

Digital Storage Stars in the Media and Entertainment Industry

SNIA Webcast – Live January 13, 2021 and on demand

Presented by Tom Coughlin
President, Coughlin Associates

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Our Speaker Today



Tom Coughlin

President, Coughlin Associates, Inc.

www.tomcoughlin.com

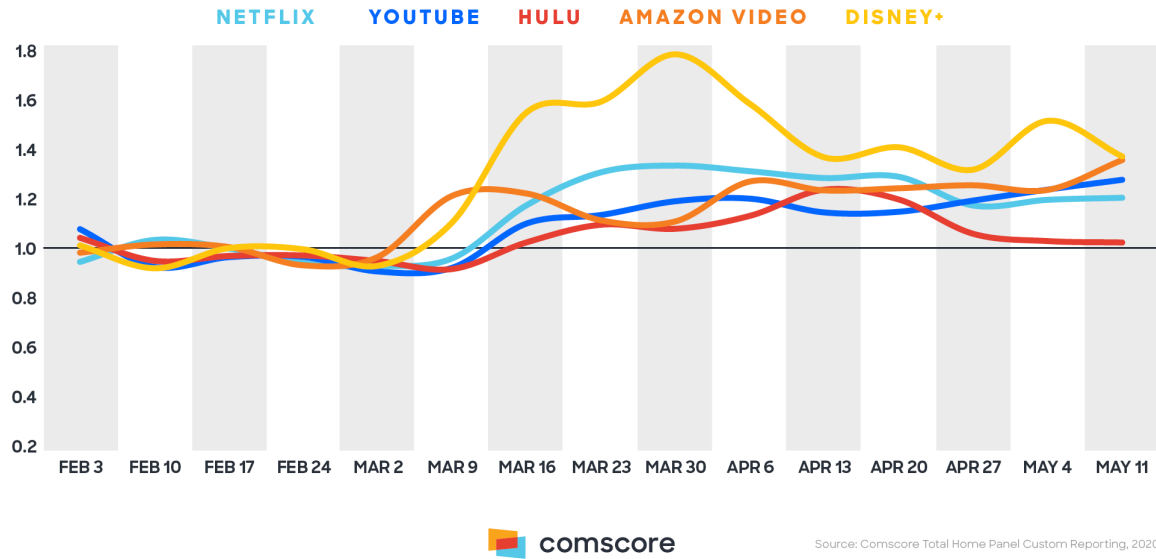
Outline

- Storage and data trends during the pandemic
- Media and entertainment content
- Storage in media and entertainment
- Remote work and growth of cloud-based workflows
- Conclusions and summary
- References

The Covid-19 pandemic changed the way we entertain ourselves and communicate

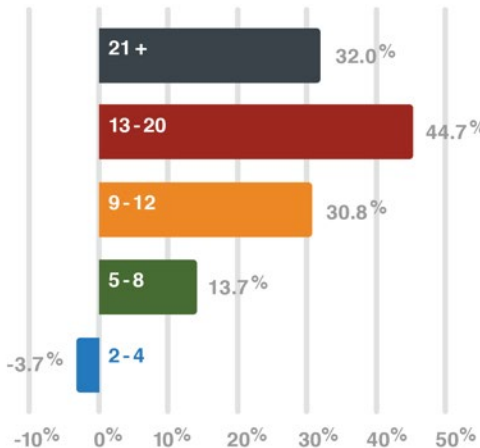
Top Streaming Apps by Total Hours (Across all Streaming Platforms)

INDEXED AGAINST THE FEBRUARY WEEKLY AVERAGE FOR EACH STREAMING APP

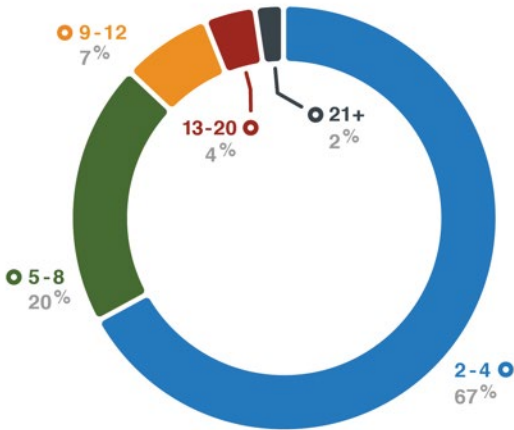


Video Meetings by Size During COVID-19 Pandemic

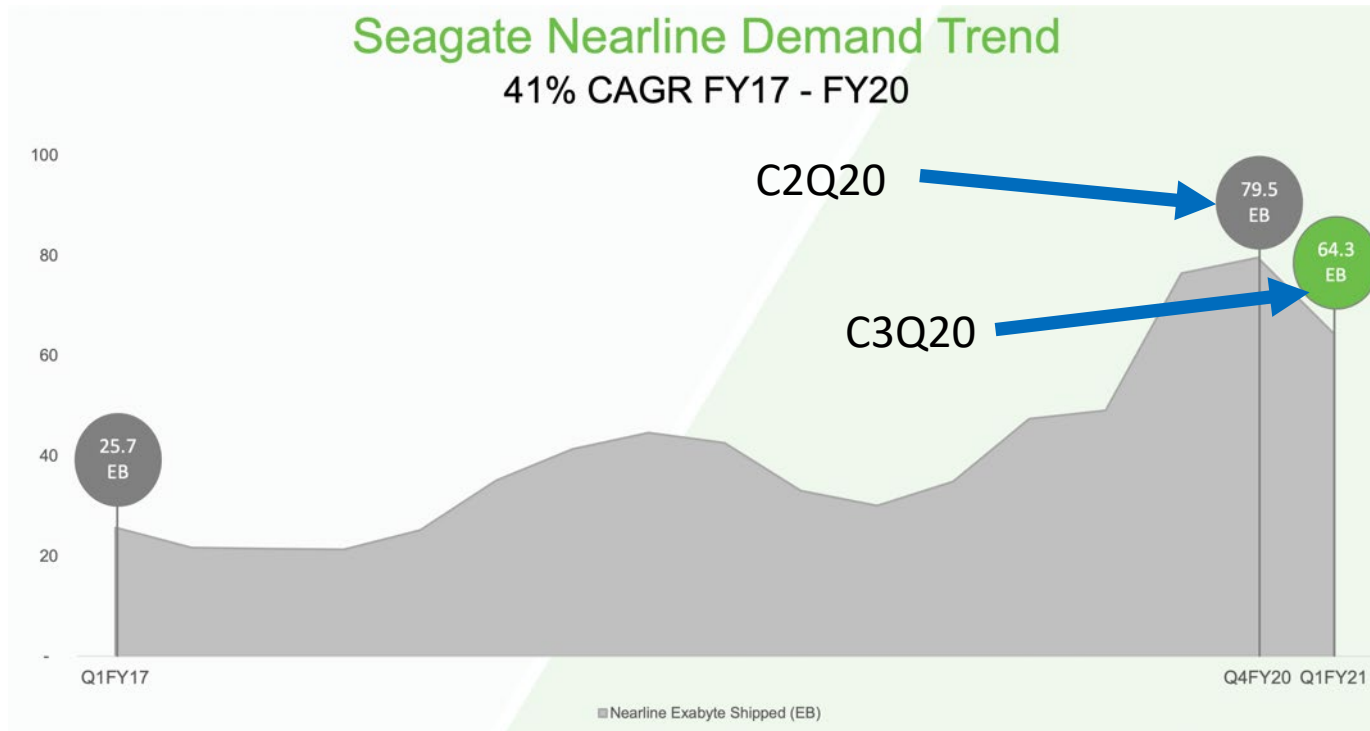
Average Growth in Meetings by Size
(May vs Feb 2020)



May Meeting Size Breakdown
(Over 2x Meeting Count vs February)

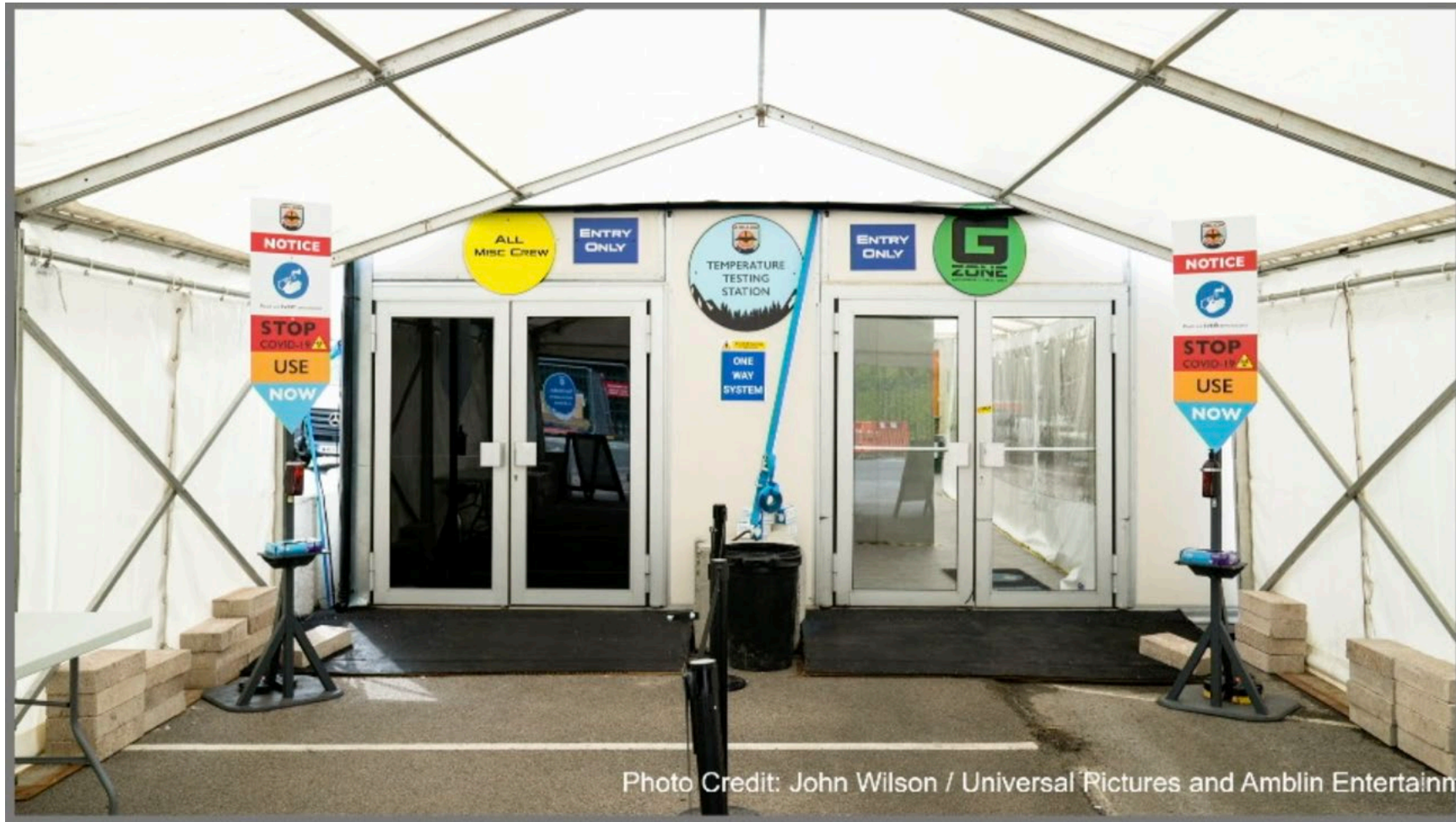


Covid led to growth in data center storage



- SSD and HDD storage shipments experienced significant growth in C2Q20 and overall in 2020 compared to 2019 due to increased use of cloud-based resources
- The high capacity nearline HDDs used for secondary storage have the biggest growth for these storage devices
- Some of this additional storage capacity supported remote M&E workflows

Entrance to a video set in 2020



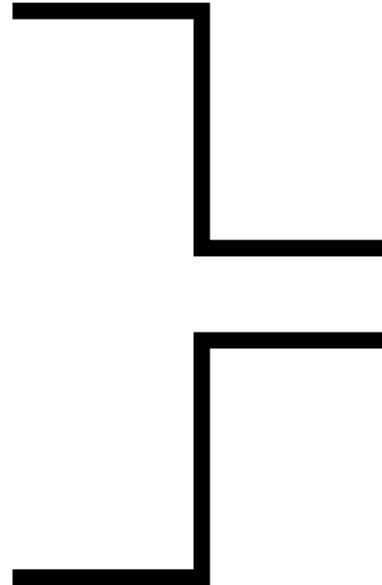
Media and Entertainment Content

The background image is a photograph of a massive, ancient stone wall, possibly a Roman fortification. The wall is constructed from irregular stones and is reinforced with horizontal bands of red brick. The wall extends diagonally from the bottom left towards the top right. In the background, to the right, a modern multi-story building with many windows is visible under a clear blue sky.

Resolution

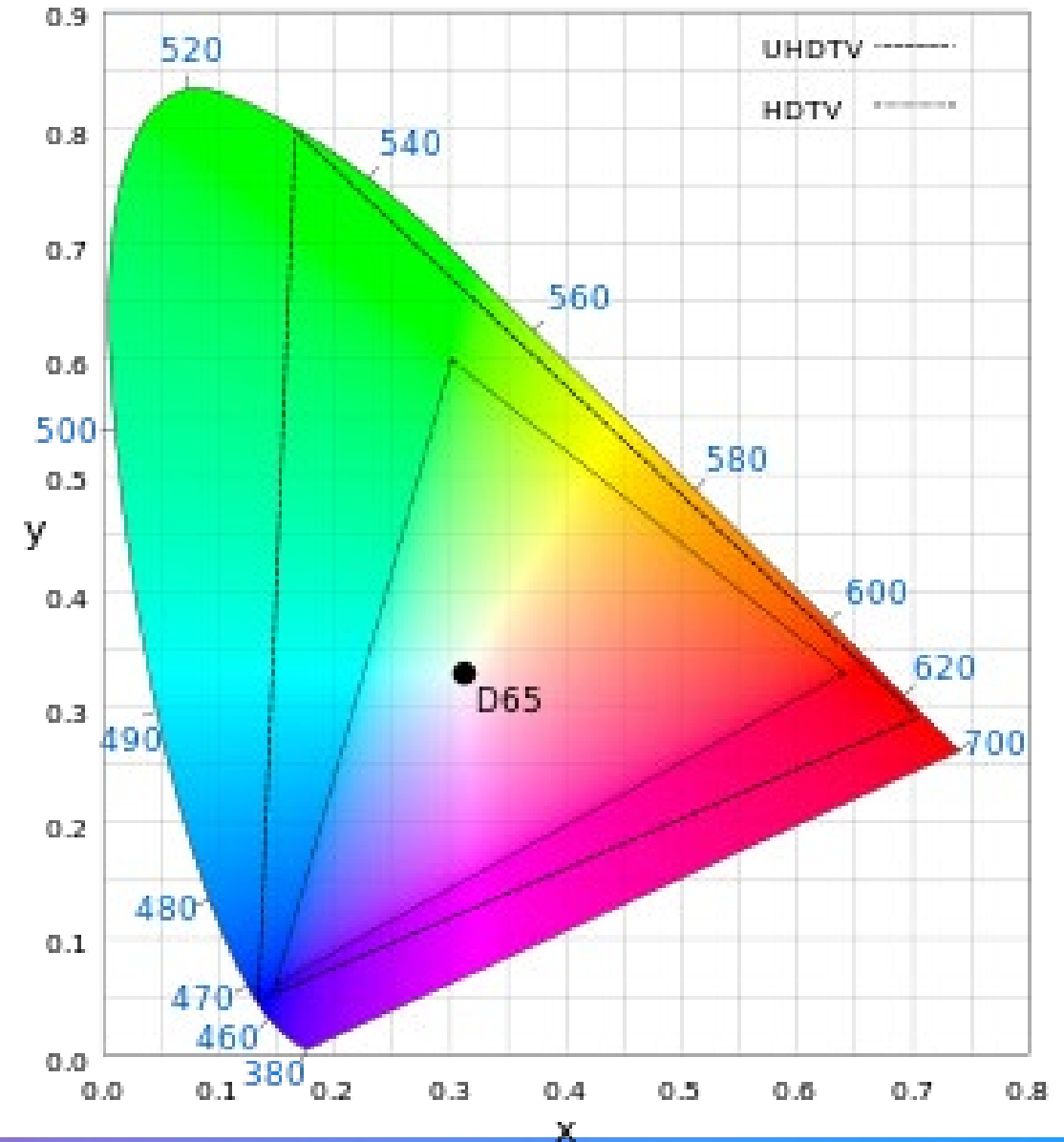


High dynamic range



Color gamut

- Color gamut is how broad a range of colors are being expressed in the image
- The image shows the CIE 1931 color space as well as the UHDTV (Rec 2020) color space in the outer triangle as well as the HDTV (Rec 709) color space in the inner triangle. The x and y axis are derived from the brightness and chromaticity of each color.
- The illuminant D65 point is defined as white in both of these display color spaces. The numbers on the outside of the locus of the CIE 1931 color space are the wavelength of the light corresponding to that color.



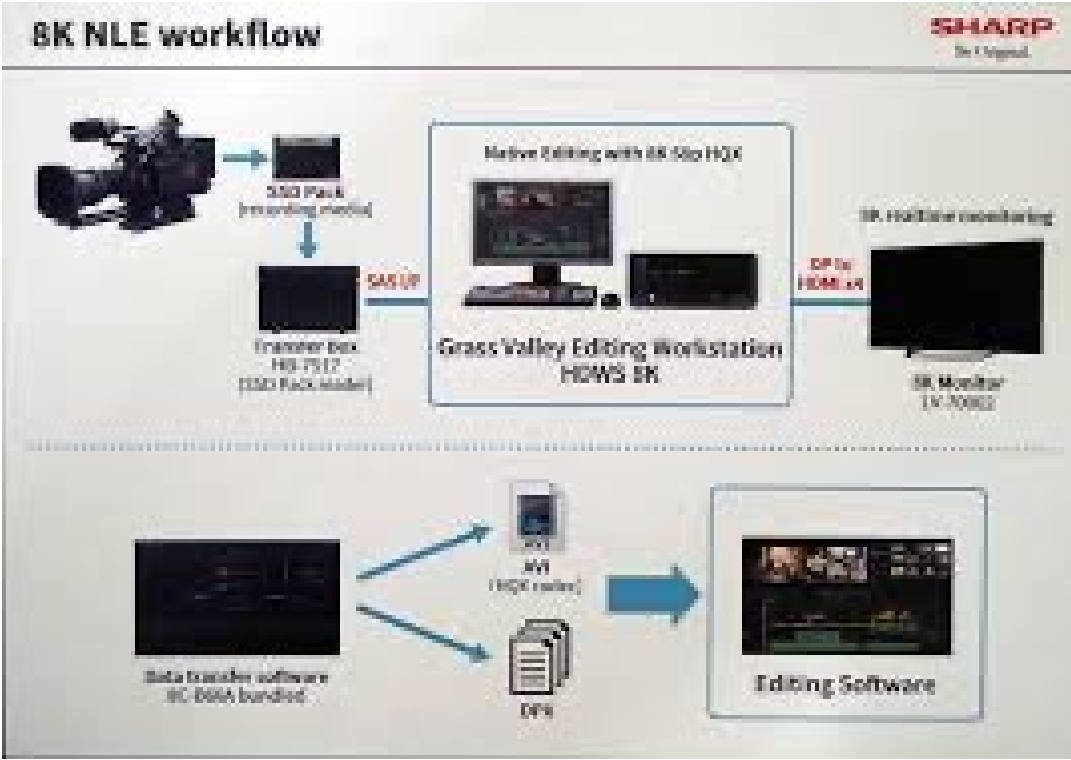
Computer generated content

- Like camera footage, animation and computer generated imagery (CGI) content is also rendered at the highest resolution possible.
- This is especially so for special effects generation that must look like a real place



8K Workflows

Display Signal	Refresh (Hz)	Color Mode	Bit Depth	Data Rate
7680x4320p	24	4:2:2	10-bit	19.1 Gb/s
7680x4320p	30	4:2:0	8-bit	17.8 Gb/s
7680x4320p	30	4:2:0	10-bit	21.4 Gb/s
7680x4320p	30	4:2:2	10-bit	28.5 Gb/s
7680x4320p	30	4:4:4	10-bit	42.8 Gb/s
7680x4320p	60	4:2:0	8-bit	35.6 Gb/s
7680x4320p	60	4:2:0	10-bit	42.8 Gb/s
7680x4320p	60	4:2:2	10-bit	57 Gb/s
7680x4320p	60	4:4:4	10-bit	85.5 Gb/s
7680x4320p	120	4:2:2	10-bit	114 Gb/s
7680x4320p	120	4:4:4	10-bit	171 Gb/s



From: 2019 HPA Retreat Talk, Peter Putman

Virtual Reality and 360 Degree Video

Image by Darin McClure



Jaunt ONE 360 degree camera

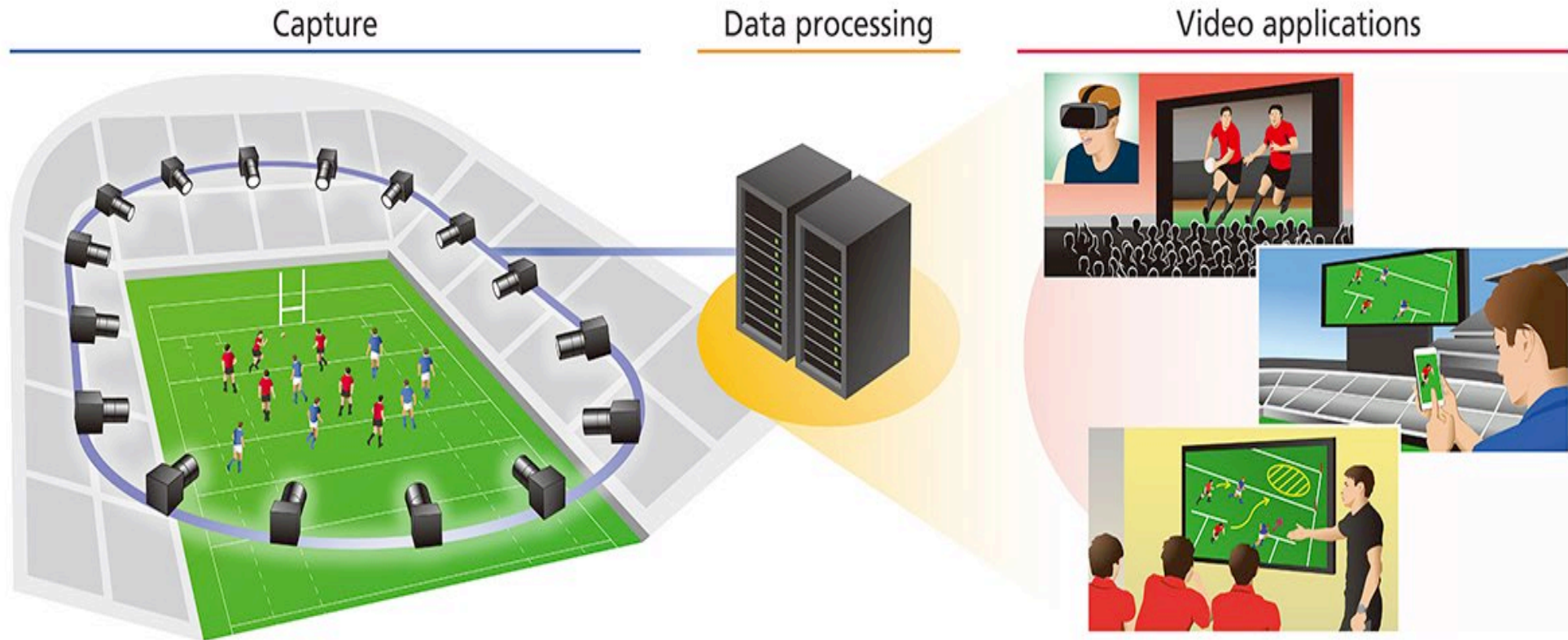


16K Video

- Nest+Visual, Inc. produced 16K ultra-wide (16320×2304-pixel) content, for a 36-screen display installed at Tokyo International Airport, Haneda. They shot the 16K-wide by 2K-high content, with a single Sony F65 CineAlta camera, equipped with an anamorphic lens.



Free Viewpoint Video



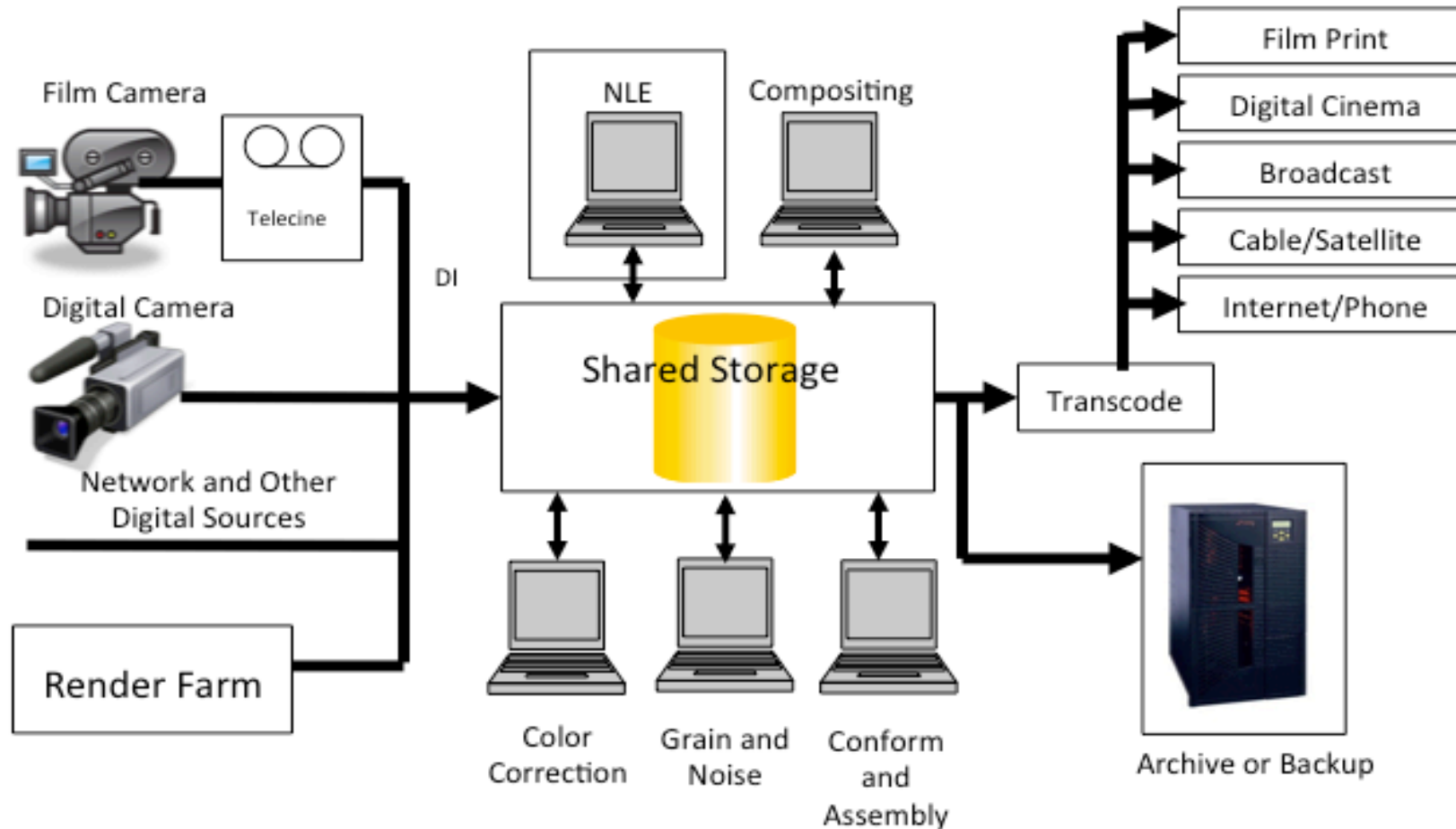
Example setup and applications of the Free Viewpoint Video System

Volumetric Video



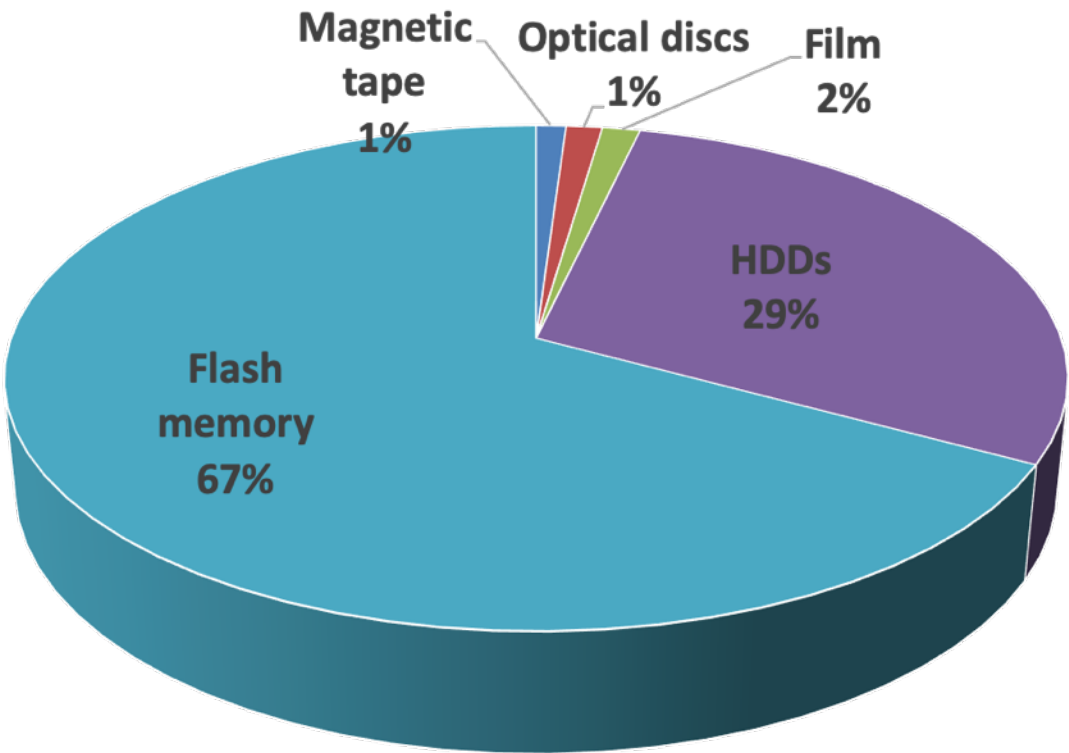
Digital Storage In Media and Entertainment

Digital entertainment content workflow



Professional camera trends

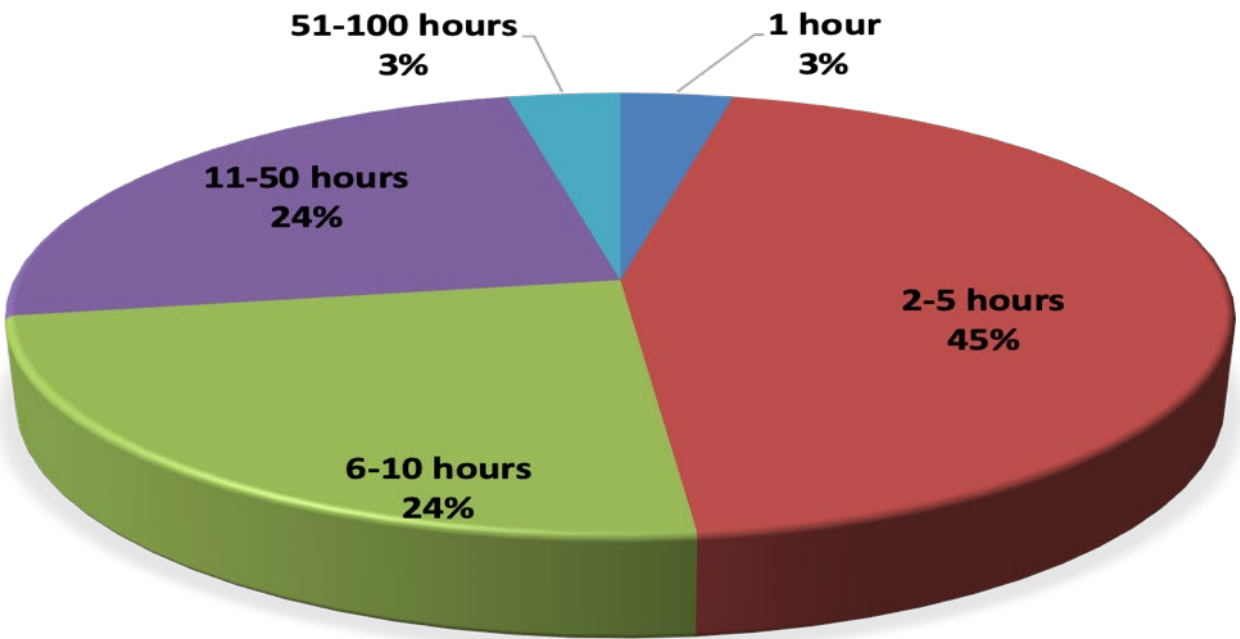
2020 Digital Storage in Media and Entertainment
Survey, Coughlin Associates



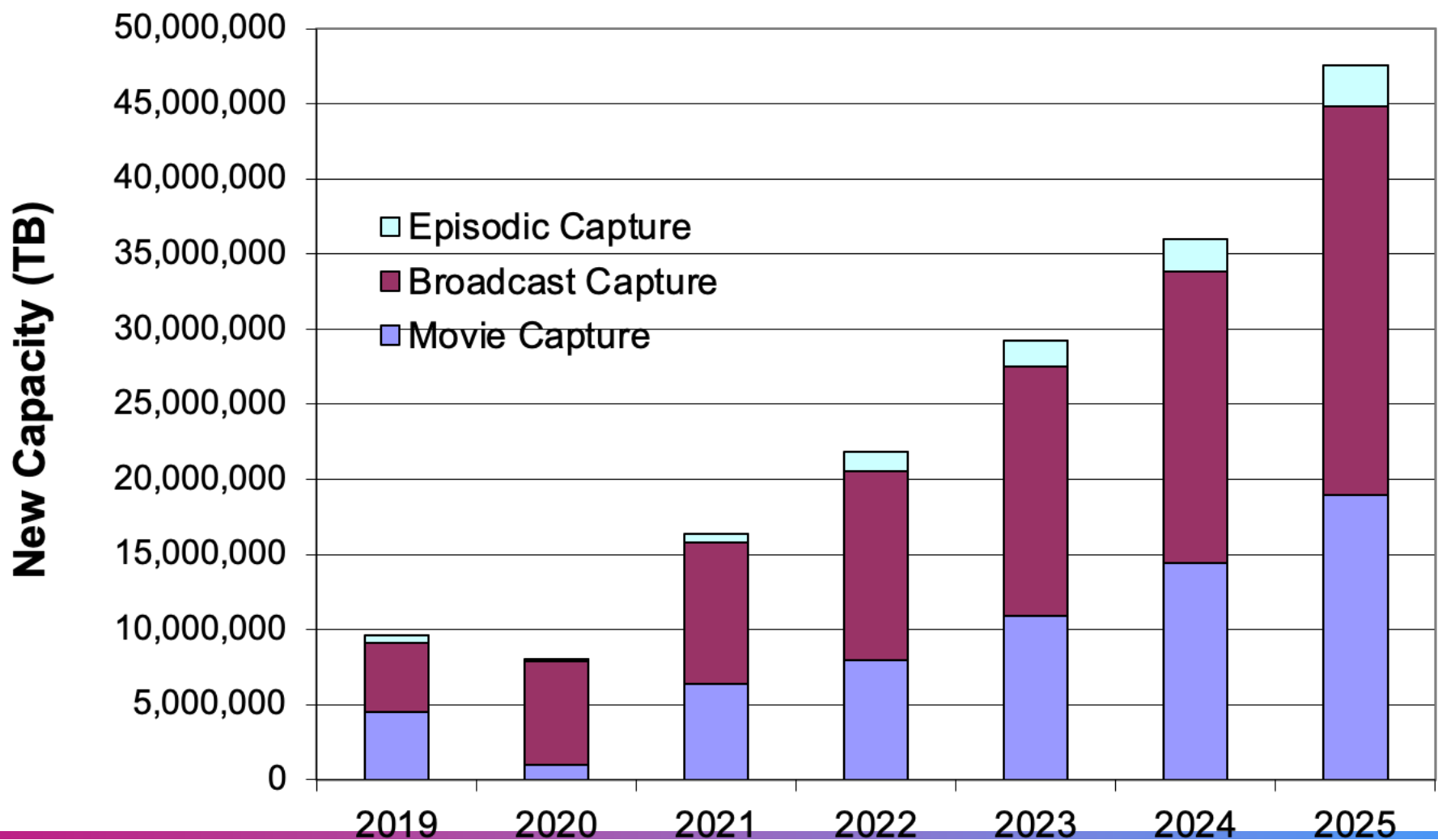
Percentage of various recording media
in professional video cameras



Content shot for an hour of completed
work

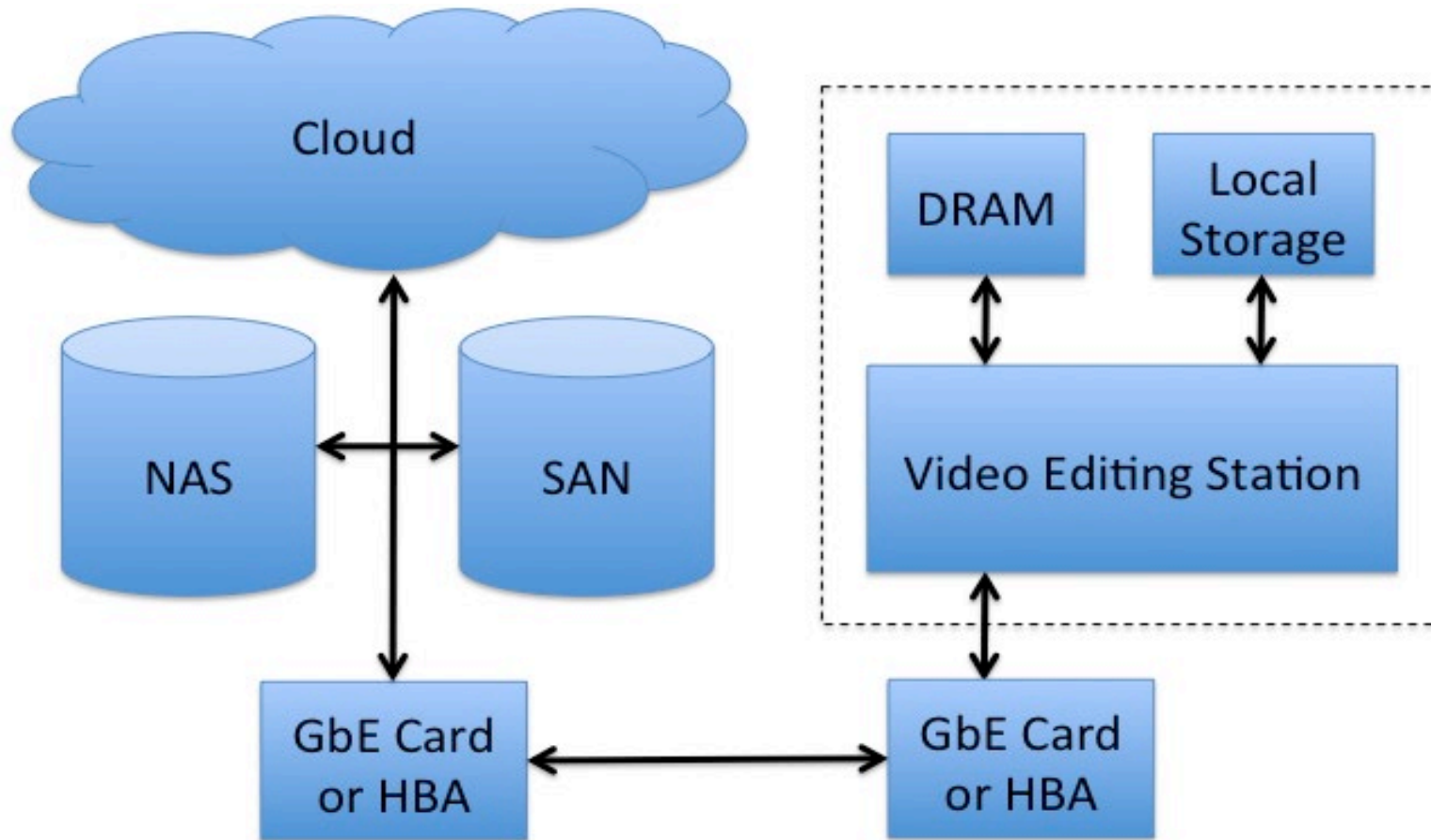


Annual storage capacity growth for digital content acquisition



From the 2020 Digital Storage in Media and Entertainment Report, Coughlin Associates

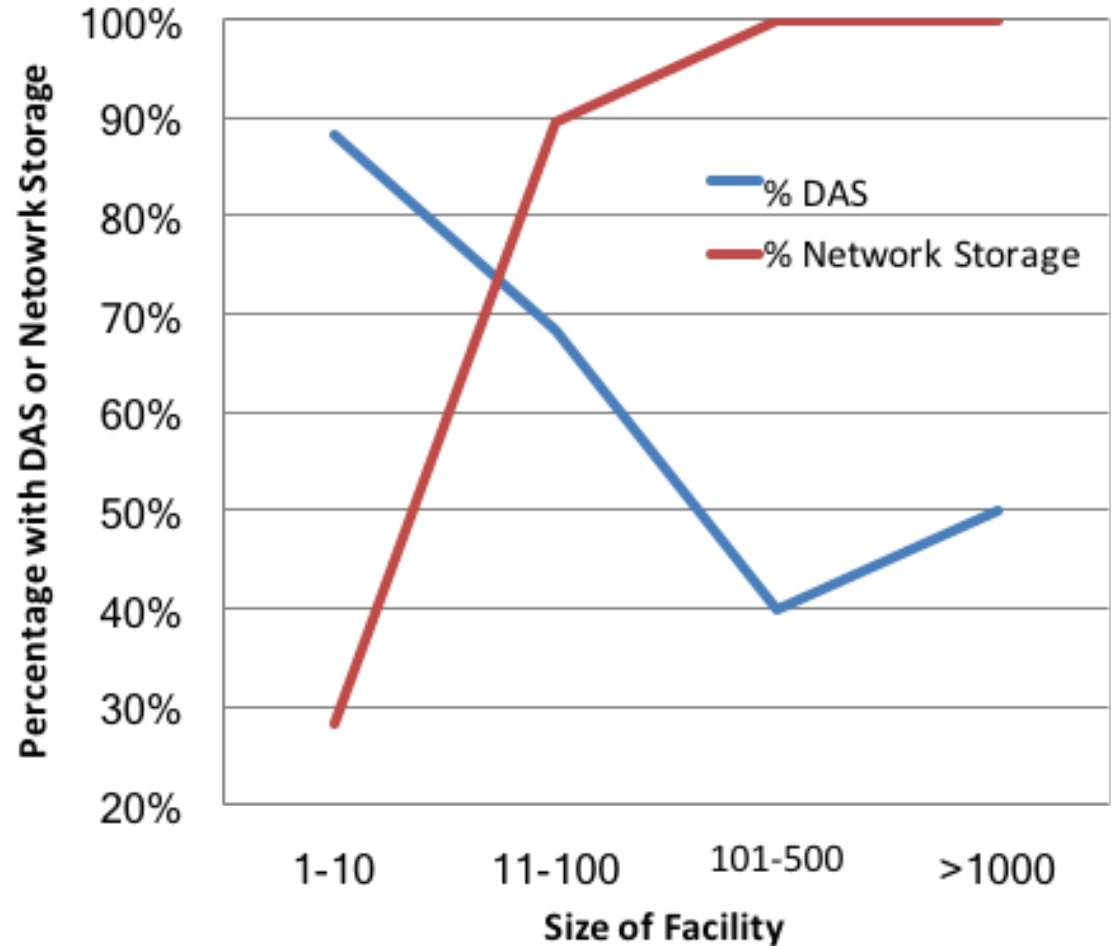
Storage for post-production and non-linear editing



- A very important part of the post-production process is editing.
- Editing uses local memory and storage for lowest latency access
- Network storage allows local collaborative work while cloud storage allows remote collaboration

Use of Networked Storage versus DAS

- This chart is from the Coughlin Associates Digital Media Professional Digital Storage Survey
- There is a general increase in the use of shared network storage (such as SAN or NAS), and a decrease in DAS storage as the number of people working in a post-production facility increases.
- Even for large facilities DAS usage only declines to 40-50%



From the 2020 Digital Storage in Media and Entertainment Report, Coughlin Associates

Using the cloud as a storage tier

- With collaborative workflows, cloud storage, either private or public, is often used to provide material that can either be downloaded for local processing, or sometimes processed directly in the cloud
- To control cloud storage costs, the content stored in the cloud is a copy and the content won't be downloaded again, just changes in the content from the workflow—e.g. EDL's from remote NLE's
- Cloud use can use different cloud services from different public cloud vendors—these are called multi-cloud environments
- For instance, some clouds have better rendering solutions, some have better metadata extraction capabilities

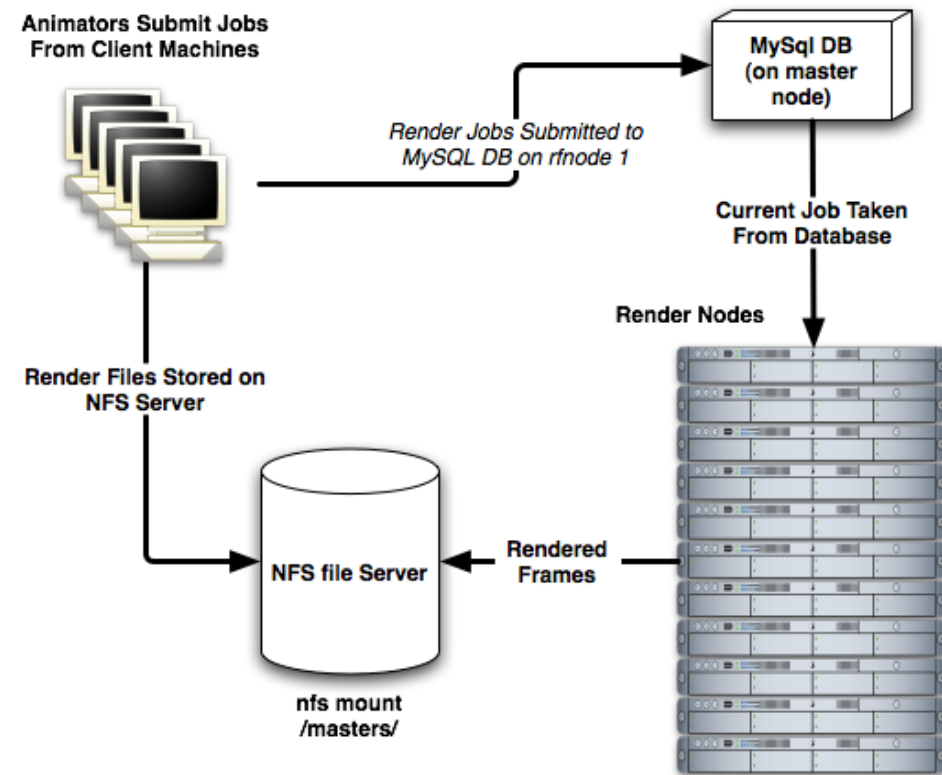
Using the cloud as a storage tier (2)

- Cloud rendering is a popular M&E application, for those who don't have their own rendering equipment or who need more rendering than they are currently equipped for.
- Cloud storage can also be used to store disaster recovery copies of content.
- There are also organizations that use cloud storage for active archives, but this is most common for <3 PB of storage

Storage for animation and special effects

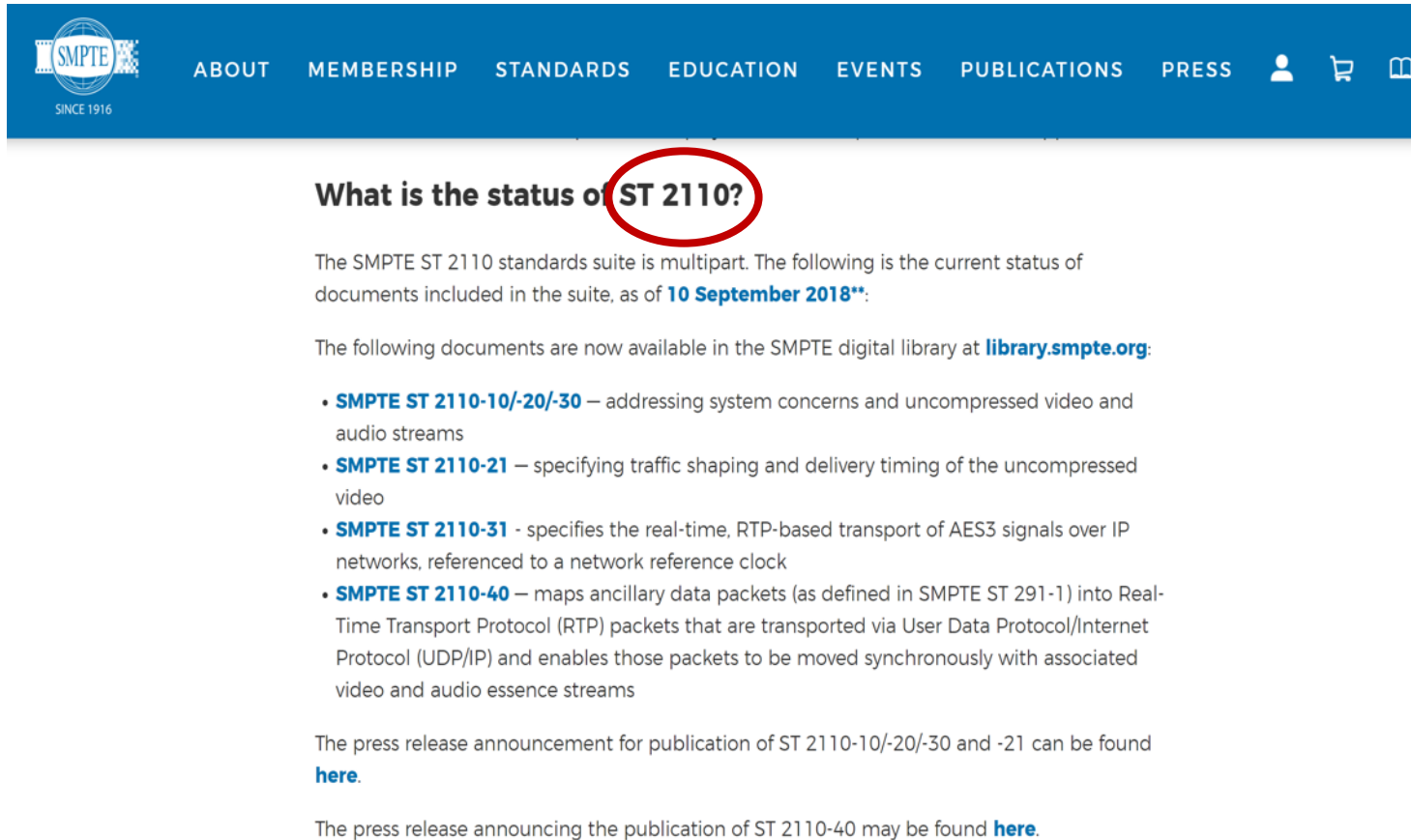


Pixar Render Farm



<http://jonmacey.blogspot.com/2010/12/render-farm-design.html>

But the world is changing for cameras & storage products



The screenshot shows the SMPTE website's navigation bar with links for ABOUT, MEMBERSHIP, STANDARDS, EDUCATION, EVENTS, PUBLICATIONS, and PRESS. Below the navigation bar, the heading "What is the status of ST 2110?" is displayed, with "ST 2110" circled in red. The text explains that the SMPTE ST 2110 standards suite is multipart and provides the current status of documents as of 10 September 2018. It lists four documents available in the SMPTE digital library at library.smpte.org:

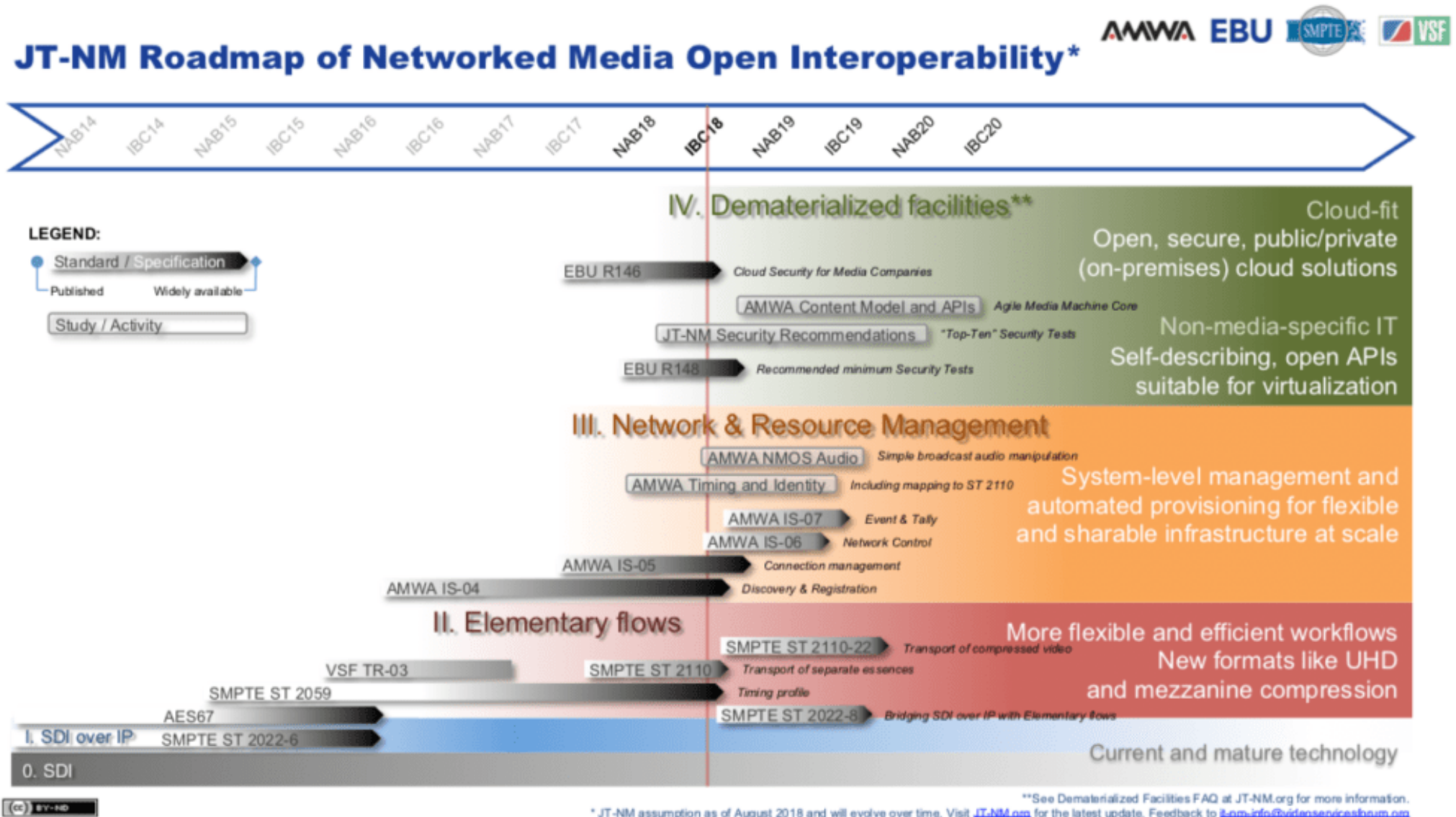
- **SMPTE ST 2110-10/-20/-30** — addressing system concerns and uncompressed video and audio streams
- **SMPTE ST 2110-21** — specifying traffic shaping and delivery timing of the uncompressed video
- **SMPTE ST 2110-31** - specifies the real-time, RTP-based transport of AES3 signals over IP networks, referenced to a network reference clock
- **SMPTE ST 2110-40** — maps ancillary data packets (as defined in SMPTE ST 291-1) into Real-Time Transport Protocol (RTP) packets that are transported via User Data Protocol/Internet Protocol (UDP/IP) and enables those packets to be moved synchronously with associated video and audio essence streams

The press release announcement for publication of ST 2110-10/-20/-30 and -21 can be found [here](#).

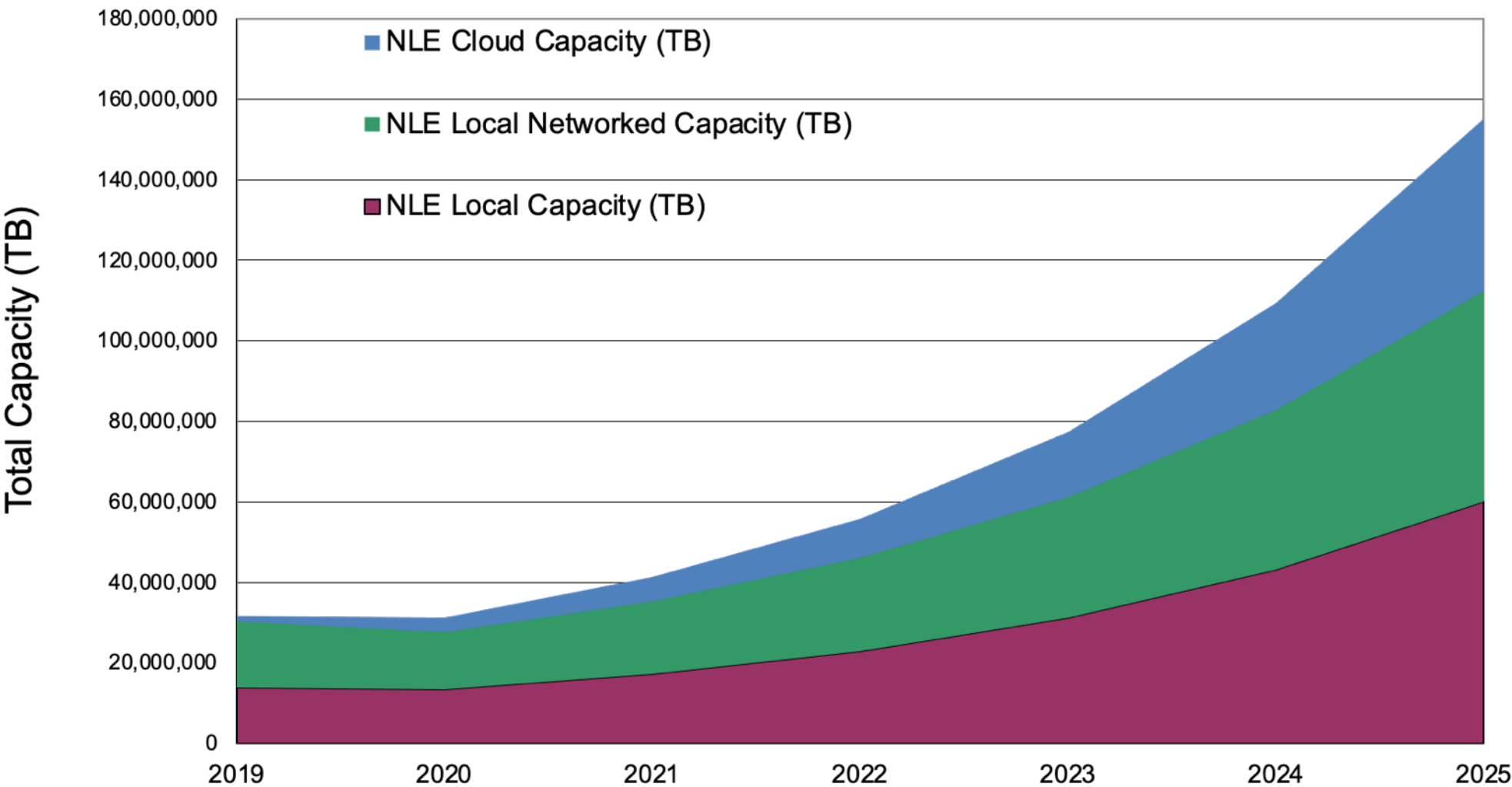
The press release announcing the publication of ST 2110-40 may be found [here](#).

Cameras, production and storage are all going digital with the IP protocol BUT NOT LIKE REGULAR IT SYSTEMS

ST 2110 (2)

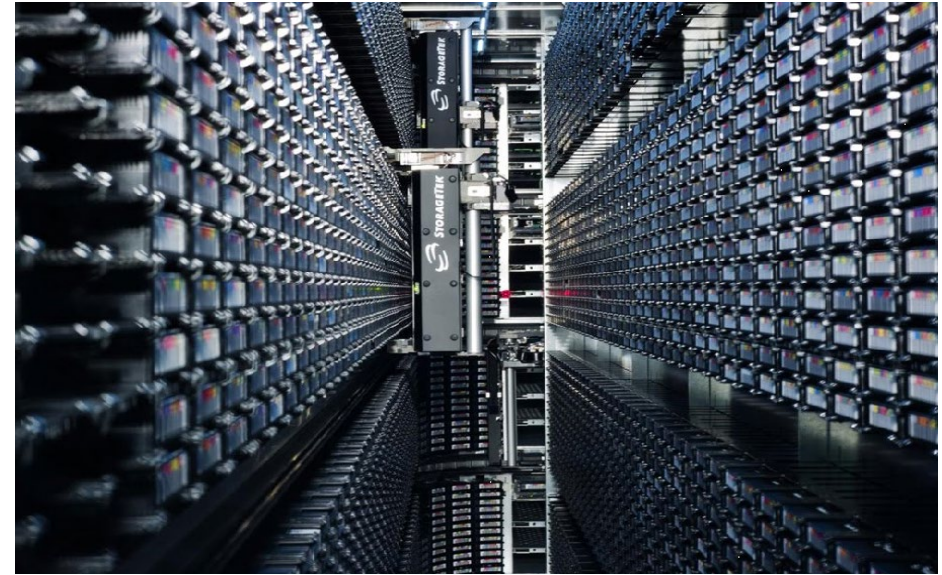


Post-production storage capacity annual demand

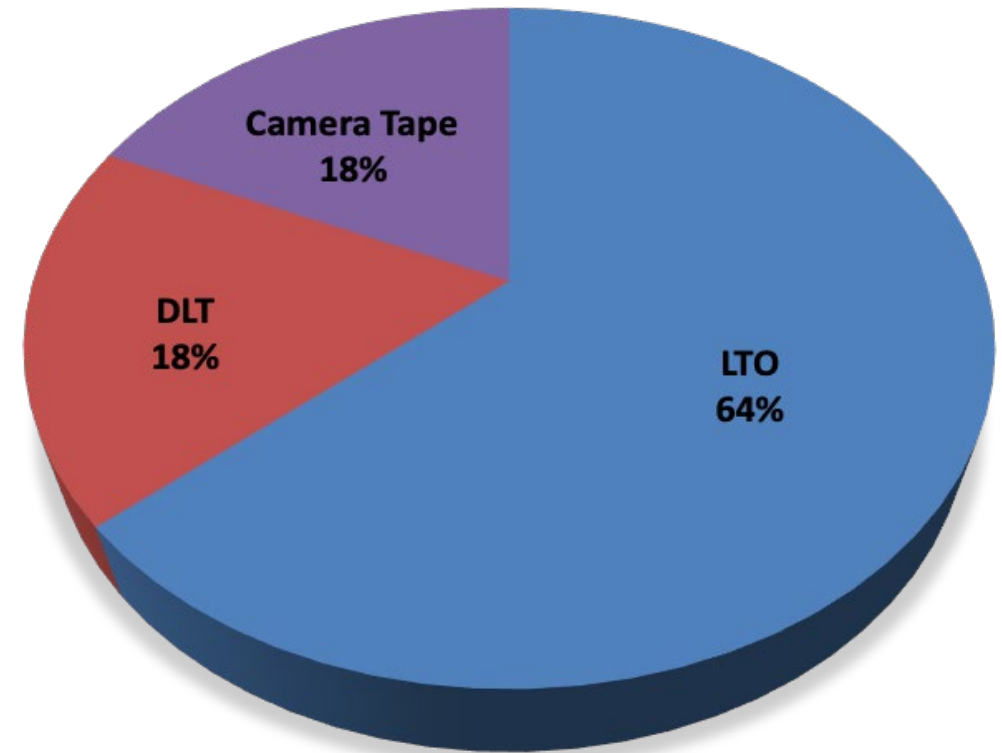
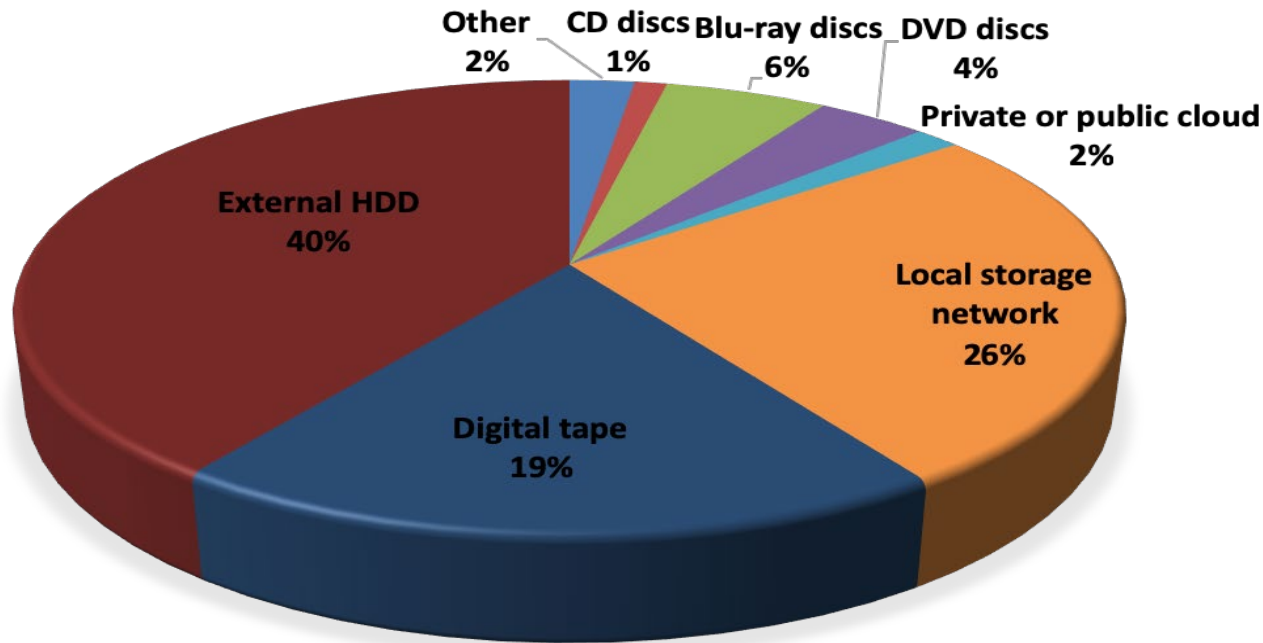


From the 2020 Digital Storage in Media and Entertainment Report, Coughlin Associates

Archive storage



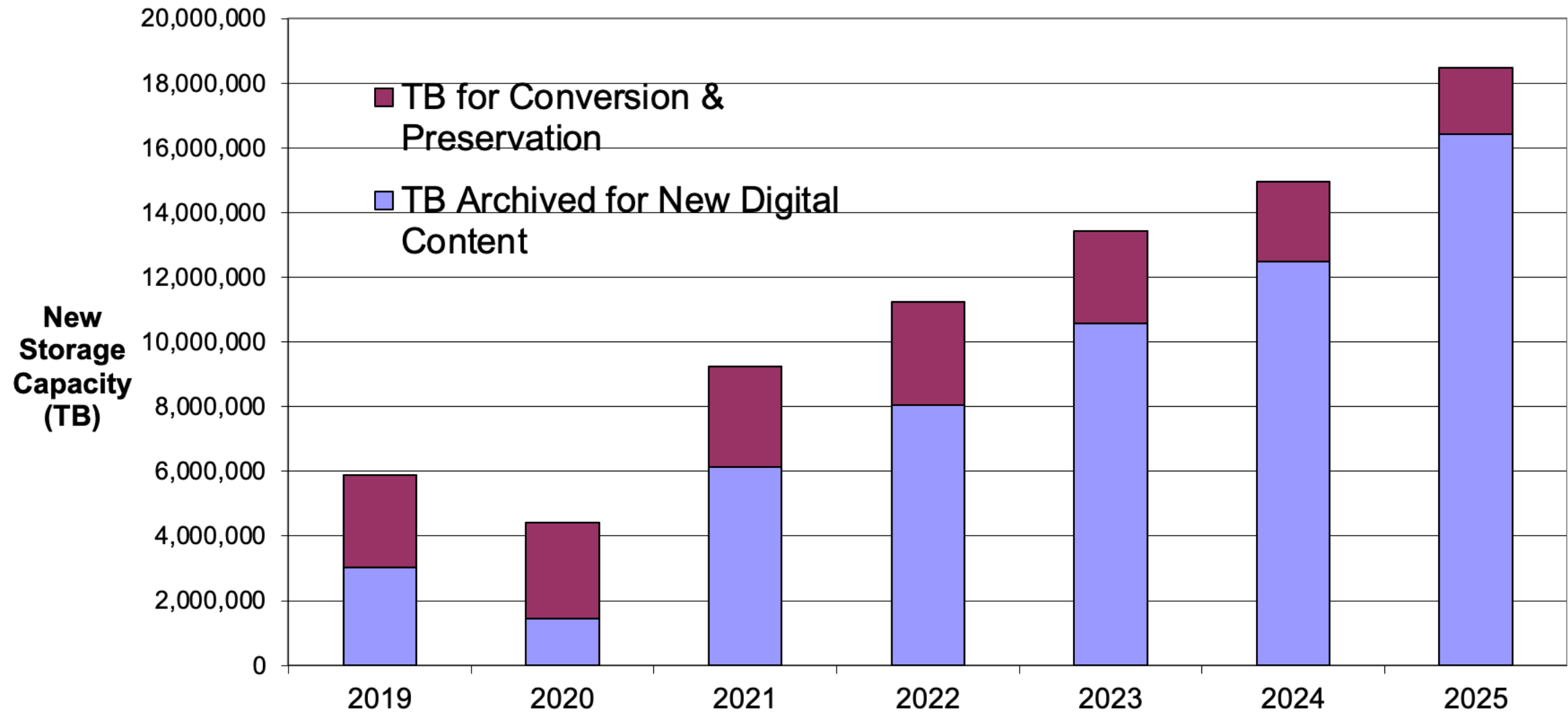
Archive storage for media and entertainment



From the 2020 Digital Storage in Media and Entertainment Report, Coughlin Associates

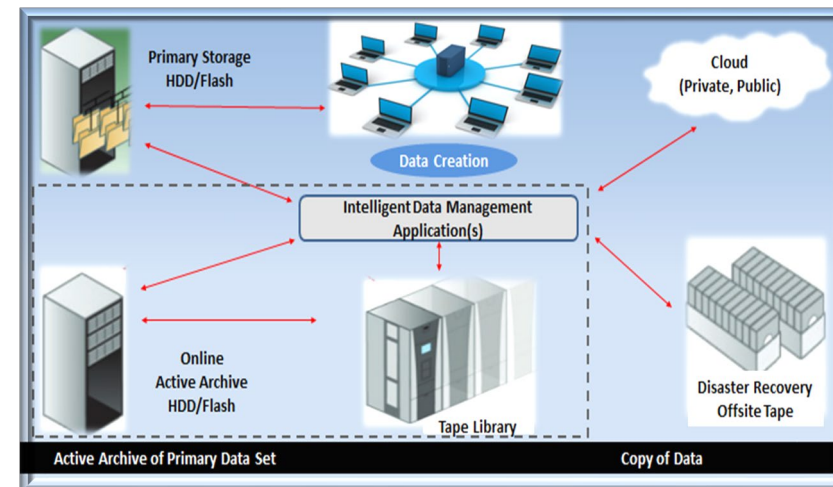
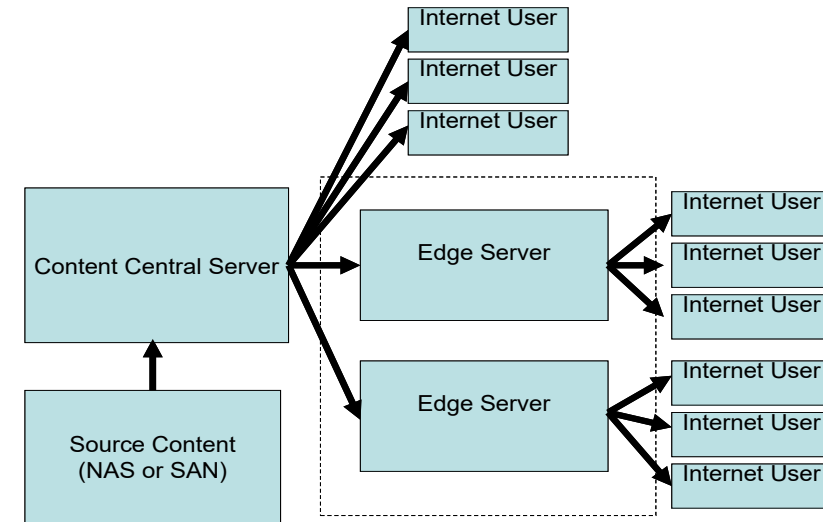
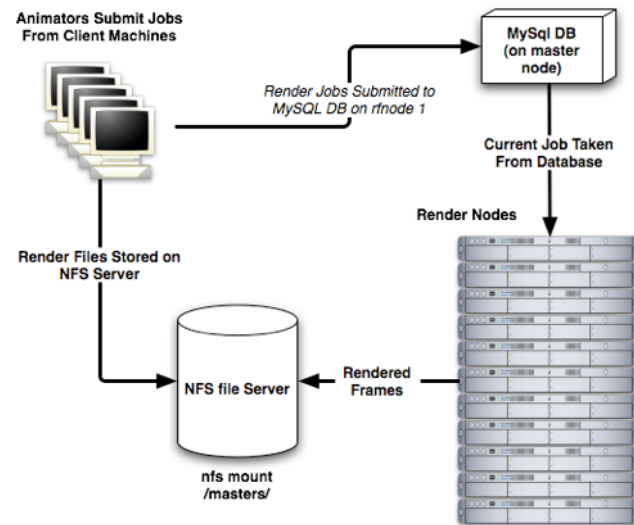
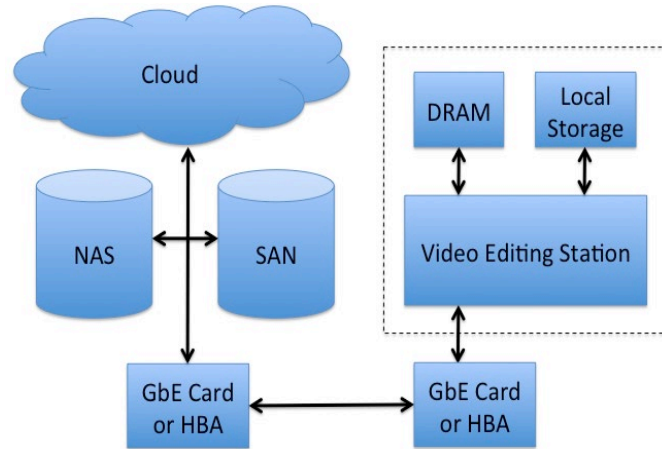
Growth of archive storage capacity

From the 2020 Digital Storage in Media and Entertainment Report, Coughlin Associates



Remote work and growth of cloud-based workflows

M&E uses for cloud storage and services



Impact of COVID on cloud use in M&E

- With the onset of the Covid-19 pandemic, many media houses had to make a sudden transition from working in a studio to working from home
- The trend towards more remote work, including collaborative workflows, that had already been underway in the industry was accelerated with the pandemic
- Although production work during the early months of the pandemic all but ceased, it is starting to return (starting in July 2020), enabled by sanitation, social distancing, the use of automation to reduce human proximity and new technologies that enabled creating realistic environments for shooting scenes that don't require travel.
- Also special effects using computers became more important and animation was less impacted than other production work

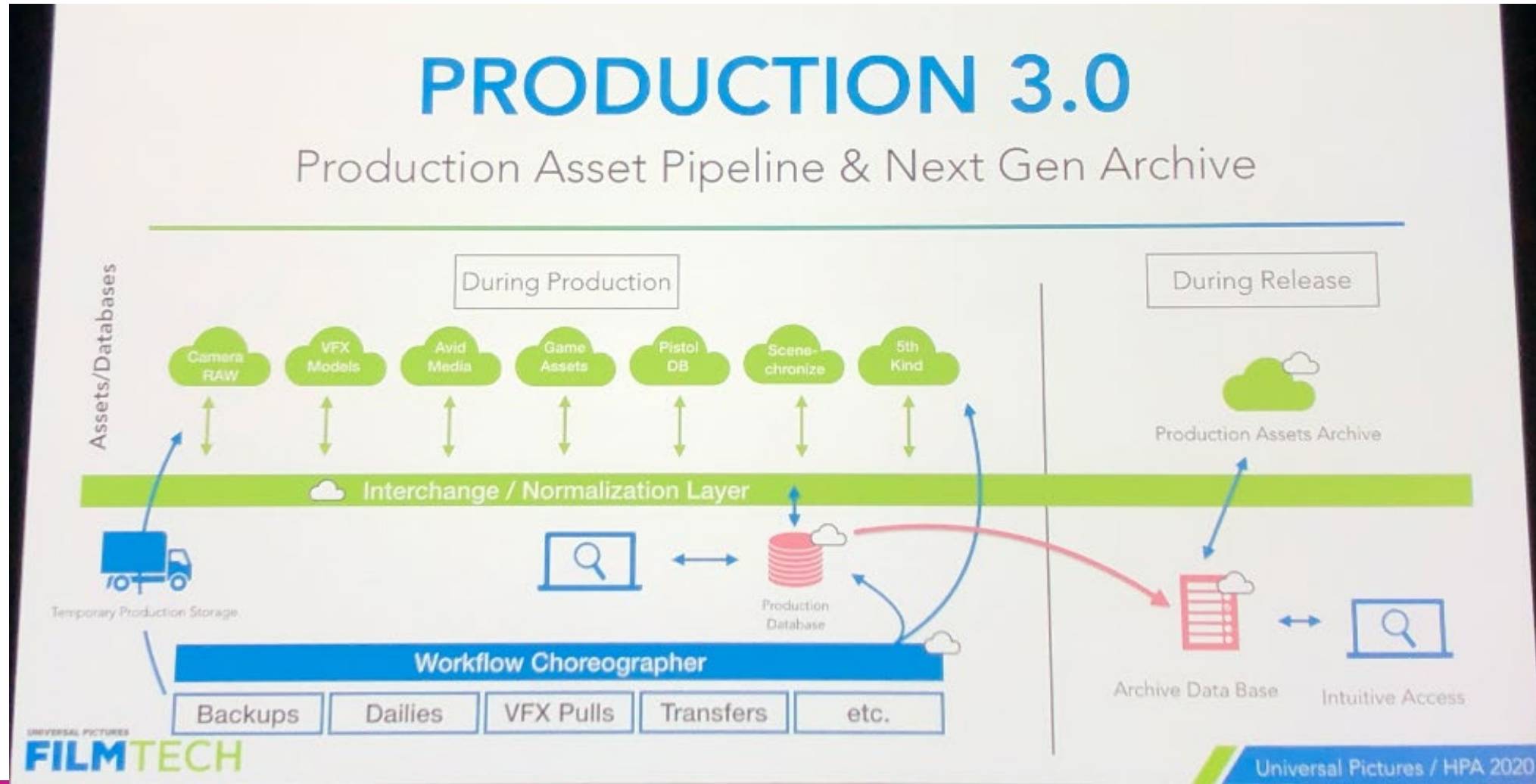
Impact of COVID on Cloud Use in M&E (2)

- Working at home increased the use of the public (as well as private) cloud resources for production and post production work
- People uploaded and downloaded content from cloud storage repositories to continue working
- Several media companies say that their use of internet/cloud resources will not decline and that working from home (WFH) will be more common, even when it is safe for people to come on site again
- Resources used for M&E work from home include virtual desktop interfaces (VDI) to connect to private clouds as well as various public cloud services and the use of tools such as Slack for workgroup coordination

Impact of COVID on Cloud Use in M&E (3)

- Overall, the pandemic will have a significant impact on M&E production in 2020 and likely continuing into 2021.
- During times of social isolation such as these, technology has been the means of continuing work
- Remote interactions using tools such as webex, zoom, bluejeans, Microsoft teams, Google Hangouts, Slack and many others are being put to the test for everything from education to conferences and events and work being done using these tools
- The capabilities of these tools as well as the networks that support on-line activities are improving as a result of this intense workout

2020 HPA Tech Retreat



Movielabs, securing the 2030 vision

10 PRINCIPLES IN 3 CATEGORIES

CLOUD FUNDAMENTALS

1. All assets go straight to the cloud
2. Applications come to the assets
3. Propagation of assets becomes a publish function
4. Archives are deep libraries controlled by policy
5. Preservation includes the means to use archived assets

SECURITY & ACCESS

6. Every individual on a project can be identified and given unique permissions
7. All media creation happens in a highly secure environment that adapts rapidly to changing threats
8. A new system to find and link media assets

SOFTWARE-DEFINED WORKFLOWS

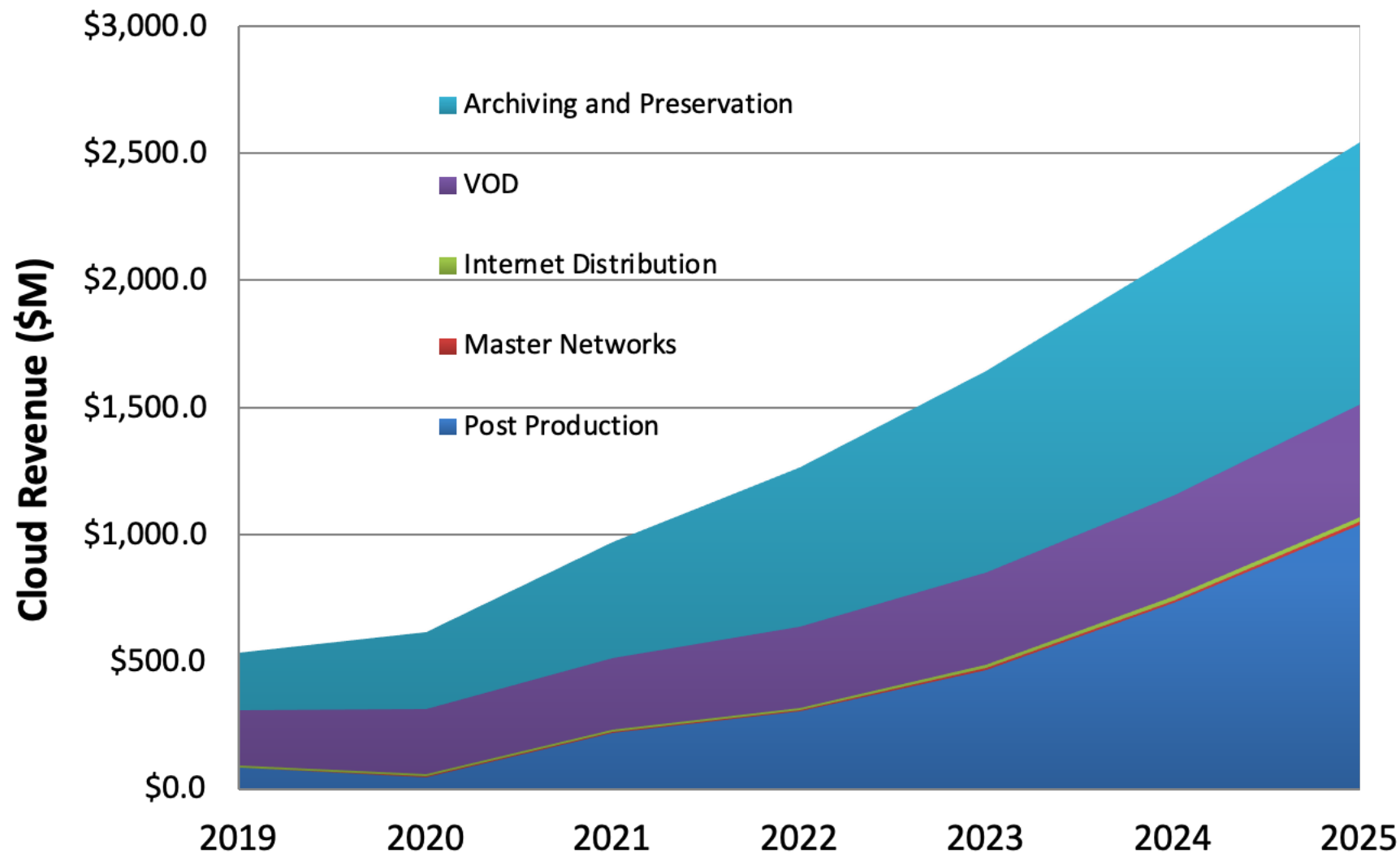
9. Workflows are non-destructive assembled using common mechanisms
10. Workflows are designed around real-time iteration

Multiclouds in Media and Entertainment

- Various public cloud companies offer different data processing options and prices for their storage and other services
- One cloud company may have a better rendering service, metadata extraction or a lower storage cost
- A multicloud strategy, that may include a private cloud storage, is popular in many industries, including M&E as a way to provide a balance in various data creation, storage and analysis packages in terms of performance and cost
- Taking a multicloud approach requires data management that spans data in the clouds and locally
- There are many companies offering ways to manage multicloud storage and other services

M&E cloud storage revenue projections

From the 2020 Digital Storage in Media and Entertainment Report, Coughlin Associates

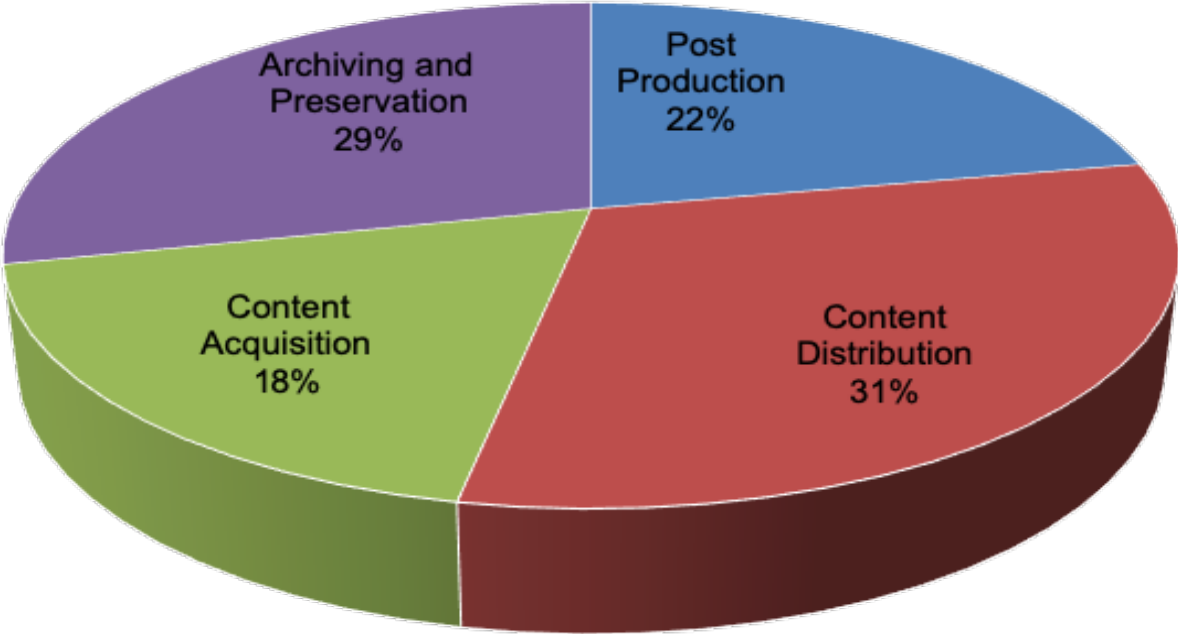


Conclusions and Summary

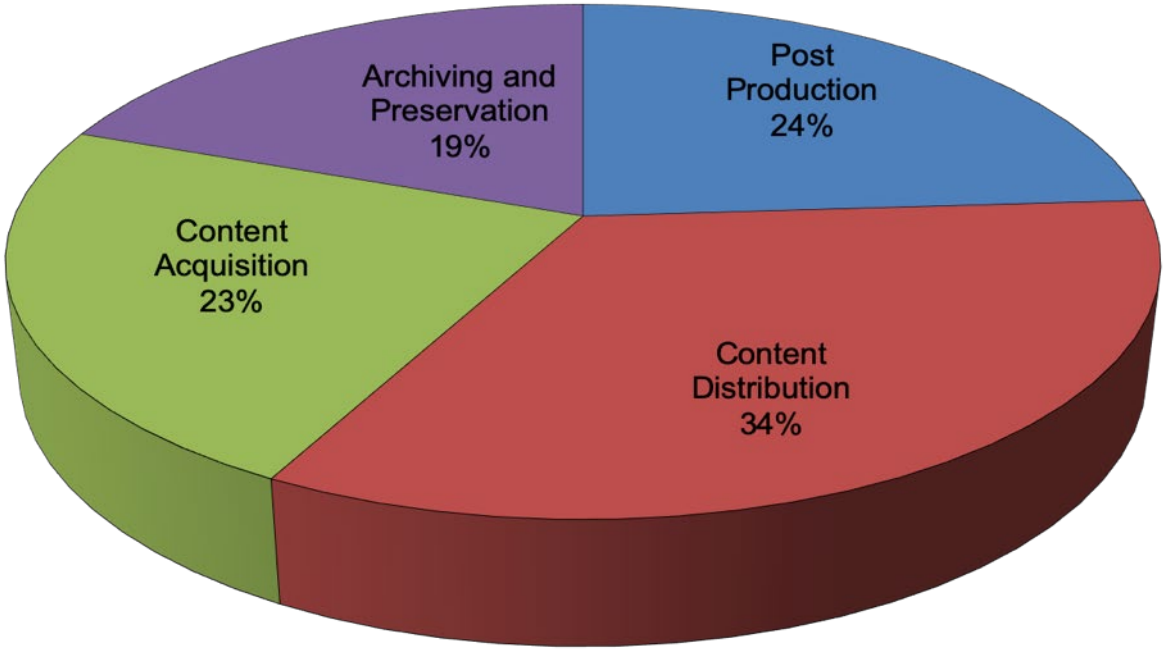


Media and Entertainment Market Storage Revenue Share by Use

From the 2020 Digital Storage in Media and Entertainment Report, Coughlin Associates



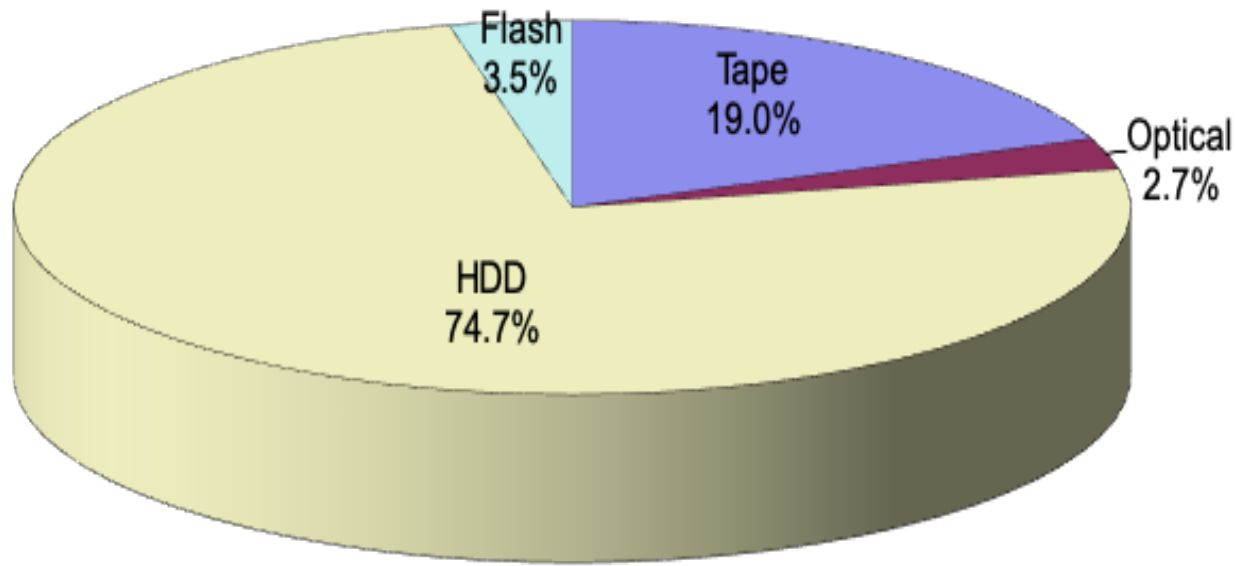
2019



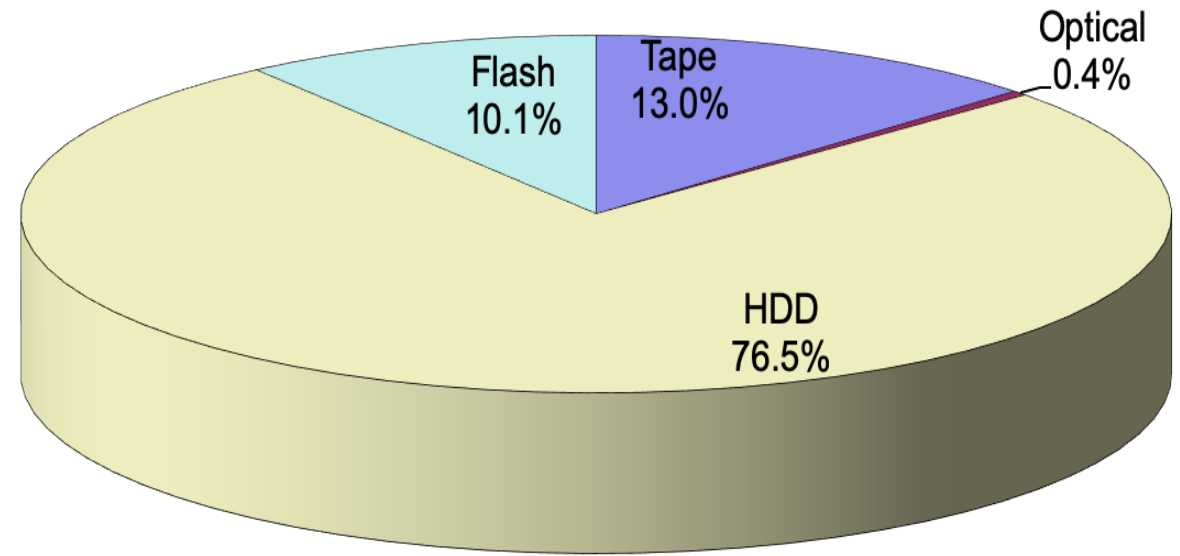
2025

Market Share of Storage Media by Storage Capacity Shipped

From the 2020 Digital Storage in Media and Entertainment Report, Coughlin Associates



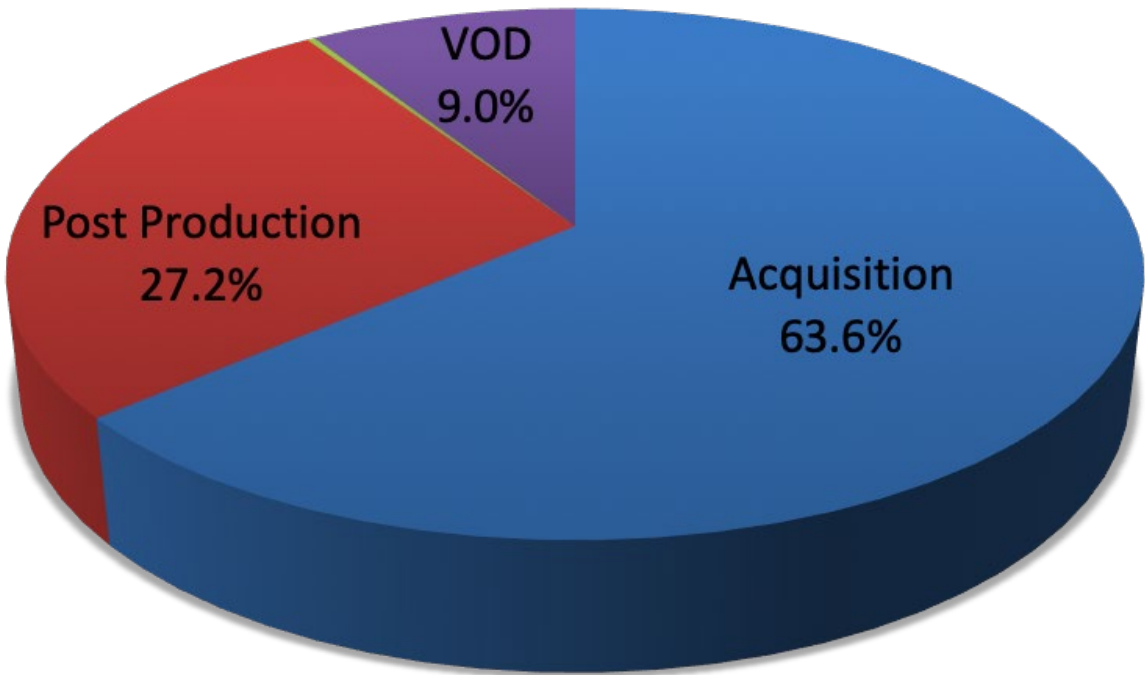
2019



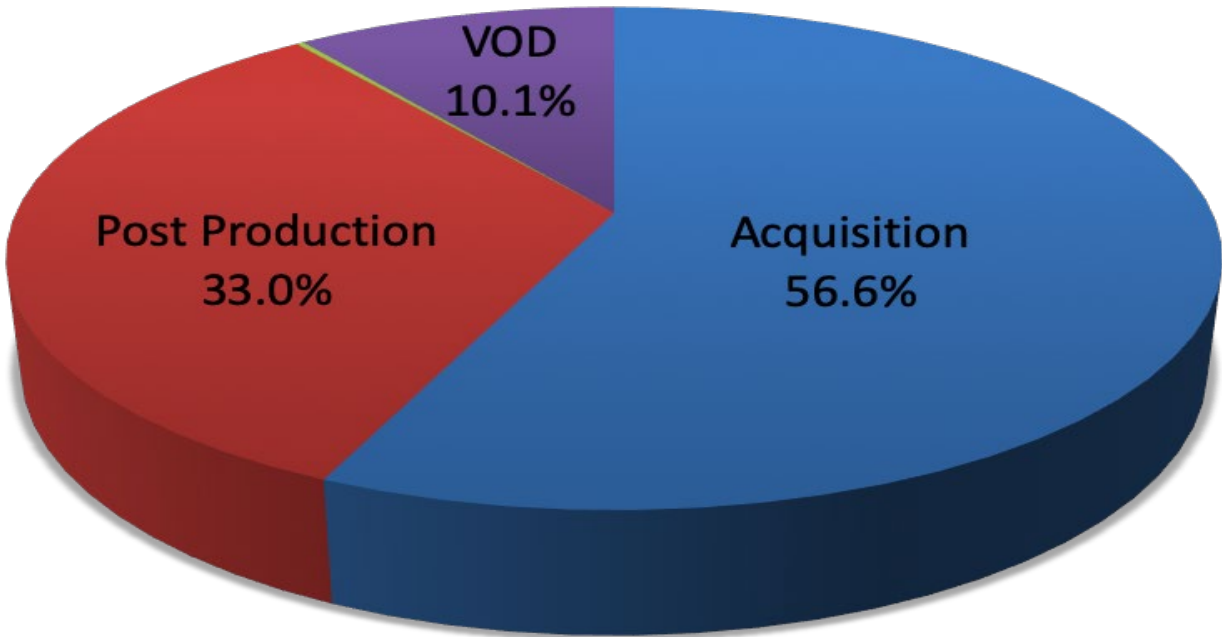
2025

M&E Flash Memory Revenue by Application

From the 2020 Digital Storage in Media and Entertainment Report, Coughlin Associates



2019



2025

Summary

- Covid-19 had a big impact on the M&E industry, shutting down and slowing production work and moving most post production to remote work
- This caused increased use of cloud resources, including storage, which will likely continue to grow
- High performance, low latency requirements in M&E is driving the use of solid state storage for many media and entertainment operations.
- Increasing storage capacity for long term storage will drive HDD and magnetic tape demand
- A continuing drive for more immersive content will require ever larger amounts of data for M&E projects

References



2020 Digital Storage for Media and Entertainment Report

-- *Digital Storage for the Capture, Creation, Editing, Archiving and Distribution of Entertainment Content* --

Thomas Coughlin

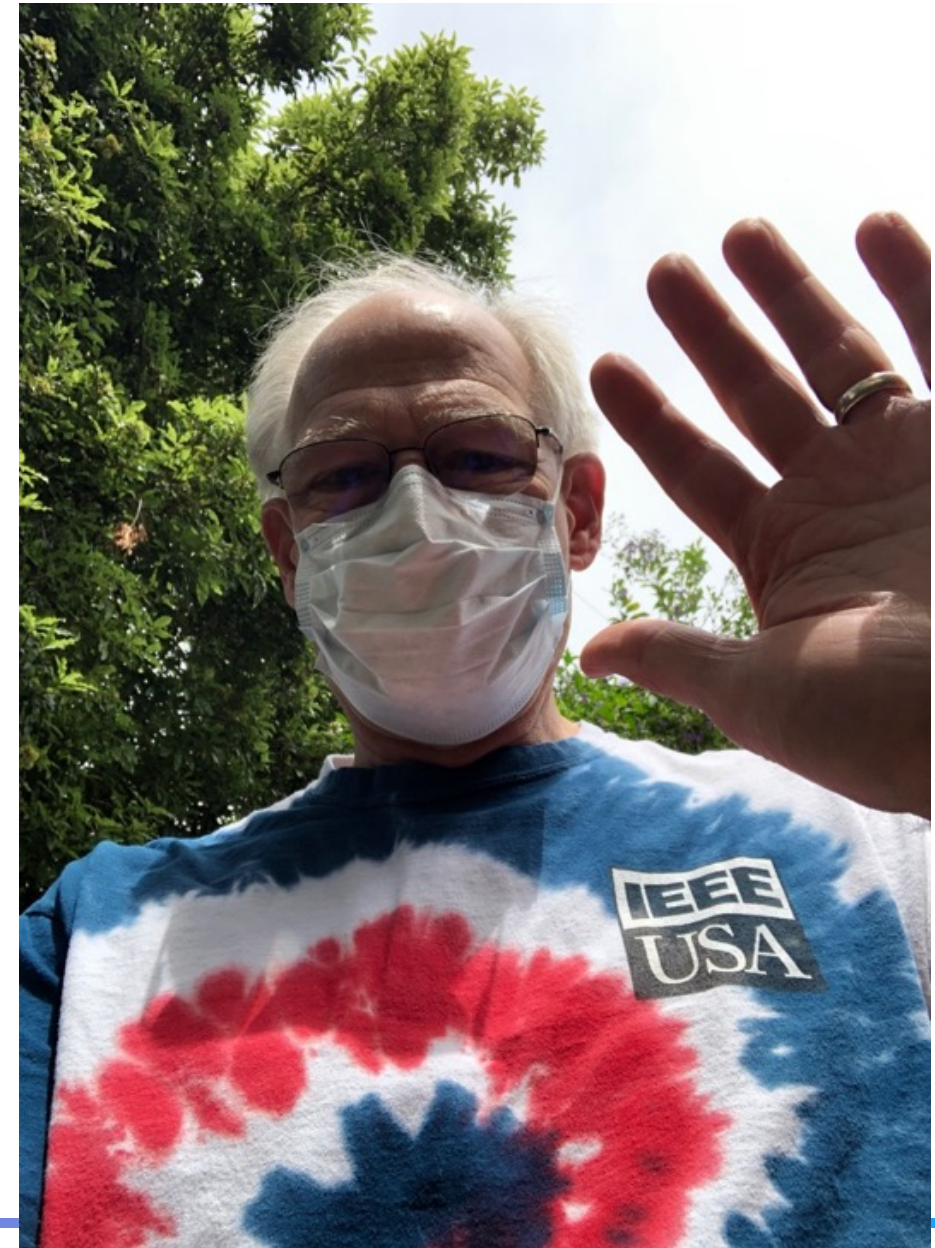
Coughlin Associates



- 2020 Digital Storage in M&E Survey, Coughlin Associates
- 2020 Digital Storage in Media and Entertainment Report, Coughlin Associates,
<https://tomcoughlin.com/product/2020-digital-storage-for-media-and-entertainment-report/>

- If you are an IEEE member, please sign my petition to let me run for IEEE President-Elect in 2021!

- www.ieee.org/petition



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- ✦ You can also find this webcast and many other videos and presentations on today's topics in the [SNIA Educational Library](#)
- ✦ A Q&A from this webcast will be posted to the SNIA [Compute, Memory, and Storage Blog](#)



Check out our blog: sniaacmsiblog.org



We invite your questions via the online Q&A

Where To Find Out More About Compute, Memory, & Storage

- Website resources

- www.snia.org/CMSI

- Twitter

- [@SNIAComputeMemoryStorage](https://twitter.com/SNIAComputeMemoryStorage)

- Blog

- [SNIA CMSI Blog](http://www.snia.org/CMSIBlog)

- Videos

<https://www.youtube.com/user/SNIAVideo/playlists>

- Educational materials

- <https://www.snia.org/educational-library>

- Joining SNIA and the Compute, Memory, and Storage Initiative

- https://www.snia.org/member_com/join-SNIA

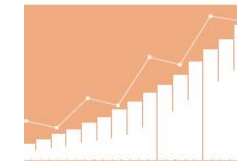


The industry leading companies of the SNIA Compute, Memory, and Storage Initiative (CMSI) support the industry drive to combine processing with memory and storage, and to create new compute architectures and software to analyze and exploit the explosion of data creation over the next decade.



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- ✓ PM and SSD Performance
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- ✓ Solid State Systems
- ✓ SSD Form Factors



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- ✓ Persistent Memory Programming Model
- ✓ PM Hardware Threat Model
- ✓ Solid State Storage Performance Test Specifications
- ✓ SSD Form Factor Specifications



CMSI Propels Technology Adoption

- ✓ Persistent Memory Programming Bootcamps
- ✓ PM Remote Access for High Availability White Paper
- ✓ SSD Form Factors Explained
- ✓ Compute, Memory, and Storage Demos at live and online technology events
- ✓ Interactive Webcasts with Industry Experts
- ✓ Technology Videos on the SNIA Video YouTube Channel

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A photograph of a beach at low tide. In the foreground, a long, dark shadow of a person stands on the golden sand, stretching from the bottom left towards the center. The shadow is cast by a person standing with their back to the camera, looking out at the ocean. The sand has some faint, wavy patterns. In the middle ground, the ocean's edge is visible with gentle waves washing onto the shore. The water is a light blue-grey color. In the background, dark rocks are visible where the waves are breaking further out. The overall lighting suggests it's either early morning or late afternoon, given the long shadow.

Thanks

<https://tomcoughlin.com>