

## Trends in Worldwide Media and Entertainment Storage

A SNIA BrightTalk Webcast https://www.snia.org/news-events/webcasts

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### **Today's Presenters**

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### **Our Agenda Today**



- M&E Storage Drivers
- Content Capture
- Post-production
- Content Delivery
- Why IP Based Video
- Content Preservation and Archiving
- Breakdown of Storage Capacity and Revenue for Media and Entertainment Applications
- Media and Entertainment Storage Trends

## **Examples of Professional Media**



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

8K Ultra-HD may use more than 170X capacity of HD!

## **Exabyte Video Projects Coming?**

Video at 16,000 X 8,000 pixel resolution, 24 bits/pixel, 300 fps raw content could require 115 GB/s data rates and 414 TB/hour. If 4 cameras were used to create data for a 360 degree presentation, the raw data would be **1.66 PB for an hour of content** Within 10 years we could have pro-video projects with close to an exabyte of data

## Digital Entertainment Content Workflow SNIA. | SOLID STATE



### **Content Acquisition**







### 2018 Results

| Year | Magnetic<br>Tape | HDD | Optical | Flash<br>Memory | Film  |
|------|------------------|-----|---------|-----------------|-------|
| 2009 | 34%              | 23% | 9%      | 19%             | 15%   |
| 2010 | 25%              | 22% | 17%     | 28%             | 8%    |
| 2012 | 20%              | 22% | 12%     | 44%             | 2%    |
| 2013 | 15%              | 18% | 7%      | 59%             | 1%    |
| 2014 | 7%               | 24% | 10%     | 57%             | 2%    |
| 2015 | 4%               | 21% | 8%      | 66%             | 1%    |
| 2016 | 2%               | 34% | 8%      | 54%             | 2%    |
| 2017 | 5%               | 33% | 3%      | 59%             | 0.16% |
| 2018 | 2%               | 35% | 2%      | 56%             | 5%    |

### **Content Acquisition (2)**



In 2018, 51% of Respondents said they capture 6 or more hours of content for 1 hour of finished work and 77% said more 90% of their content was born digital

| Percent Born Digital | 2010  | 2012  | 2013  | 2014  | 2015  | 2016  | 2017  | 2018  |
|----------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| <10%                 | 3.9%  | 0.9%  | 1.1%  | 0.0%  | 0.0%  | 0.0%  | 1.2%  | 2.1%  |
| 11% to 20%           | 1.3%  | 0.4%  | 0.0%  | 1.1%  | 1.6%  | 3.4%  | 0.0%  | 2.1%  |
| 21% to 30%           | 3.2%  | 0.0%  | 0.0%  | 1.1%  | 1.6%  | 3.4%  | 1.2%  | 0.0%  |
| 31% to 40%           | 3.2%  | 2.6%  | 1.1%  | 2.1%  | 1.6%  | 0.0%  | 0.0%  | 2.1%  |
| 41% to 50%           | 5.2%  | 2.2%  | 3.3%  | 2.1%  | 0.8%  | 1.1%  | 3.6%  | 2.1%  |
| 51% to 60%           | 52%   | 1.7%  | 2.2%  | 1.1%  | 1.6%  | 3.4%  | 1.2%  | 0.0%  |
| 61% to 70%           | 5.8%  | 3.1%  | 6.5%  | 4.2%  | 1.6%  | 1.1%  | 0.0%  | 6.3%  |
| 71% to 80%           | 8.4%  | 8.3%  | 10.9% | 7.4%  | 5.7%  | 4.5%  | 7.1%  | 2.1%  |
| 81% to 90%           | 16.1% | 10.9% | 15.2% | 15.8% | 7.3%  | 14.8% | 13.1% | 6.3%  |
| 91% to 100%          | 47.7% | 69.9% | 59.8% | 65.3% | 78.0% | 68.2% | 72.6% | 77.1% |



Hours of Content Shot for 1 Hour of Completed Video (2018)

### Digital Content Acquisition Capacity Growth





- Projecting approaching 70 Exabytes of storage capacity used for content acquisition and creation by 2023.
- About 4.5X growth from 2017 to 2023

### Professional Non-linear Editing Model SNIA. SOLID STATE SSSI STORAGE

- Besides direct attached storage and traditional NAS and SAN, there is an increasing use of cloud storage to facilitate collaborative workflows.
- Flash memory, using NVMe interfaces is becoming more popular in editing as resolution, frame rate, number of concurrent streams and bits per frame increase



# Annual Post Production Storage Demand (TB)



In 2018 48% of said they used cloudbased storage for editing and post production

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In 2018 56% said that they had 1 TB or more storage capacity in the cloud

### Conventional Internet Content Distribution System (CDN)





### **Content Distribution**

#### CDN Survey Results

- Note that in 2018 39% of survey respondents said that they used flash memory in their central delivery servers.
- High-speed enterprise solidstate drives (SSDs) and other solid-state storage technology for edge content delivery was 48% in 2018
- In 2018 internet distribution was the most popular way to view proxies

|   | 2009 | 2010 | 2012  | 2013  | 2014  | 2015  | 2016  | 2017  | 2018  |
|---|------|------|-------|-------|-------|-------|-------|-------|-------|
| Hrs on<br>CDN                                 | 200  | 700  | 1,894 | 2,275 | 1,142 | 4,182 | 2,174 | 3,214 | 1,241 |
| Avg<br>Ingested/<br>Mo                        | 150  | 200  | 500   | 837   | 668   | 492   | 427   | 296   | 372   |
| >5% on<br>Edge<br>Servers                     |      |      | 24%   | 42%   | 43%   | 43%   | 38%   | 35%   | 43%   |
| Used<br>Flash<br>Memory<br>on Edge<br>Servers | 20%  | 16%  | 14%   | 12%   | 21%   | 20%   | 31%   | 18%   | 48%   |

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2018 Proxy Distribution Survey Results



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## Why IP-based Video?

### **Raw Video Quality Increase**



Need for Higher Performance Networking and Storage Solutions



### **Ethernet Enables Higher Efficiency**



#### Why have 2 or even 3 networks? When you can deploy a single network for video storage



#### Ethernet





- Ethernet is significant lower \$ cost than both FC and Serial Digital Interface (SDI)
- Mellanox can deliver an E2E solution -Single support point
- Can be less than \$260/port @ 25Gb/s for the NIC, switch and the cabling



#### **Higher Performance**



- Use an Ethernet storage platform it'll grow with you (100GbE is 3x FC)
- Reduce your failures with reduced adapters
- Ethernet is much easier to manage and our tools are FREE!
- Put all your workloads on the same wire and segregate them

#### Why IP-based Video Delivering Converged Fabrics for Video Studio

- Current Generation Connectivity
  - Serial Digital Interface (SDI)
    - Expensive and proprietary
    - > Coax cables with BNC connectors
  - Installation
    - > Multiple cables to support multiple streams
    - > Inflexible, heavy and easy to break
- Next-Gen Video Processing Connectivity: <u>SMPTE ST2110</u>\*
  - Ethernet Cables
    - > Cheaper multiple vendors, open standard
    - > Leveraging IP technology from data centers
  - Installation
    - > Single optical cable supporting multiple HD streams
    - Light, flexible and resilient
  - Upgrades
    - Upgrade transceivers re-use existing cables!

\*The Society of Motion Picture and Television Engineers (SMPTE®) Professional Media Over Managed IP Networks standards suite



SDI-based

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IP-based

### **Exponential Bandwidth & Storage Growth**



High Dynamic Range (HDR)

#### 10GbE is too slow for uncompressed 4K/8K video streams

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| Format      | Resolution  | Color<br>Depth | FPS | Bandwidth<br>per Stream | 10GbE<br>#Streams | 25GbE<br>#Streams | 40GbE<br>#Streams | 50GbE<br>#Streams | 100GbE<br>#Streams |
|-------------|-------------|----------------|-----|-------------------------|-------------------|-------------------|-------------------|-------------------|--------------------|
| 4K DPX      | 4096 x 2160 | 10-bit         | 24  | 6.4 Gb/s                | 1                 | 3                 | 6                 | 7                 | 14                 |
| 4K-Full DPX | 4096 x 3112 | 10-bit         | 24  | 9.2 Gb/s                | 1                 | 2                 | 4                 | 5                 | 10                 |
| 4K-Full EXR | 4096 x 3112 | 16-bit         | 24  | 14.7 Gb/s               |                   | 1                 | 2                 | 3                 | 6                  |
| 8K DPX      | 7680 x 4320 | 10-bit         | 24  | 23.4 Gb/s               |                   | 1                 | 1                 | 2                 | 4                  |
| 8K EXR      | 7680 x 4320 | 16-bit         | 24  | 28.2 Gb/s               |                   |                   | 1                 | 1                 | 3                  |
| 4K-Full EXR | 4096 x 3112 | 16-bit         | 60  | 36.7 Gb/s               |                   |                   | 1                 | 1                 | 2                  |



Image Resolution





Higher Frames Rate (HFR)



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Wide Color Gamut (WCG)

#### **Bandwidth Impact (Uncompressed)**

4K(2160p) vs 1080i HD=400%

HFR(50-60fps->100-120fps)=200%

"HDR+"(HDR+WCG+10-bit)=25%

### Flash Storage Requires Lower Latency SNIA. SOLID STATE Ethernet





Network hops multiply latency



#### Networking Offloads Boosts Video over IP Efficiency





### Deploy Video over IP with Ethernet Video Fabric NOW SNIA. | SOLID STATE SSSI | STORAGE

Ultra HD video resolution drives high-bandwidth requirements





Single multi-purposed network

### Content Archiving Storage Media





### Percentage of Digital Long-Term Archives on Various Media



- For the last two years the survey has shown HDDs percentage higher than magnetic tape
- LTO is the biggest percentage of tape storage, at 74%
- Growth in archiving content in the cloud among survey participants
- In 2018 32% had more than 2,000 hours in a long term archive.



Digital Storage Projections for Archiving and SNIA. | SOLID STATE Digital Content Conversion & Preservation SSSI | STORAGE



- Average annual analog conversion rate was 4% (Survey)
- Over the next few years content that will be digitized will start to diminish
- Increasing size of new content will drive archive growth

# The Cloud in Media and Entertainment SNIA. SOLID STATE

- 77% said that they did proxy distribution through the Internet
- 6% said that they archived on a private or public cloud in 2018
- 66% said they would use a private or public cloud for archiving in 2018









### Where Will This Flash Be Used?



#### **2023 Projections**



- Flash memory used in professional video camera media by 56% of survey participants in 2018
- Use of flash in post production is expected to grow
- For CDN content delivery about 39% used flash memory on their edge servers in 2018

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#### **Media and Entertainment Storage Trends**

- Increasing resolution, higher dynamic range, higher frame rate and multiple camera projects will drive M&E storage demand
- Flash memory use will grow as price declines and bandwidth demands increase
- Cloud storage (public and private) will play an increasingly important role in all aspects of professional media and entertainment.
- HDDs, optical discs and tape will serve a bulk storage role.









- 2018 Survey of Storage in Professional Media and Entertainment, Coughlin Associates
- 2018 Digital Storage in Media and Entertainment Report, Coughlin Associates
  - http://www.tomcoughlin.com/techpapers.htm
- NAB 2019 Conference
  - https://www.nabshow.com/



### **Thanks for Attending**

### Q&A at http://sniasssiblog.org

### Visit <u>www.snia.org/sssi</u> for information on Solid State Storage