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Acknowledgements

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Executive Summary

This report is the fifteenth report on data storage and emerging applications and the thirteenth report on data storage in the entertainment and media market published by Coughlin Associates.

Data storage is a key element in the digital transformation of content creation, editing, distribution and reception. Data capacity and communication speed increases, changing form factors, lowered product prices and the growing familiarity with digital editing, digital intermediates and various forms of digital distribution are key components in the continued growth and development of entertainment.

Because of the large file sizes required for high resolution and multi-camera
images there is increasing demand for high capacity storage devices. The entire content value chain of content creation, editing, archiving, distribution as well as consumer electronics content reception devices, provide an accelerating feedback mechanism. This drives growth in data storage for all entertainment content applications.

For many archiving and distribution applications where content is relatively static low cost/high capacity SATA HDD storage, optical discs and tape-based storage libraries will predominate. Hard disk drives as well as enterprise SSDs are also used in high performance storage applications where storage cost factors must be combined with performance requirements.

For applications requiring rugged field use or fast playback response flash memory either as cards or solid-state drives (SSDs) are becoming more popular.

Due to input form from industry groups, SMPTE, HPA, EBU (and other media and entertainment workers) survey results and discussions with industry end users and equipment providers we have adjusted many of our models for current storage estimates as well as future growth in 2017. We have made modifications to the 2015 assumptions to better model current market conditions, in particular for content acquisition, post production, video on demand and media. This has resulted in significant increases in capacity assumptions, including for content archiving than earlier editions of this report. In addition, we have updated our storage cost estimates.

We list some key points of the report in the following list.

**Key Points**

- Creation, Distribution & Conversion of video content creates a huge demand driver for storage device and systems manufacturers
- As image resolution increases and as stereoscopic VR video becomes more common, storage requirements explode
- The development of 4K TV and other high-resolution venues in the home and in mobile devices will drive the demand for digital content (especially enabled by high HEVC (H.265) compression.
- HDD areal density increases are slower but flash memory growth has increased. This might cause more applications to use flash memory
- Activity to create capture and display devices for 8K X 4K content is occurring with planned implementation in common media systems by the next decade
- Active archiving will drive increased use of HDD storage for “archiving” applications, supplementing tape for long term archives
- Optical storage developments for higher capacity write-once Blu-ray optical cartridges will create higher capacity discs and this may help slow the reduction in optical disc archiving
• Flash memory dominates cameras and will find wider use in post production and content distribution systems
• From 2016 to 2022 entertainment and media digital storage TAM (without archiving and preservation) will increase by about 2.2X to from $3.3 B to $7.2 B
• The growth in storage capacities will result in a total media and entertainment storage revenue growth of about 2.0 X between 2016 and 2022 (from $5.6 B to $11.1 B)
• Overall annual storage capacity demand for non-archival applications is expected to increase over the period from 2016 to 2022 by 10X from 7.6 EB to 51.1 EB (about 6.7 X)
• Between 2016 and 2022 media and entertainment storage revenue is expected to grow about 2.0 X between 2016 and 2022 (from $5.6 B to $11.1 B)
• In 2016 archiving and preservation is estimated to have been 41% of total storage revenue followed by content distribution (29%), post-production (22%) and content acquisition (8%)
• In 2022 the projected revenue distribution is 33% content distribution, 35% archiving and preservation, 28% post production and 4% content acquisition
• Between 2016 and 2022 we expect about a 3.5 X increase in the required digital storage capacity used in the entertainment industry and about a 3.7 X increase in storage capacity shipped per year (from 42,568 PB to 156,739 PB)
• The greatest storage capacity demand in 2016 is for digital conversion and preservation as well as archiving of new content (about 82%). Content acquisition follows at 6.3% with post production at 7.2% and content distribution at 4.3%
• By 2022 we expect about 71% of archived content to be in near-line and object storage, up from 56% in 2016
• in 2016 we estimate that 68.2% of the total storage media capacity shipped for all the digital entertainment content segments was in HDDs with digital tape at 23.6%, 5.1% optical discs and flash at 3.1%
• By 2022 tape has been reduced to 14.7%, HDDs shipped capacity is 79.1%, optical disc capacity is down to about 1.3% and flash capacity percentage is at 4.8%
• Media revenue is expected to increase about 1.8 X from 2016 to 2022 ($2.2 B to $3.9 B).
• The single biggest application (by storage capacity) for digital storage in the next several years as well as one of the most challenging is the digital conversion of film, video tape and other analog formats
• Over 106 Exabytes of new digital storage will be used for digital archiving and content conversion and preservation by 2022
• Storage in remote “clouds” is playing an important role in enabling collaborative workflows and in archiving
Overall cloud storage for media and entertainment is expected to grow about 16.5 X between 2016 and 2022 (3,041 PB to 50,128 PB)

Overall object storage for media and entertainment is expected to grow about 4.7 X between 2016 and 2022 (8,237 PB to 38,381 PB)

Cloud storage revenue will be about $2.4 B by 2022

By our estimates, professional media and entertainment storage capacity represents about 5% of total shipped storage capacity in 2016. Professional media and entertainment uses about 13% of all tape capacity shipments, 8% of all hard disk drive shipments and 2% of all flash memory shipments in 2016

Digital cinema conversion is almost complete in many countries with movement to 4K video wide-spread

Silver halide film as a content distribution media will vanish before the end of the decade.

AXF and other new standards may help format obsolescence

Several petabytes of storage can be required for a complete stereoscopic digital movie production at 4K resolution and there is some production work as high as 8K

By the next decade total video captured for a high end digital production could be hundreds of PB, approaching 1 exabyte

Non-linear editing requires high performance storage devices. Over the forecast period lower network storage costs and higher performing low cost storage networks will result in faster growth of network storage than direct attached and local.

ATA HDD arrays are becoming the dominant mode for readily retrievable fixed content storage.

Magnetic tape will remain as an archival media although use in other applications is in decline, particularly content capture

Flash memory is the clear majority storage media in professional video cameras with survey results showing about 59% utilization in 2017

The continued need to storage for higher performance and high capacity workflows are driving strong storage growth in the projection periods—assuming no great negative economic trends.

The data presented in this report is subject to change as the content storage market develops. We have additional information that we have gathered in addition to that included in this published report. We will continue to monitor and develop our models of this market as time goes on. We would be glad to work with customers on specialized presentations or reports and in general to conduct research to answer specific questions on a project or ongoing basis.
This updated and expanded report is the thirteenth 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 and 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.

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