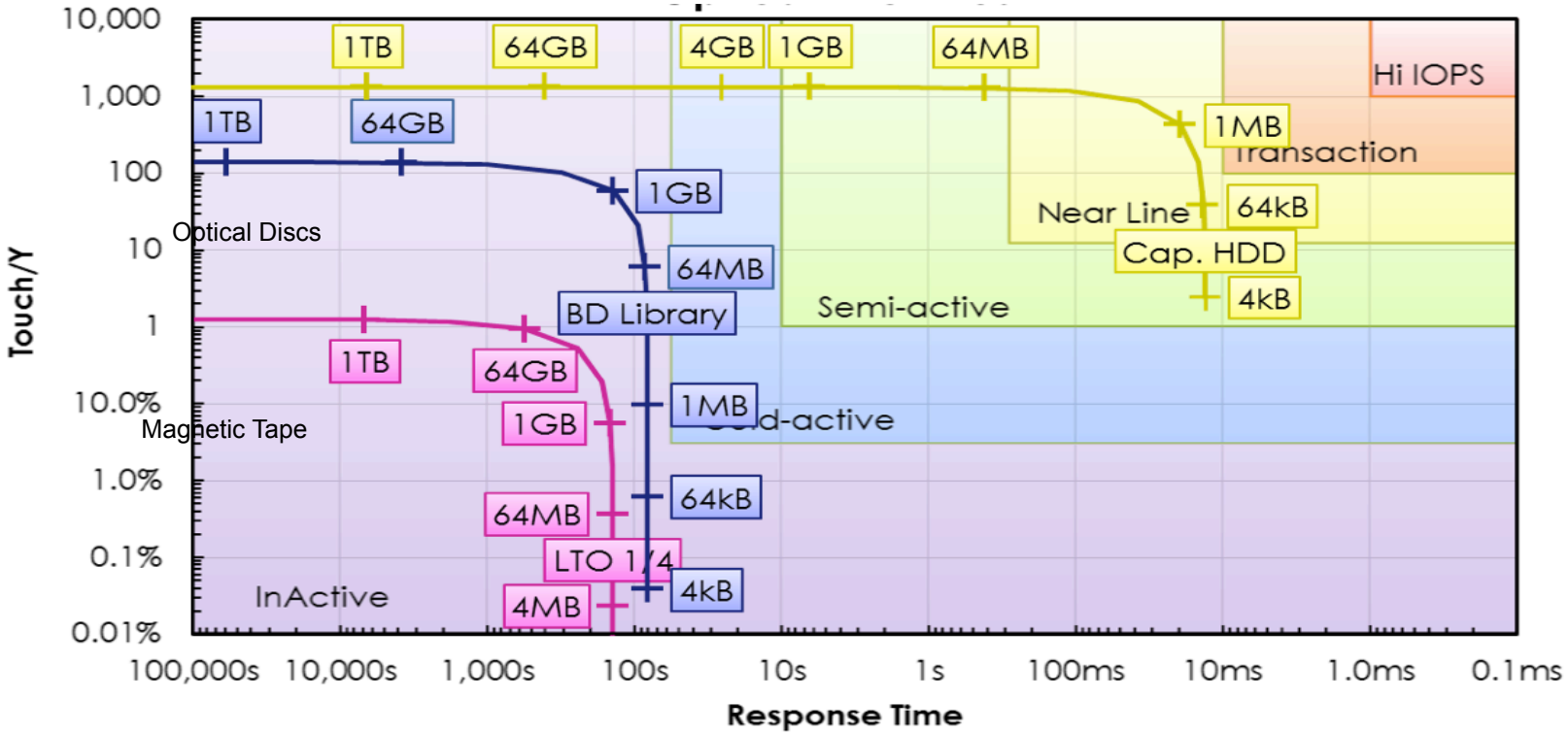
Comparison of archive storage devices



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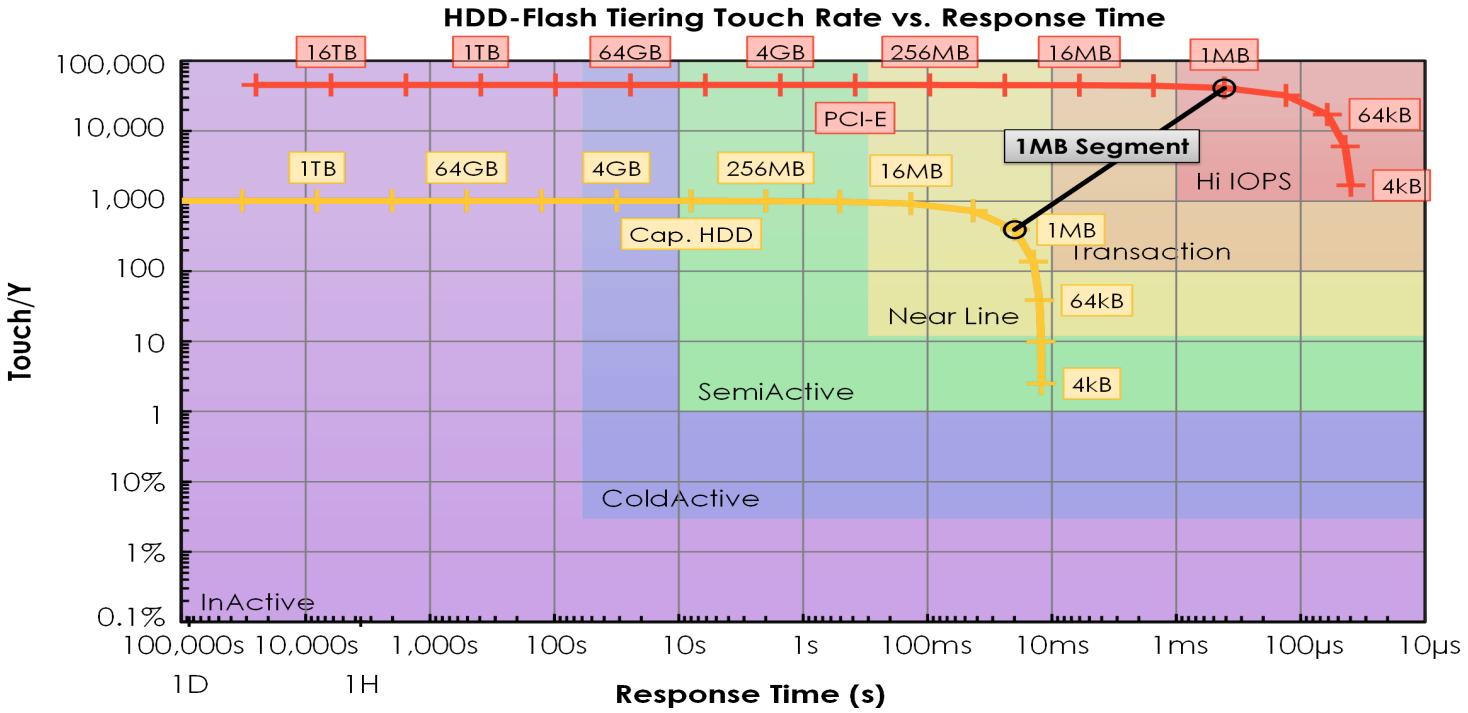
HDD-Flash tiering/caching touch rate chart



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Storage devices for M&E

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Storage devices for M&E (2)

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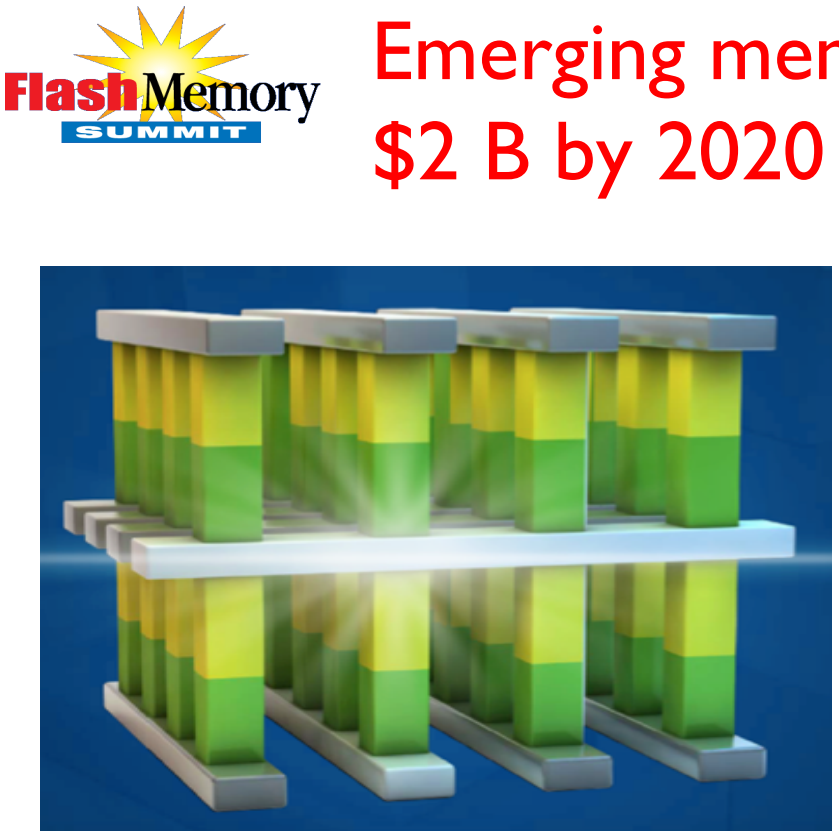
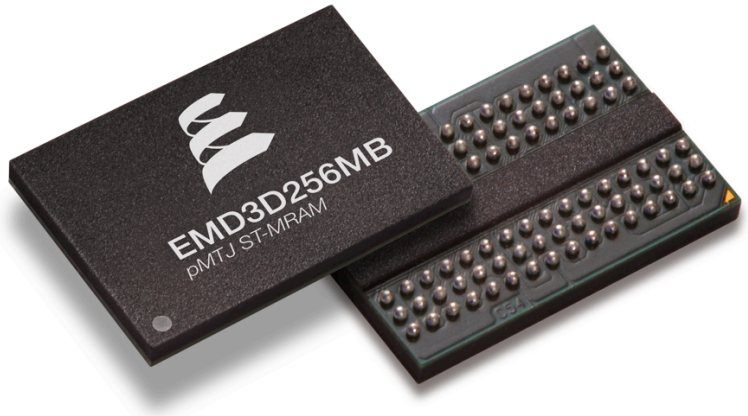


Emerging memory market exceeding $2 B by 2020



2015 Emerging Non-Volatile Memory & Spin Logic Technologies and Manufacturing Report, Coughlin Associates

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Drivers for video content

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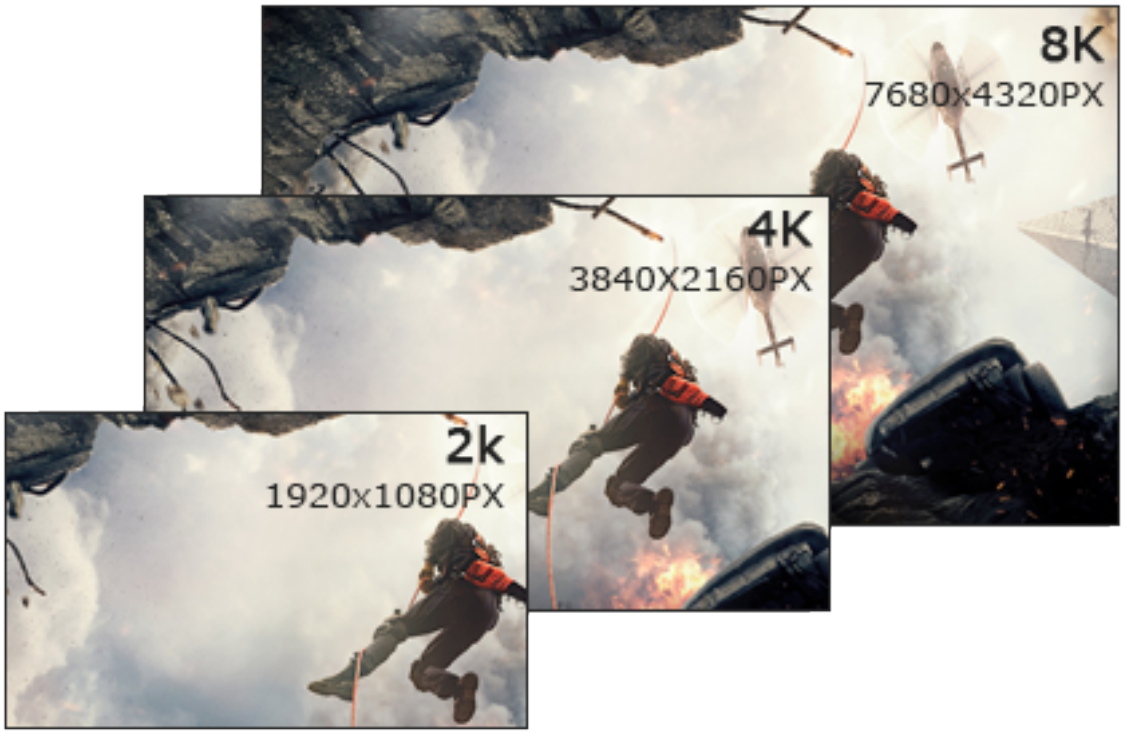
Higher resolution is better…

- ***In order to future-proof their content, many modern video professionals shoot their content at the highest resolution that they can afford.***



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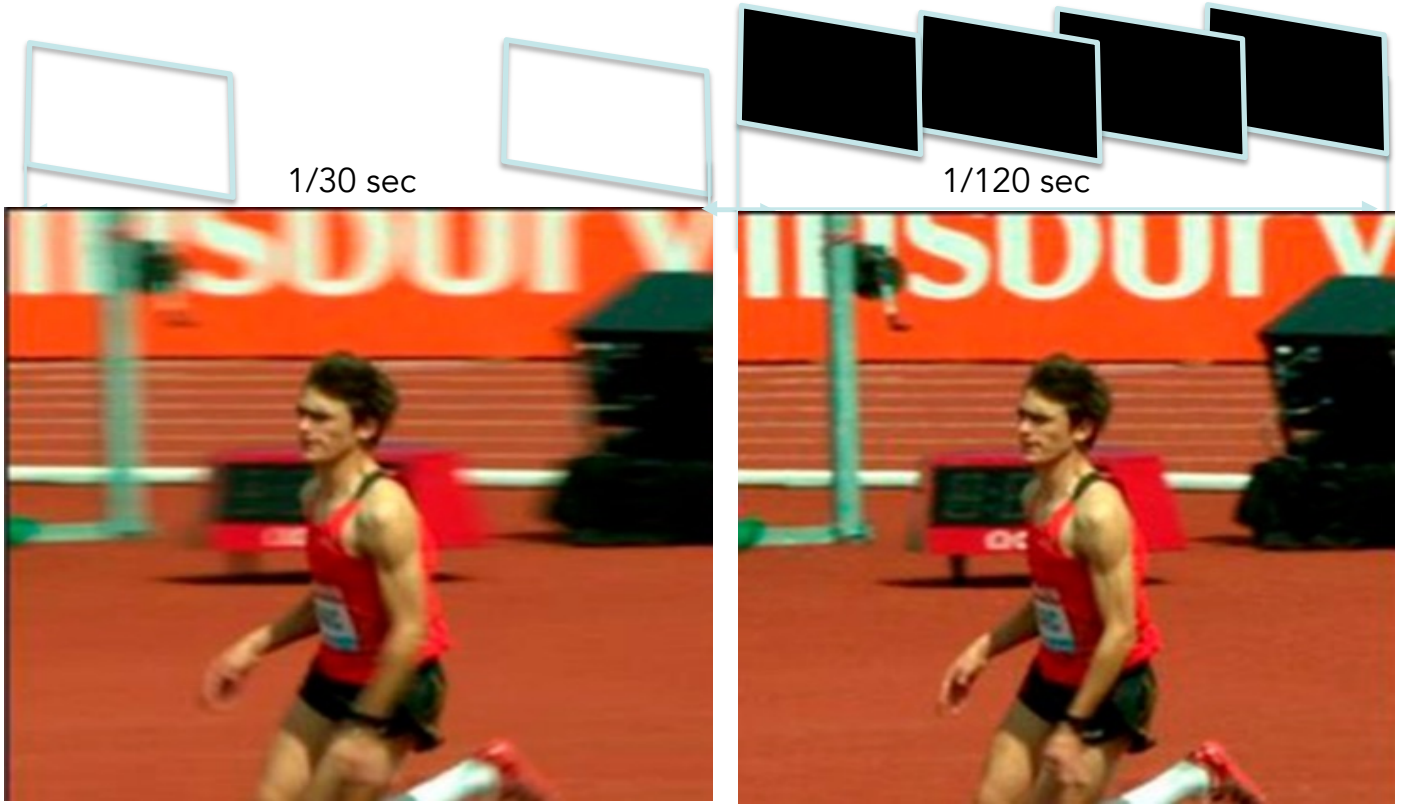
High frame rate = better resolution



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High dynamic range shows more

Together

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Color depth also improves image

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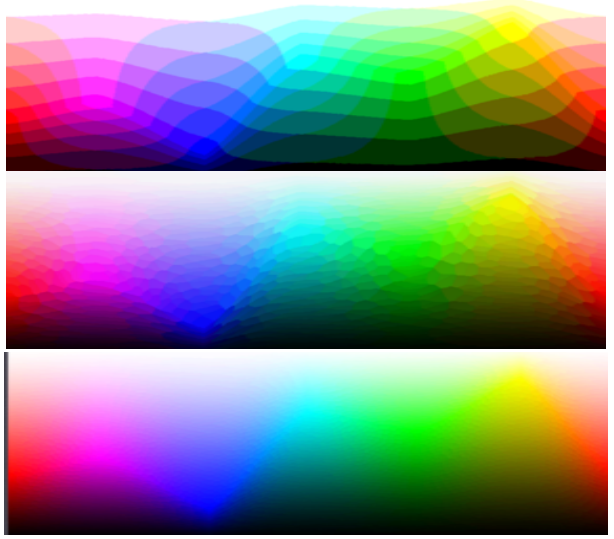
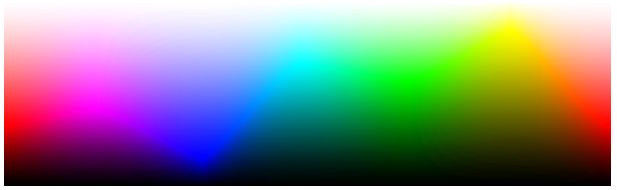
Bit Depth

Lower



Higher



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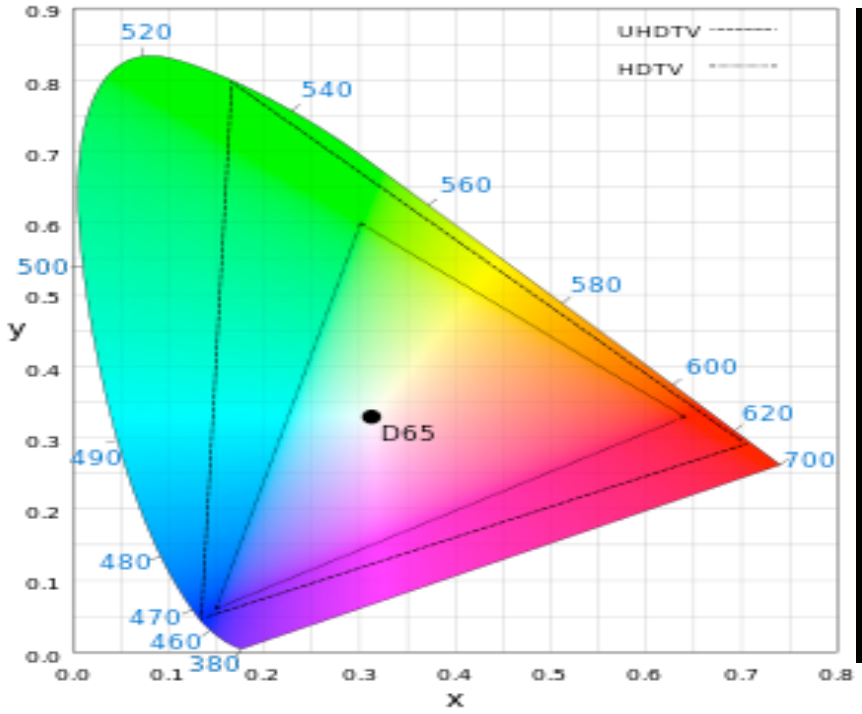
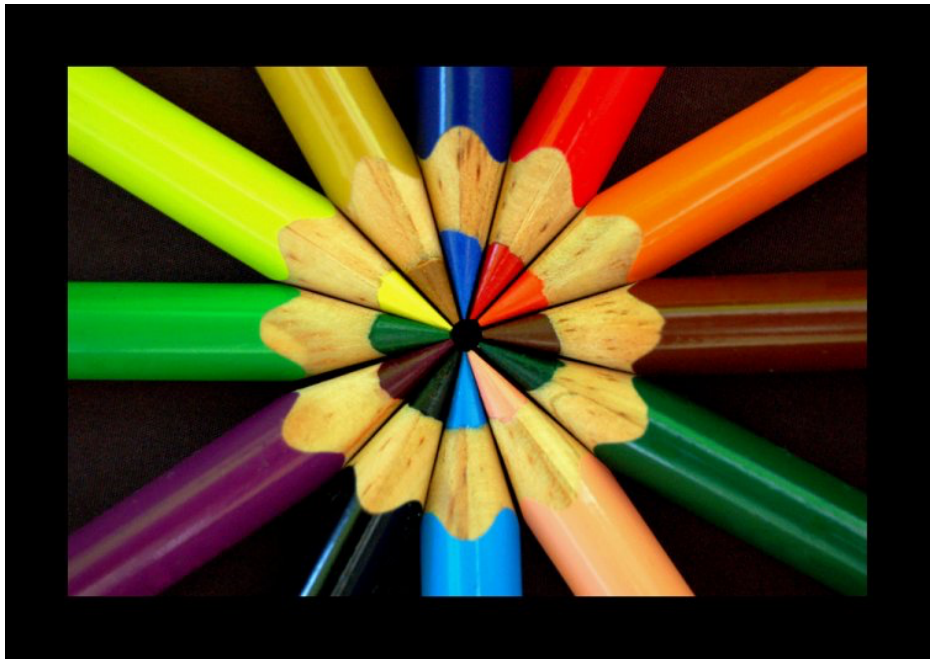
Color gamut determines what you see





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Richer Images = more storage & more bandwidth

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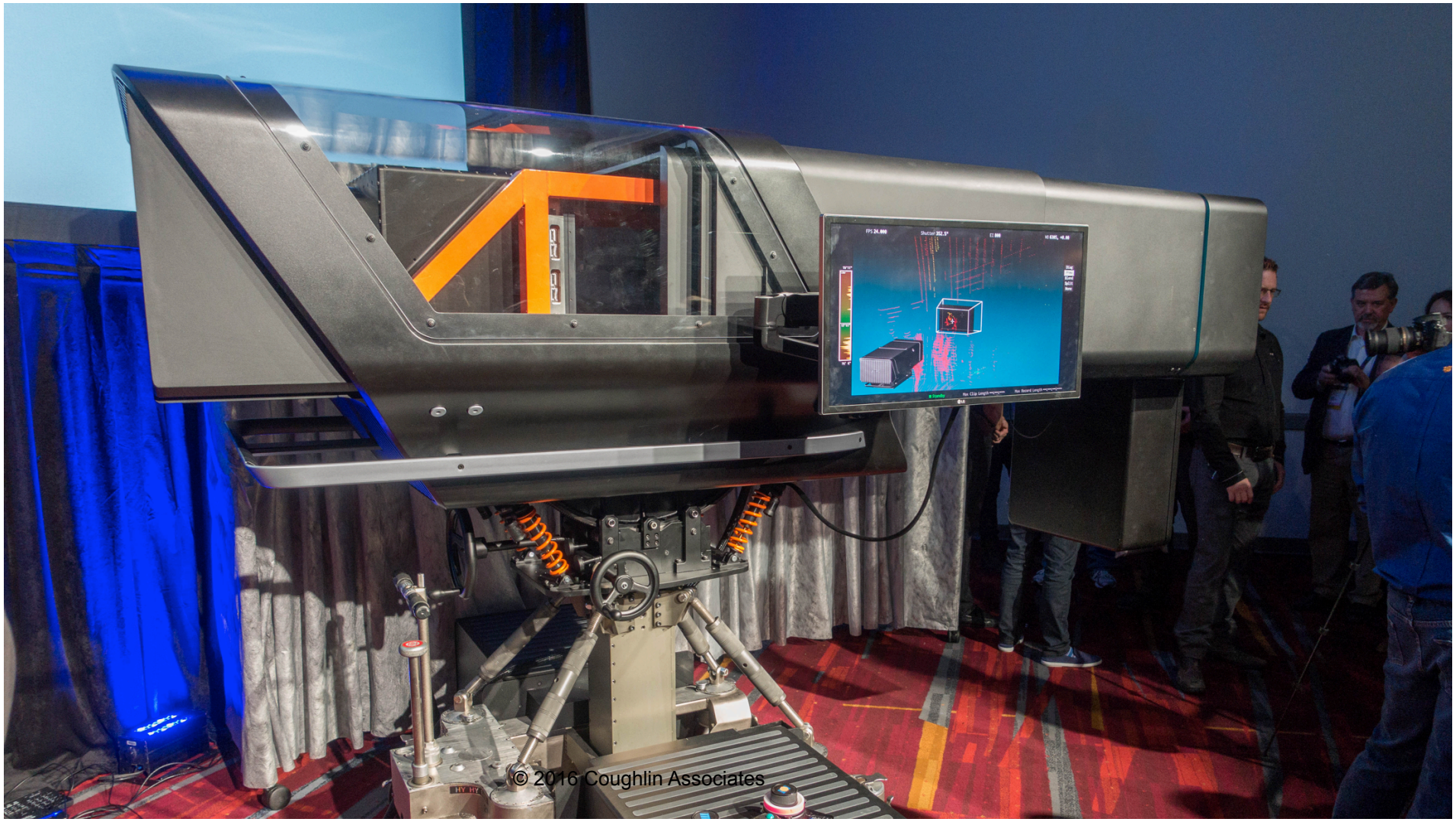
Using these input video streams, we can generate novel viewpoints between the real viewpoints...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Stereoscopic video make it more real

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Calculating the Size of Digital Content

- **Equation 1.** Frame size = Width x Height x Bits/pixel x Colors
  - 3,840 pixels x 2,160 pixels x 10 bits/pixel x 3 colors = 248 Mb/ frame / 8 bits/Byte = 31.1 MB/frame
- **Equation 2.** Data Rate = Frame size x Frames/second
  - 31.1 MB/frame x 60 fps = 1,866 MB/sec
- **Equation 3.** Data in 1 Hour = Data Rate x 3600 seconds
  - 1,866 MB/sec x 3600 sec x 1024 MB/GB = 6,718 GB

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M&E formats getting bigger

Format	Resolution (width X height)	Frame Rate (fps)	Data Rates (MB/s)	Storage Capacity GB/Hour
SDTV (NTSC, (8-bit)	720 X 480	~30	31	112
HDTV (1080p, 8-bit) RGB	1920 X 1080	24	149	537
UHD-1 4K (10-bit) RGB	3840 X 2160	60	1,866	6,718
UHD-2 8K (12–bit) RGB	7680 X 4320	120	17,916	64,497
Digital Cinema 2K (10-bit) YUV	2048 X 1080	24	199	717
Digital Cinema 4K (12-bit) YUV	4096 X 2160	48	1,910	6,880
Digital Cinema 8K (16 bit) YUV	8192 X 4320	120	25,480	91,729

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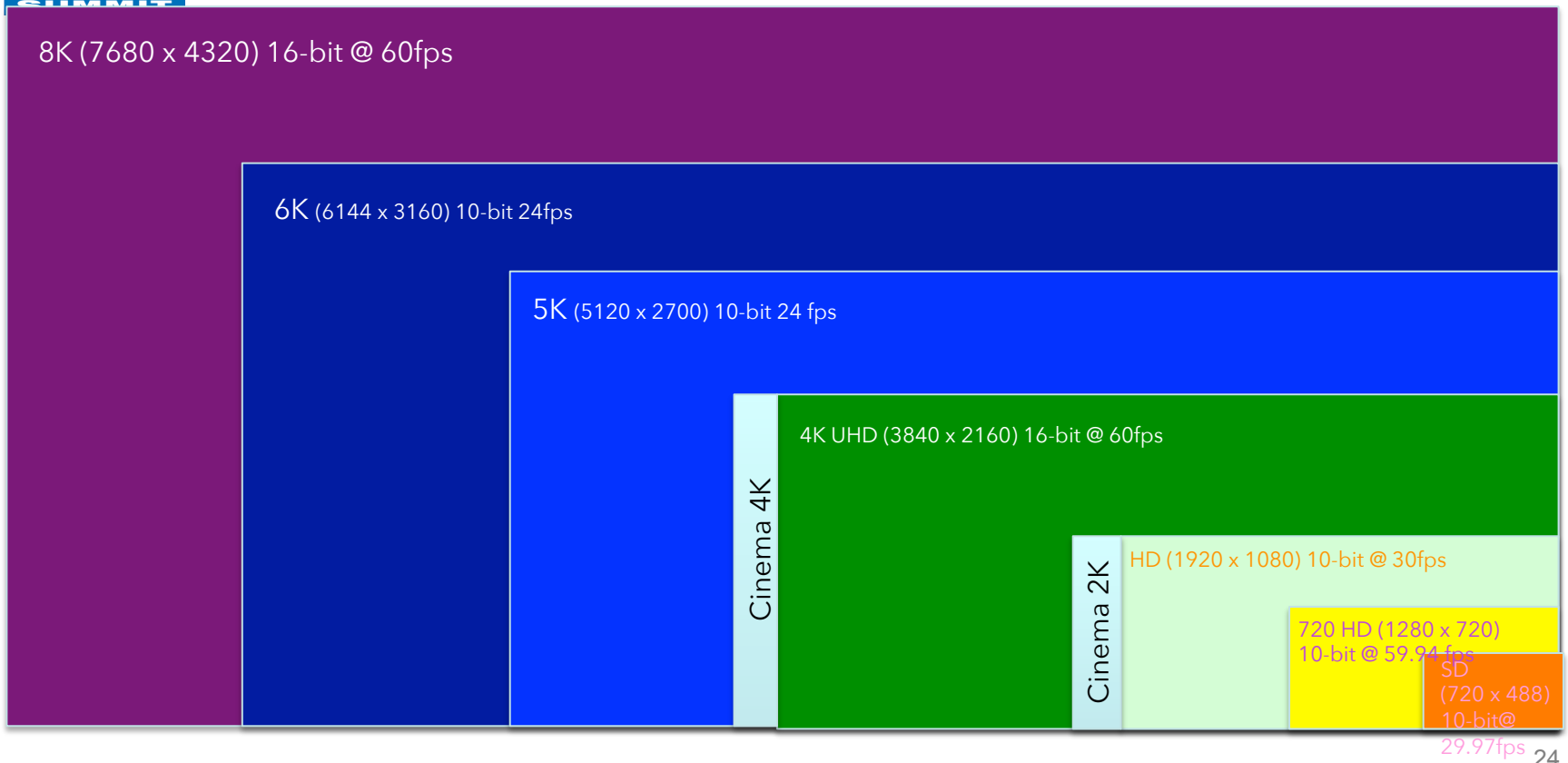
Visual comparison of resolution



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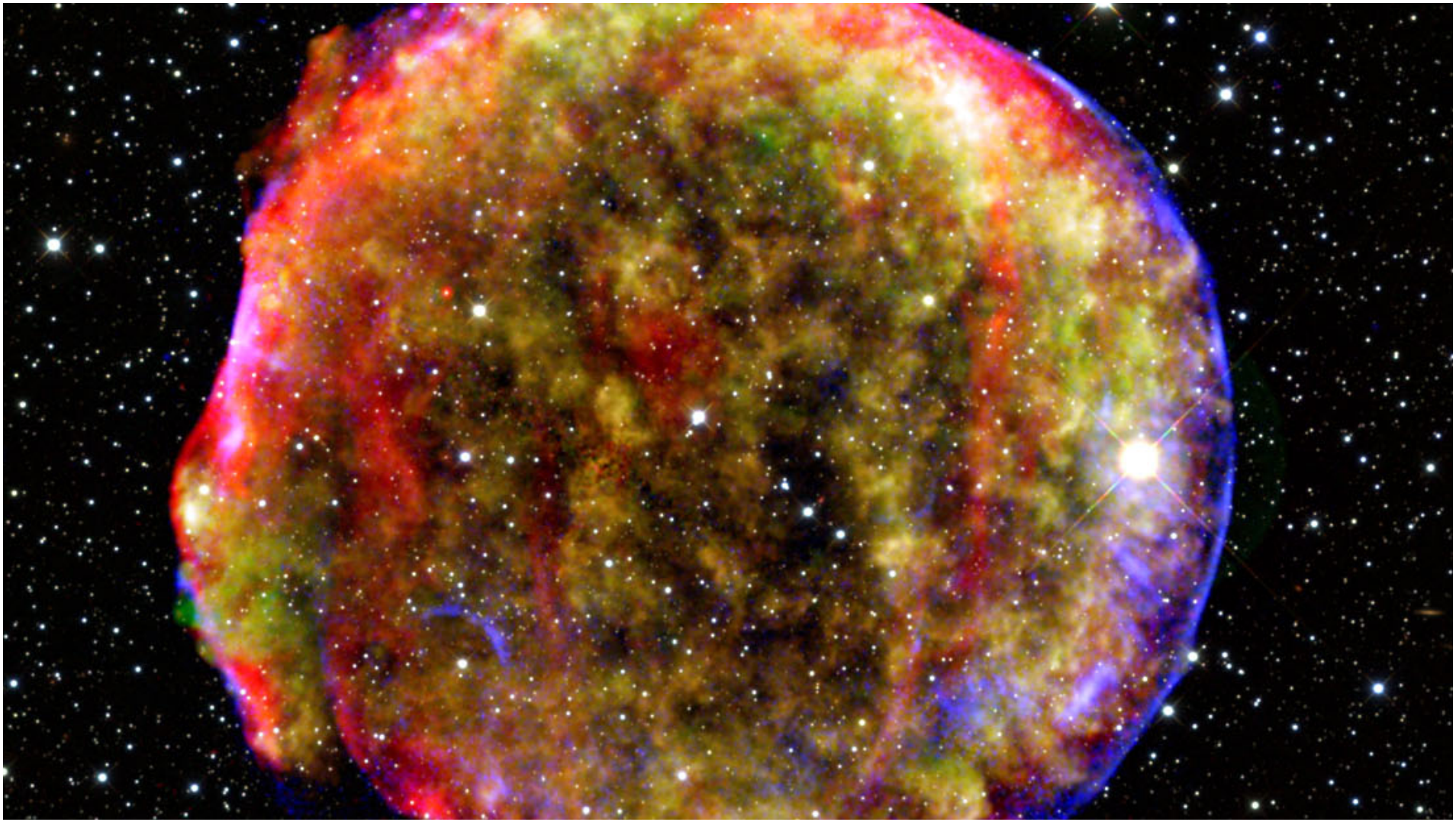

Digital storage in media workflows

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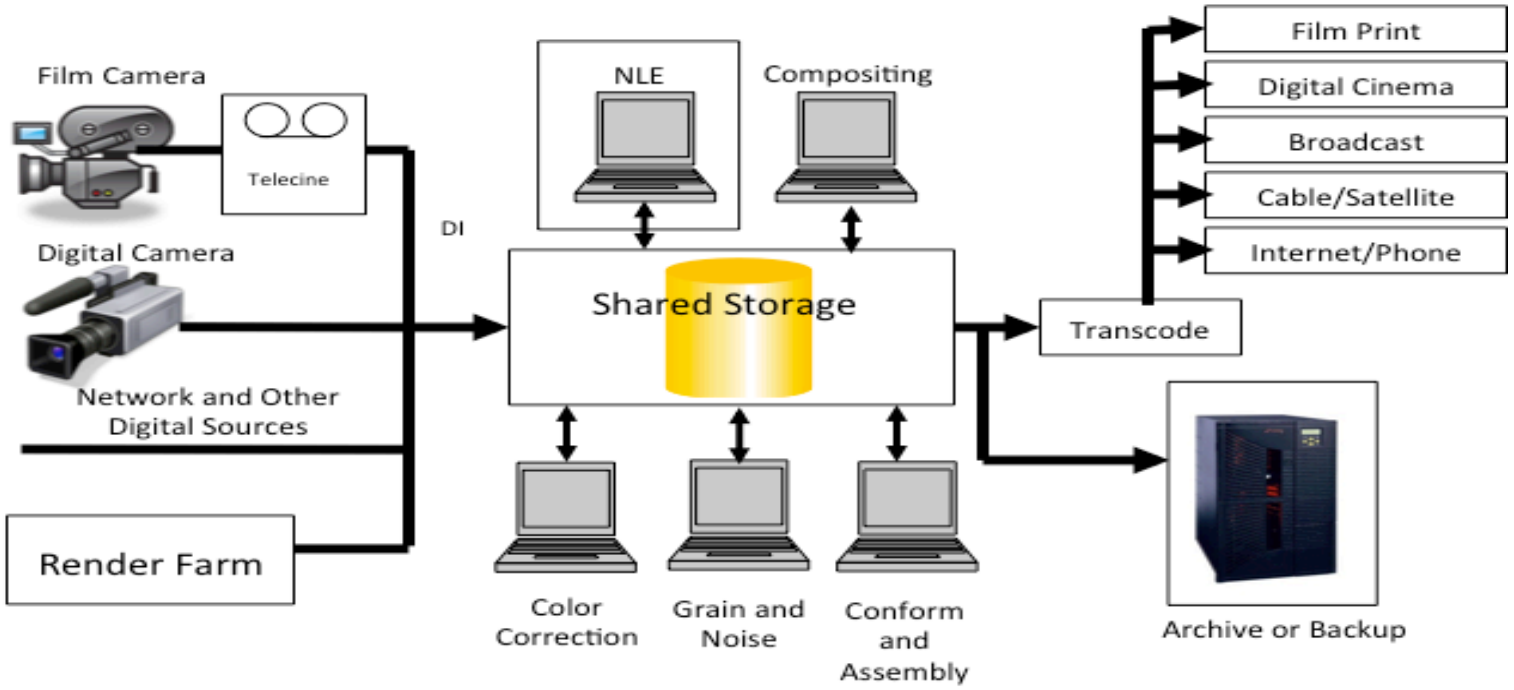
Digital Entertainment Content Workflow.



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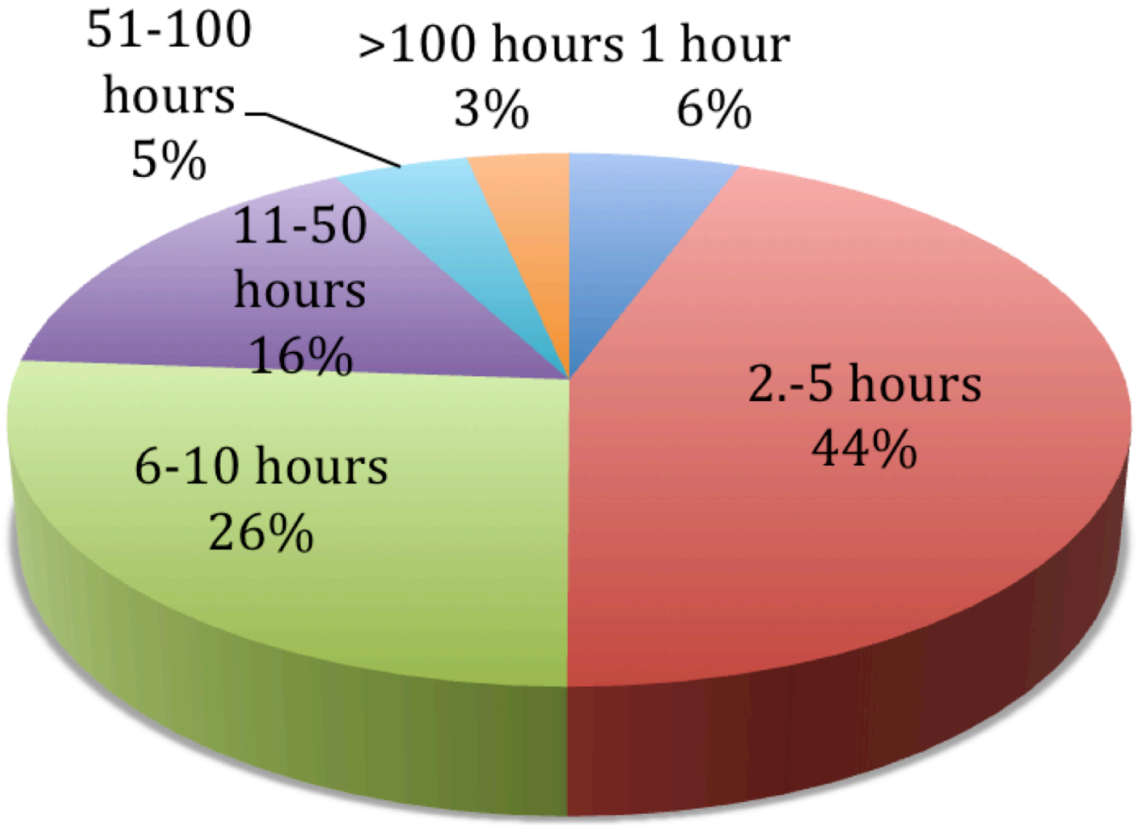
Hours of Content Acquisition Grows

Hours captured for an hour of final content



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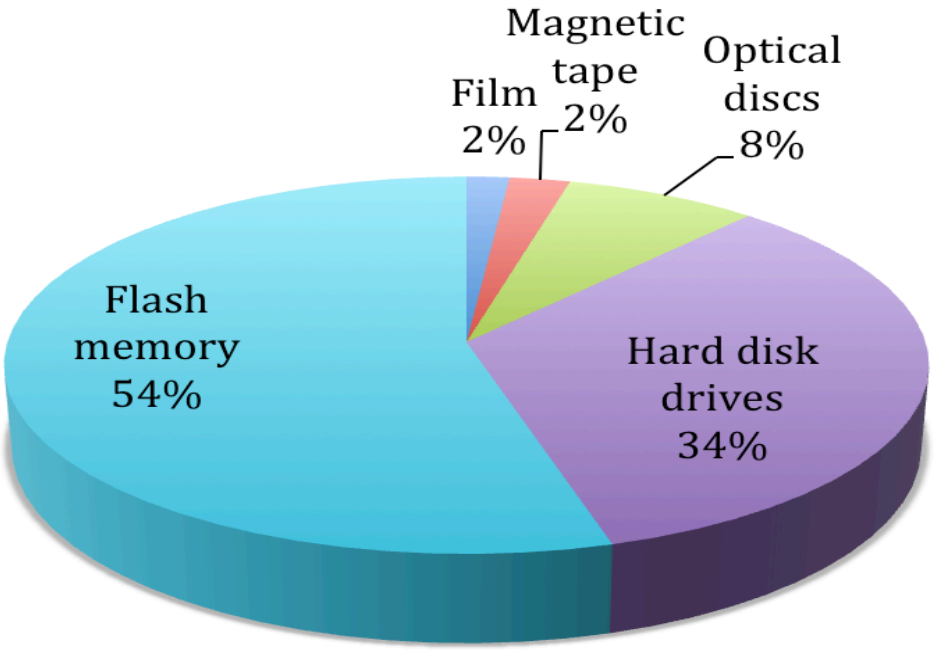
Flash memory is dominant camera storage



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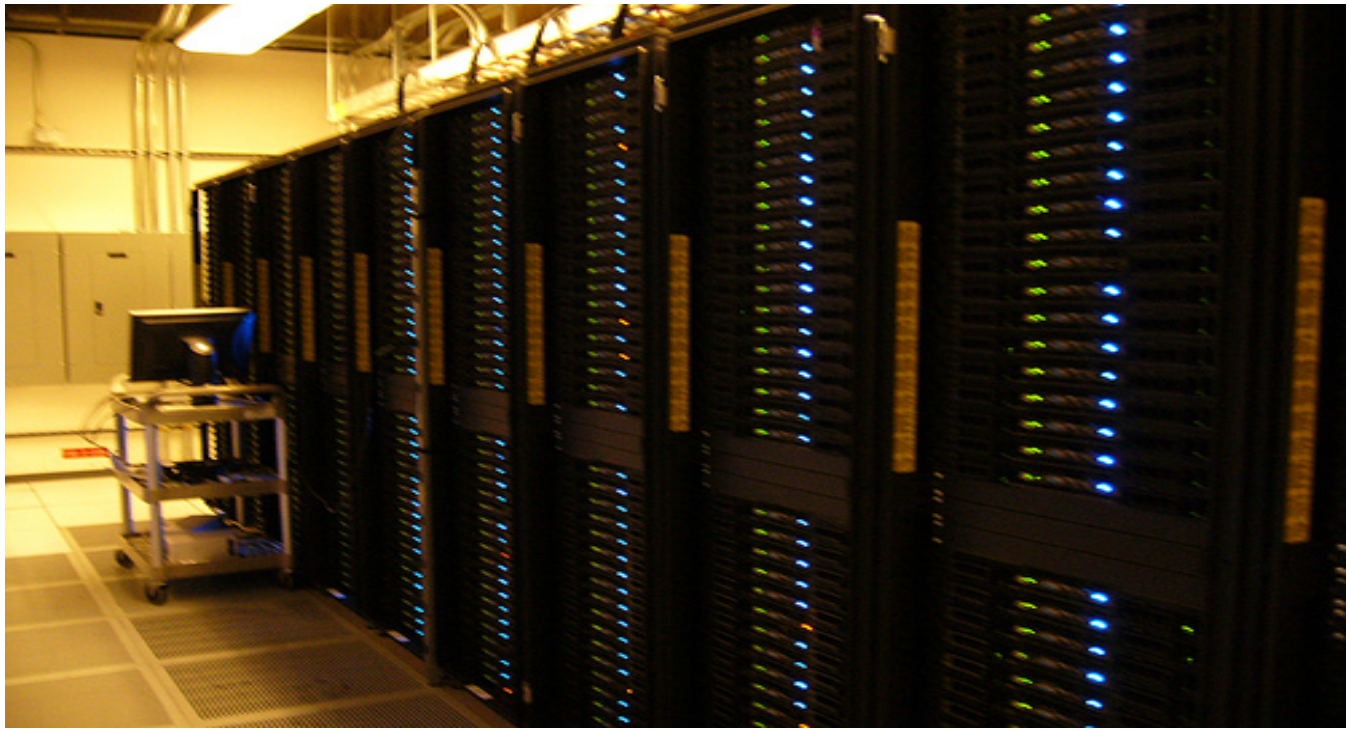
Pixar Render Farm



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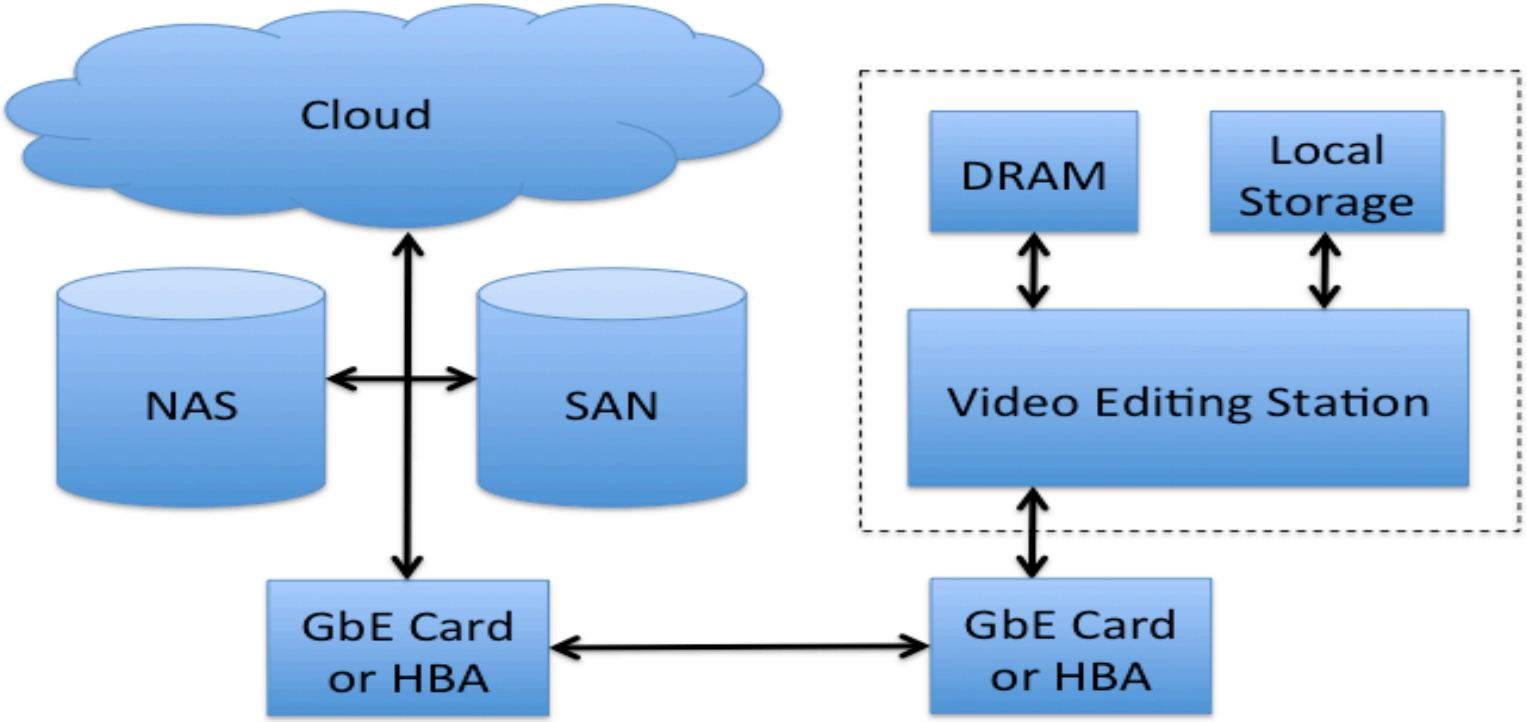
Modern post production



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Flash-based video workstations

Apple Mac Pro

HP Zbook Studio Workstation

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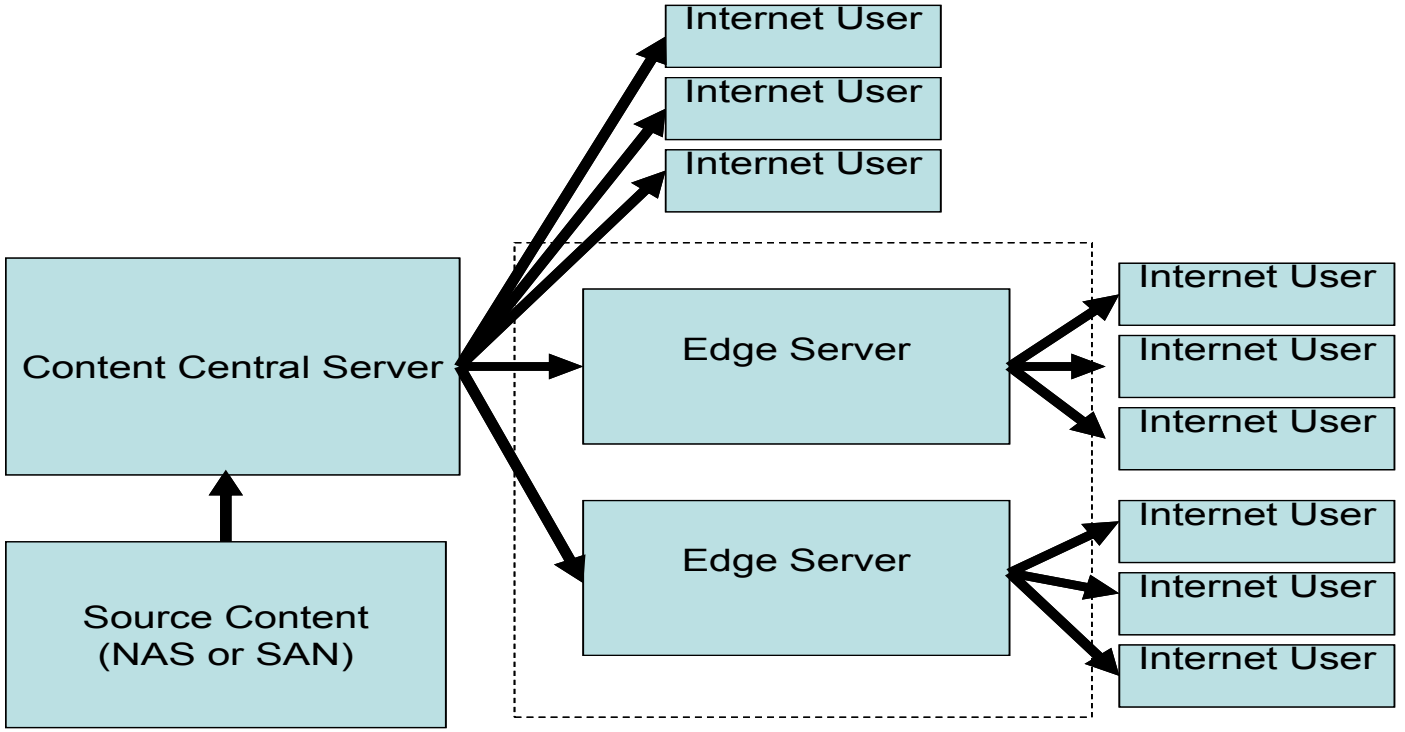
Internet Distribution System (CDN)



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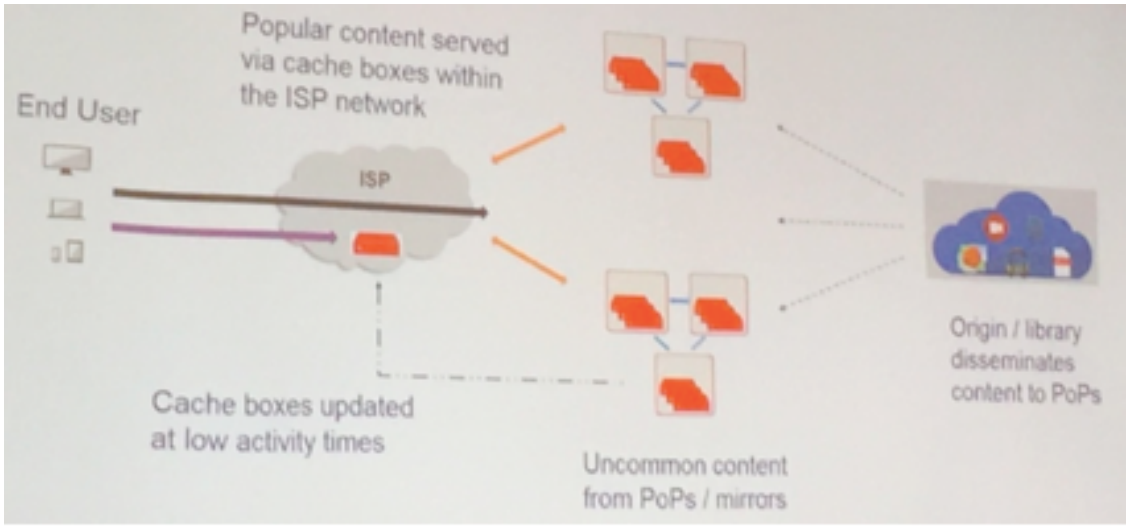
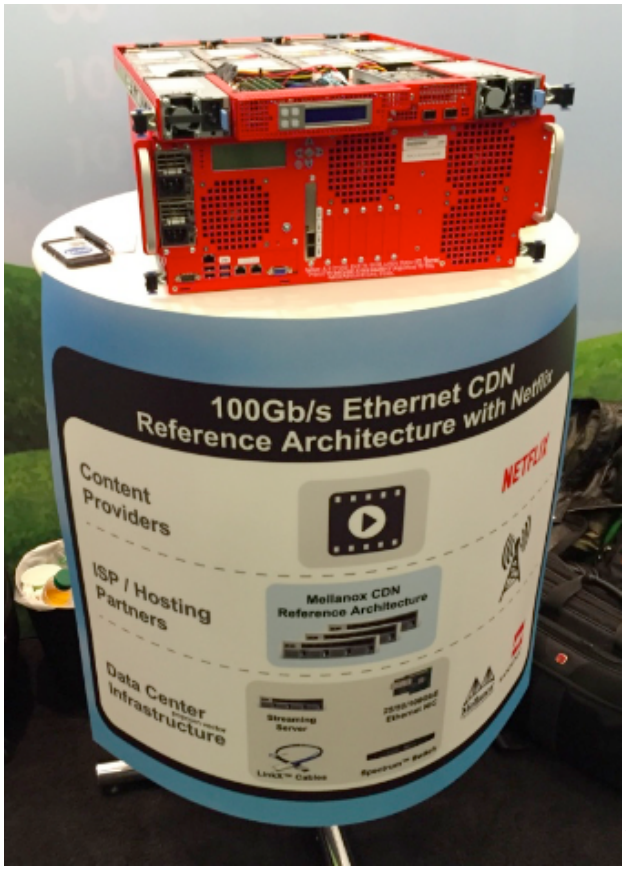
Internet delivery gets fast





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VOD storage requirements increasing

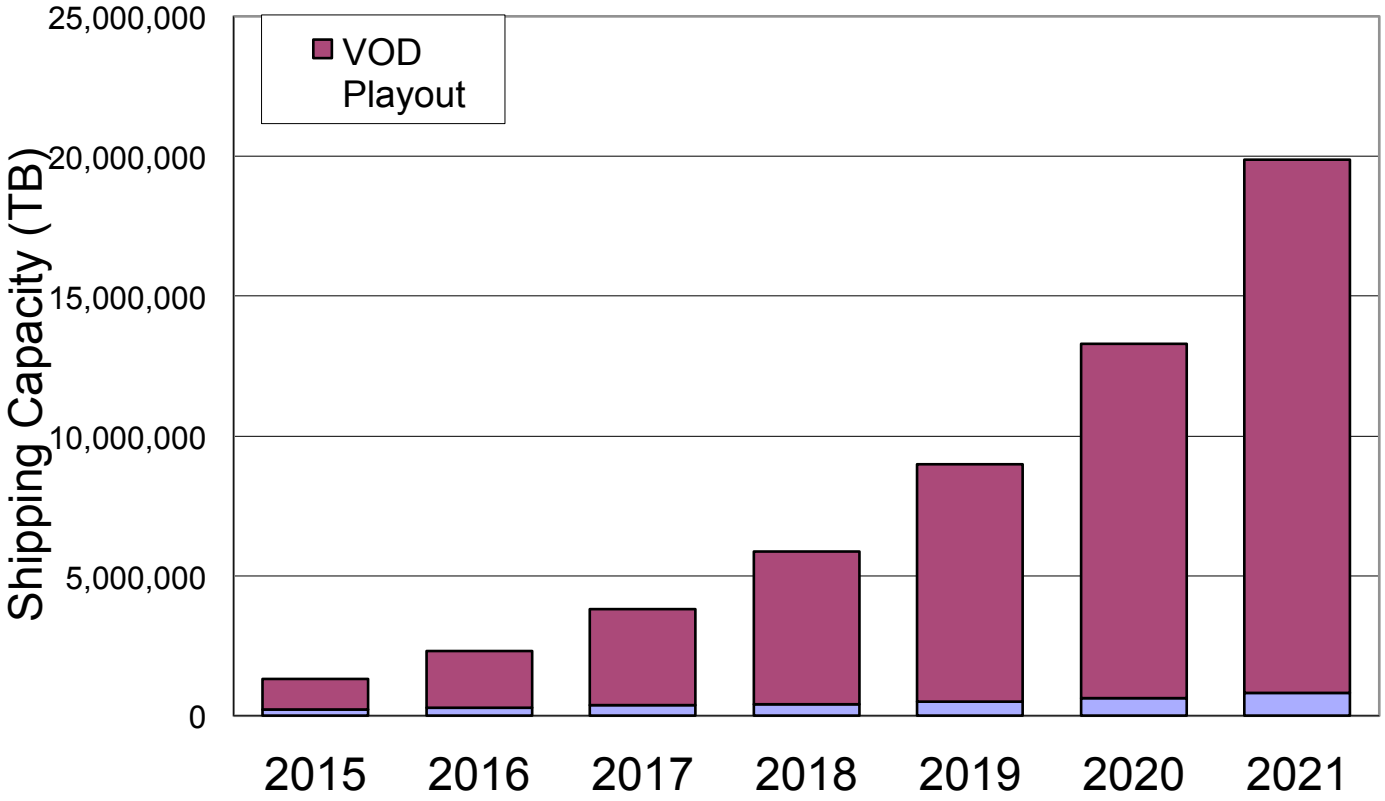

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Figure 35. Toshiba on-air Max Flash

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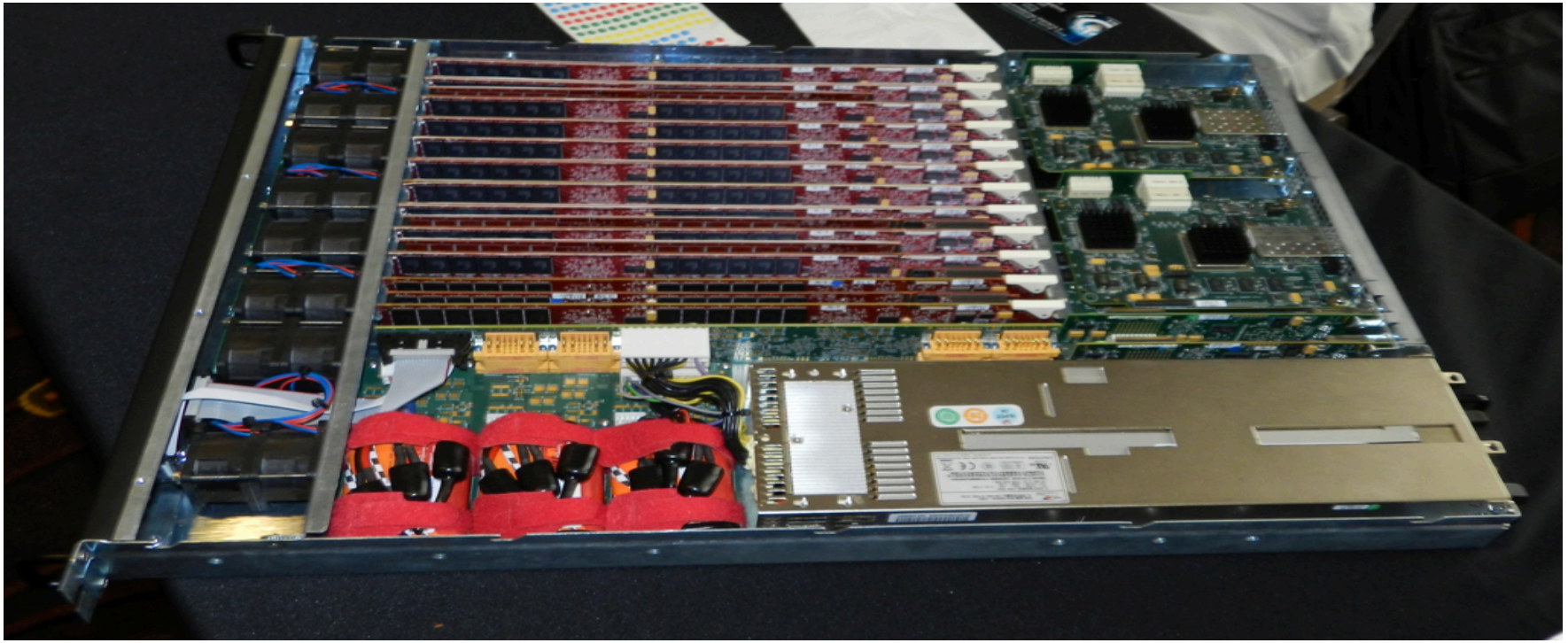
IBM flash-based content-delivery server



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Active archives provide flash role

- Traditional Archive Storage Technology
  - Magnetic Tape
  - Optical Discs
  - High Capacity HDDs (especially for active archives)
- Active Archives
  - Because of demand for access to content many archives are actually more like content libraries—they **are active archives**

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Flash memory as an archive cache

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Flash as an archival media?

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Flash in M&E Summary

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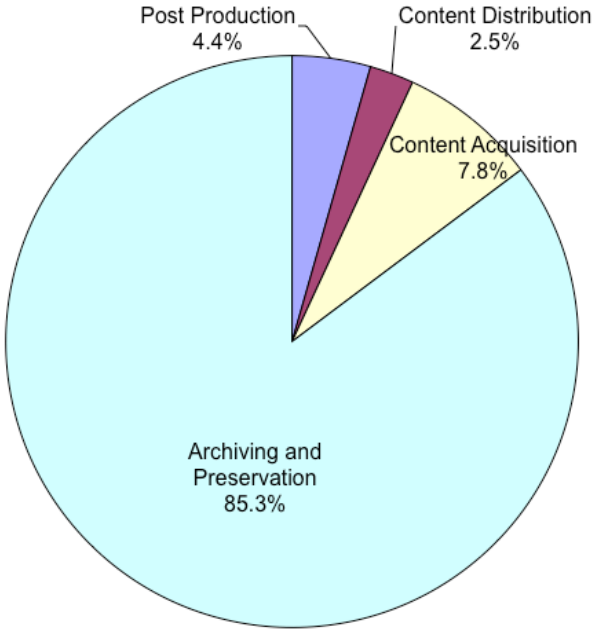
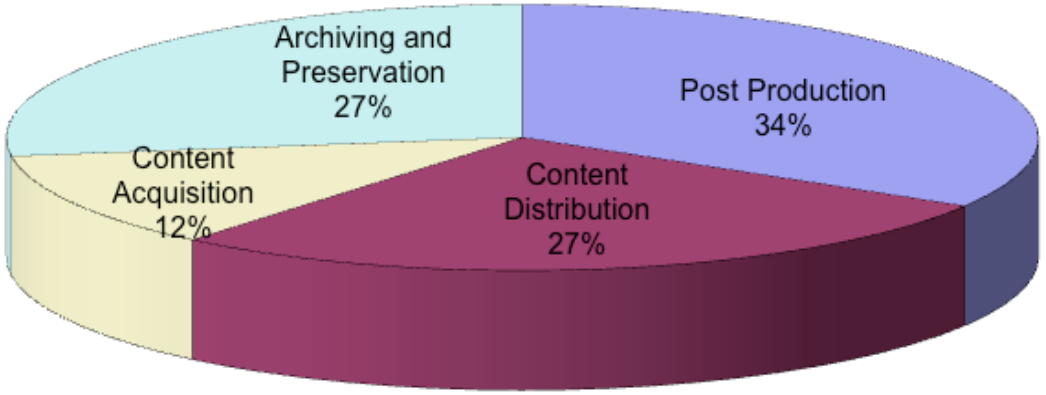
2015 Media and Entertainment Storage

2016 Digital Storage for Media and Entertainment Report

Distribution of Storage Capacity





Media and Entertainment Market Storage Revenue Share by Segment

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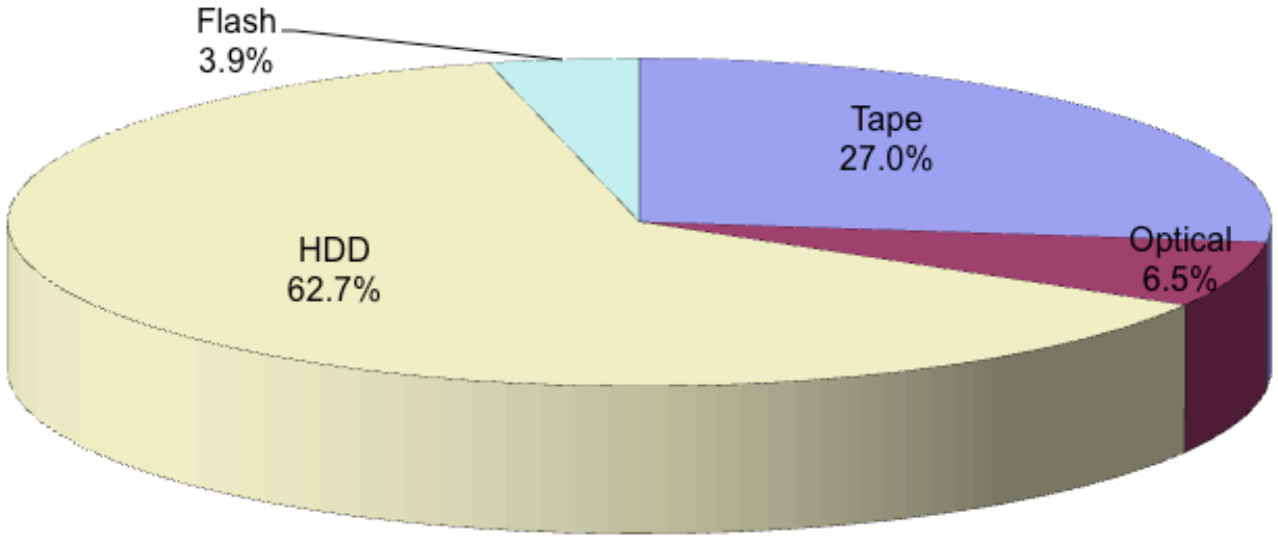
2015 Total M&E Market Share by Capacity Shipped



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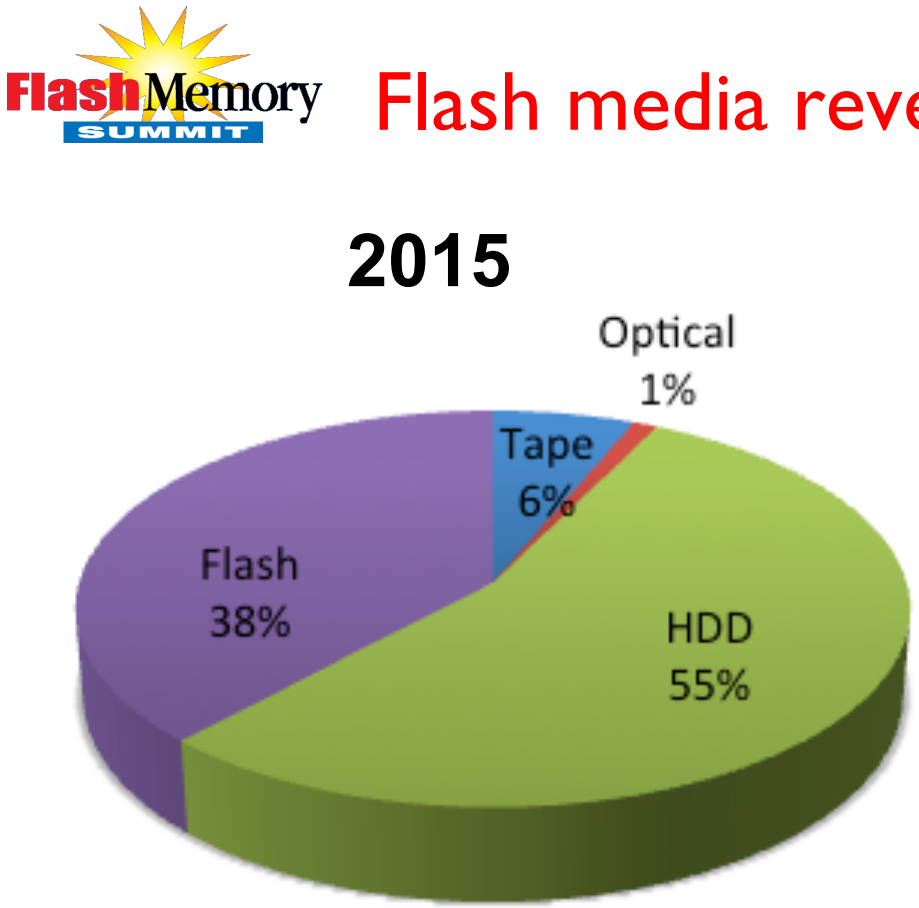

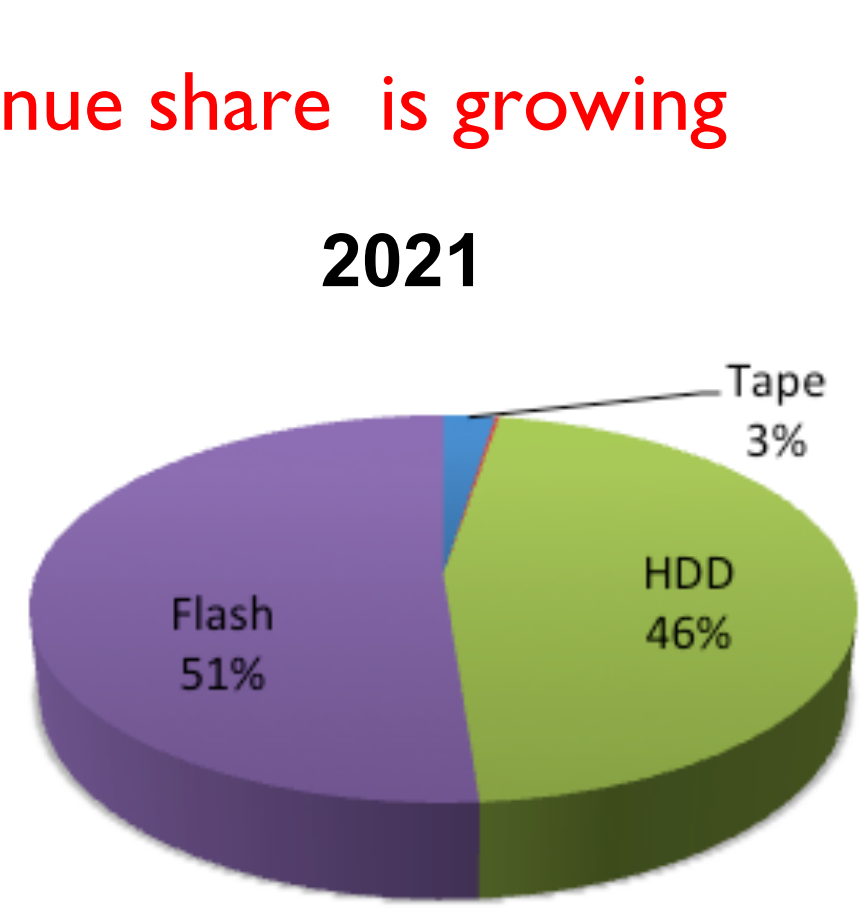

Flash media revenue share is growing

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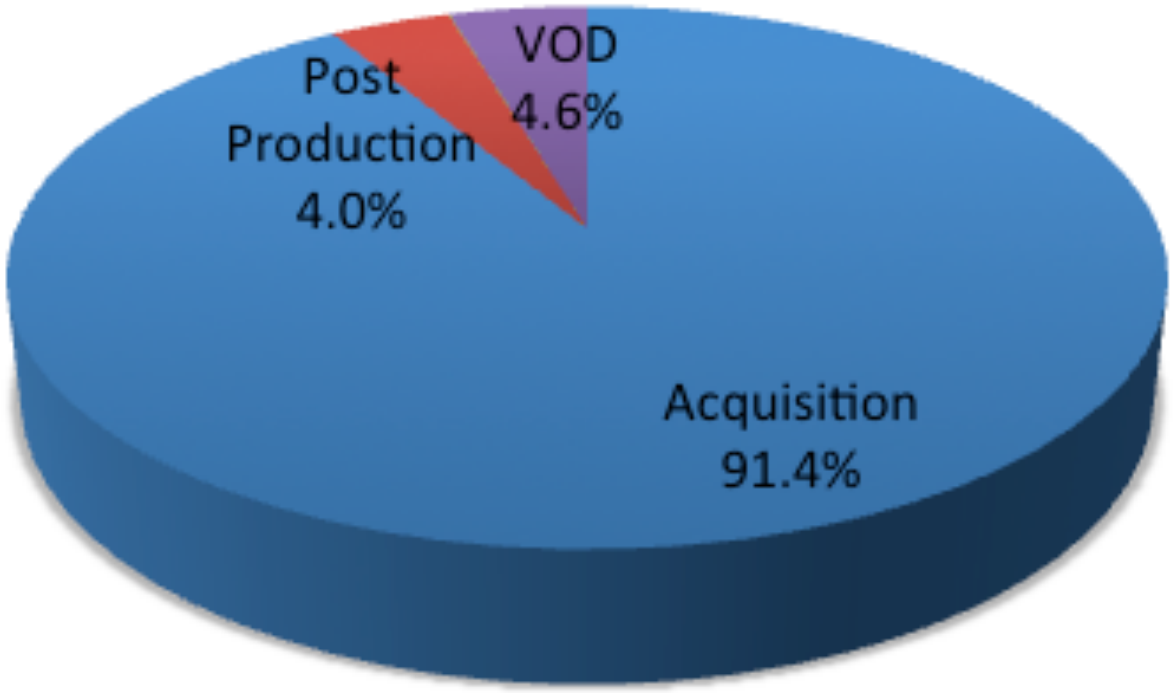
Growing use of flash memory in Media and Entertainment

2021 Projections



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Conclusions

- Media and entertainment applications require large amounts of stored content & higher performance storage
- Flash memory provides the performance needed for modern M&E applications.
- Flash memory is the dominant storage media for content capture
- As the cost decreases, flash memory will be used increasingly to improve overall performance in applications ranging from post production to archiving, often as part of a hybrid storage system
- The revenue for flash in media and entertainment applications is increasing.

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References

- Touch Rate: A metric for analyzing storage system performance, Steven Heltzer and Tom Coughlin, 2015,
- 2009-2016 Survey of Storage in Professional Media and Entertainment
- 2016 Digital Storage in Media and Entertainment Report, Coughlin Associates
- 2015 Emerging Non-Volatile Memory & Spin Logic Technologies and Manufacturing Report
- Information on all these are available at: http://www.tomcoughlin.com/techpapers.htm

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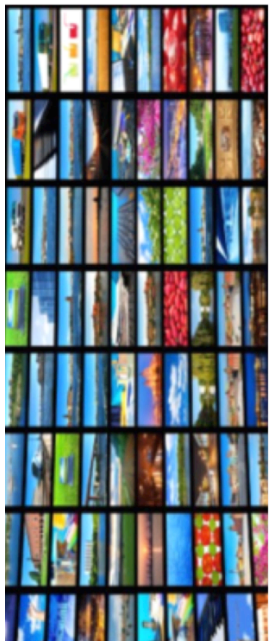

2016 DIGITAL STORAGE FOR MEDIA AND ENTERTAINMENT REPORT

This updated and expanded report is the twelfth annual comprehensive reference document on this topic. The report analyzes requirements and trends in worldwide data storage for entertainment content acquisition; editing; archiving and digital preservation; as well as digital cinema; broadcast; satellite; cable; network; internet and OTT as well as VOD distribution. Capacity and performance trends as well as media projections are made for each of the various market segments. Industry storage capacity and revenue projections include direct attached storage, cloud, real time as well as near-line network storage.

Web Link to Report Flyers at: http://www.tomcoughlin.com/techpapers.htm

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Next Meeting--Opportunities in Solid State Storage

August 11, 2016

6 PM, Dave and Busters, Milpitas, CA

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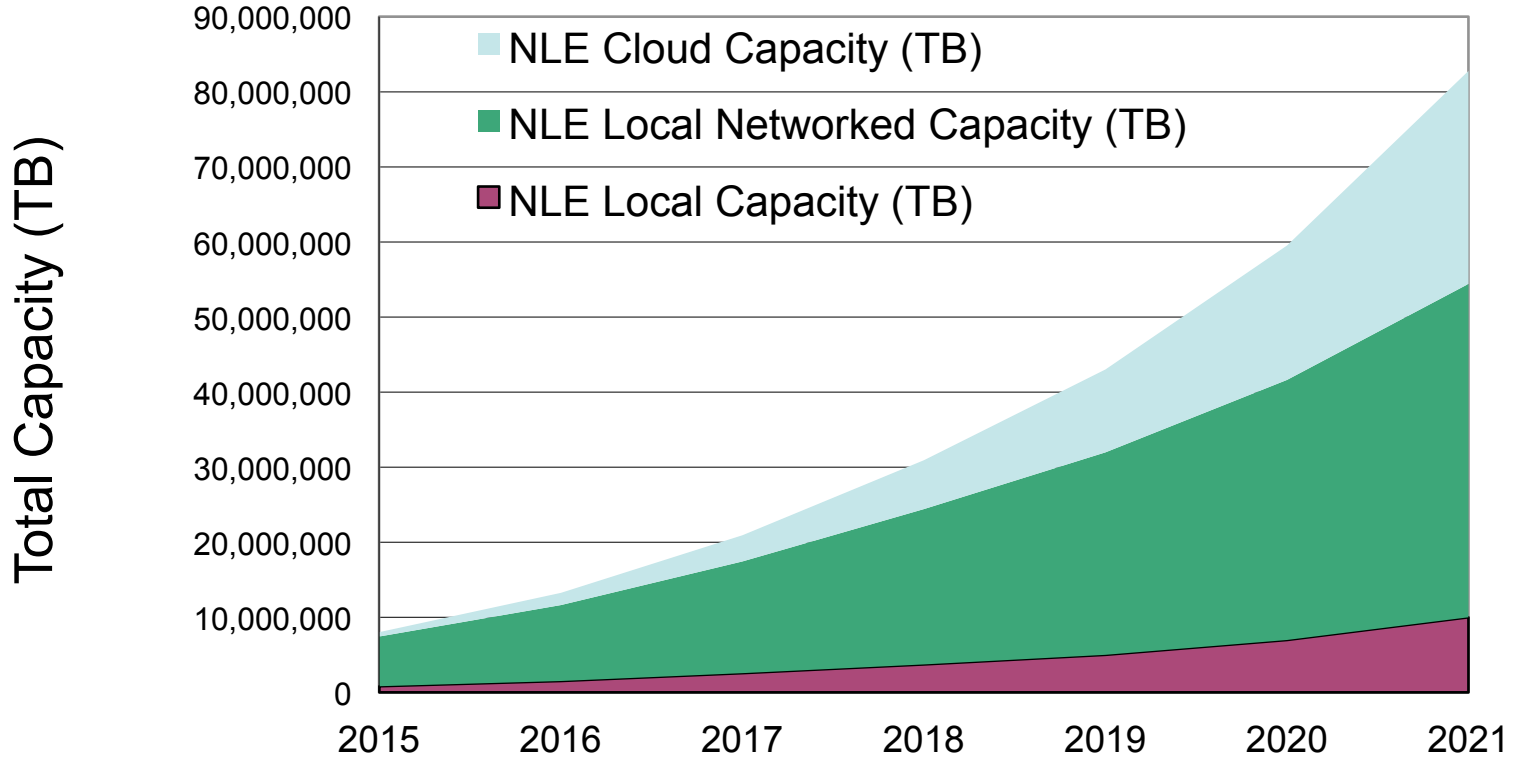
Post production moves to the clouds



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