



# 2017 Digital Storage for Media and Entertainment Report

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



Thomas  
Coughlin

Coughlin  
Associates

***Digital  
Entertainment  
Series***

Coughlin Associates  
408-202-5098  
[www.tomcoughlin.com](http://www.tomcoughlin.com)



The Digital Storage for Entertainment and Media Report is published by:

Coughlin Associates  
9460 Carmel Road  
Atascadero, Ca. 93422

Tel (408) 978-8184

[www.tomcoughlin.com](http://www.tomcoughlin.com)

**© 2017 Coughlin Associates**

All rights reserved. No portion of this report may be reproduced in any form or by any means without permission from the publisher. Information in this report is believed to be reliable but cannot be guaranteed to be complete or correct.

## Table of Contents

Acknowledgements .....	11
The Author .....	12
Executive Summary .....	12
Key Points .....	13
Introduction .....	16
Cinema and Video Formats .....	20
Media and Entertainment Professional Storage Survey .....	32
Content Creation and Acquisition .....	33
Feature Film Acquisition .....	33
TV Production .....	52
Film Scanning .....	54
Storage Capacity Projections for Digital Content Acquisition .....	56
Post Production including Editing and Special Effects .....	62
Non-Linear Editing (NLE) .....	62
Special Effects and Other Post Production .....	83
Summary Post-Production Digital Storage Capacity Demand .....	83
Storage Capacity and Storage Revenue Projections for NLE, Special Effects and Other Post Production Activities .....	84
Media and Entertainment Content Distribution .....	96
Lower Bandwidth Richer Media Distribution Technology .....	99
Local Broadcast .....	101
Cable Distribution .....	107
Satellite Headend .....	113
TV Networks .....	113
Digital Cinema .....	125
Hard Disk Drives Used in Digital Cinema .....	130
Professional Media and Entertainment Internet Distribution .....	136
Video on Demand (VOD) .....	147
Summary of Non-Archive Entertainment and Media Storage .....	156
Archiving and Digital Preservation .....	169
Hard Disk Drives .....	169
Magnetic Tape .....	171
Optical Discs .....	176
Cloud and Object Archive Storage .....	180
Survey Archive Results .....	185
Digital Conversion of Older Analog Content .....	190
Costs of Digital Conversion .....	191
Costs of Long Term Storage .....	193
Archiving of Digital Created Content .....	194
Total Archive and Preservation Storage Projections .....	194
Archiving Storage: Off-line, Near-Line, in the Cloud .....	194
Uses of Archived Content—Making an Archive ROI .....	203
Migration of Content to Avoid Format Obsolescence .....	203
Capacity Requirements by Market Segment .....	205

## 2017 Digital Storage for Media and Entertainment Report

Storage Revenue Estimates by Market Segment .....	214
Storage Media Projections .....	224
Touch Rate Versus Response Time .....	224
Response time definition.....	224
Touch rate definition.....	224
Touch rate vs. response time.....	225
Technology regions.....	227
IO Object size curve.....	228
Media Projections for Media and Entertainment .....	229
Conclusions .....	241
Some Media and Entertainment Market Companies .....	245
NEWSLETTER SUBSCRIPTIONS.....	248

## Table of Figures

Figure 1. Digital Entertainment Content Value Chain (An Accelerating Positive Feedback Loop).....	16
Figure 2. Digital Entertainment Content Workflow.....	17
Figure 3. Hybrid Motion Picture Production and Post-Production using Digital Intermediates .....	18
Figure 4. Size Comparison of Raw Camera and Digital Intermediary Files .....	25
Figure 5. Video Resolution Comparisons.....	29
Figure 6. Content is made up of Essence plus Metadata.....	30
Figure 7. Uses and Flow of Metadata in the Entertainment Content Process ....	30
Figure 8. Sphericam VR Video Camera Setup .....	36
Figure 9. Jaunt One Video Camera Rig .....	37
Figure 10. Spherical Image Display .....	38
Figure 11. ARRI ALEXI Stereoscopic Video Camera Setup.....	39
Figure 12. Canon C300 DSLR Used for Professional Video .....	39
Figure 13. For-A Super Slo-Mo Camera .....	40
Figure 14. BBC Image of an HNK Super Hi-Vision Camera .....	41
Figure 15. Sharp 8K X 4K LCD Display at 2012 CES.....	41
Figure 16. NHK 8K SHV Field Camera .....	42
Figure 17. Percentage of Various Recording Media in Professional Video Cameras .....	43
Figure 18. FOR-A Video Archive Recorder .....	44
Figure 19. Content Shot for an Hour of Completed Work .....	45
Figure 20. Panasonic Micro P2 Flash Module and Adapter.....	46
Figure 21. Panasonic P2 and Sony SxS Flash Memory Camcorder Modules....	47
Figure 22. Sony External SSD Video Recording SSD .....	47
Figure 23. SanDisk CFast Compact Flash Card.....	48
Figure 24. Lexar microSD U3 Card for Media Content Capture.....	48
Figure 25. Atmos Master Caddy .....	49
Figure 26. Maxell iVDR Storage Module on a Sony Professional Camera .....	50
Figure 27. LaCie 2big Dock Thunderbolt 3 Drive.....	51
Figure 28. NHK Super High Vision Equipment Roadmap .....	53
Figure 29. Percentage Scanned into Different Digital Resolutions.....	55
Figure 30. Digital Content Generation Capacity Projections.....	60
Figure 31. Annual Storage System Capacity Growth for Digital Content Acquisition .....	61
Figure 32. Professional Non-Linear Editing Model System.....	62
Figure 33. DAS vs. Shared Storage and Number of People in a Post Facility (2016 survey) .....	68
Figure 34. AWS Snowball Data Transport Solution .....	72
Figure 35. Example Render Farm Layout.....	73
Figure 36. Pixar Render Farm .....	74
Figure 37. Physical Distribution Media for Proxies or Completed Post Work .....	83
Figure 38. Post Production Storage Capacity Annual Demand (TB).....	90

Figure 39. Projections for Post Production, CGI/FX New Storage Requirements .....	92
Figure 40. Price of Storage/GB for Facility Niche .....	94
Figure 41. Toshiba On-Air Max Flash .....	98
Figure 42. Bit Rate Reduction Curve Showing Big-Rate Savings between H.264 and HEVC (Horizontal Axis indicates Quality Target Resolution) .....	100
Figure 43. Local Broadcaster Content Distribution Storage Capacity Analysis .....	105
Figure 44. Estimate of Local Broadcaster Distribution Network Storage TAM (\$M) .....	106
Figure 45. Cable Head End Distribution Storage Capacity Analysis .....	111
Figure 46. Estimate of Cable Head End Network Storage TAM (\$M) .....	112
Figure 47. Satellite Head End Distribution Storage Capacity Analysis .....	117
Figure 48. Estimate of Satellite Headend Network Storage TAM (\$M) .....	118
Figure 49. TV Network Delivery Storage Capacity Analysis .....	122
Figure 50. Estimate of TV Networks Local Near-Line and Cloud Storage Capacity (TB) .....	123
Figure 51. Estimate of TV Networks Network Storage TAM (\$M) .....	124
Figure 52. USB Hard Drive for Movie Distribution to Theatre (Mercado Theatre in Santa Clara, CA) .....	125
Figure 53. Schematic of a Play-To-Screen Server with Functional Blocks (Thompson Grass Valley) .....	127
Figure 54. Digital Cinema Projector .....	128
Figure 55. Schematic Digital Projector Showing IMB Containing Content Storage (a) and with content storage external to the IMB (b) .....	129
Figure 56. Integrated Media Block Containing HDDs .....	130
Figure 57. Annual New Storage Capacity for Digital Cinema .....	134
Figure 58. Estimate of Digital Cinema Storage TAM (\$M) .....	135
Figure 59. Internet Content Distribution System (CDN) .....	136
Figure 60. Level 3's Content Delivery Network .....	137
Figure 61. Internet Content Delivery Storage Capacity Analysis .....	145
Figure 62. Estimate of Internet Content Delivery Network Storage TAM (\$M) .....	146
Figure 63. IBM Flash-based Content-Delivery Servers .....	148
Figure 64. Video on Demand Total Storage Capacity Model .....	152
Figure 65. Annual Growth in Video on Demand Storage Capacity .....	153
Figure 66. Estimate of VOD Storage TAM by Category (\$M) .....	154
Figure 67. Estimate of Cloud and Conventional VOD Storage Capacity .....	155
Figure 68. Non-Archive Media and Entertainment Annual Network Storage TAM Estimate .....	157
Figure 69. Non-Archive On-Line Network Annual Storage TAM Estimate .....	158
Figure 70. Non-Archive Near-Line Network Annual Storage TAM Estimate .....	159
Figure 71. Non-Archive Object Storage Annual TAM Estimate .....	160
Figure 72. Non-Archive Direct Attached and Local Storage Annual TAM Estimate .....	161
Figure 73. Total Non-Archive Storage Annual TAM Estimate .....	162
Figure 74. Non-Archive Network Storage Capacity Annual Demand Estimate .....	163

Figure 75. Non-Archive On-Line Network Storage Capacity Annual Demand Estimate .....	164
Figure 76. Non-Archive Near-Line Network Storage Capacity Annual Demand Estimate .....	165
Figure 77. Non-Archive Object Storage Capacity Annual Demand Estimate ...	166
Figure 78. Non-Archive Direct Attached Storage and Local Storage Capacity Annual Demand Estimate .....	167
Figure 79. Non-Archive Total Storage Capacity Annual Demand Estimate .....	168
Figure 80. HDD Cartridge Products (iVDR and RDX).....	169
Figure 81. Spectra Logic SMR HDD Archive Storage System .....	170
Figure 82. ATSC HDD Technology Roadmap.....	170
Figure 83. LTO Projected Tape Generations .....	173
Figure 84. LTO-7 Tape Cartridge .....	173
Figure 85. Uses for LTFS Tape in Media and Entertainment Workflows.....	176
Figure 86. Sony/Panasonic Optical Archive Roadmap.....	177
Figure 87. Sony Blu-Ray Optical Disc Cartridge and Drive.....	177
Figure 88. XenData Tape and Optical Disc Library.....	179
Figure 89. Elements in an AXF Object Wrapper.....	182
Figure 90. Percentage of Digital Long-Term Archives on Various Media.....	187
Figure 91. Percentage of Tape Formats Used in Digital Archiving .....	189
Figure 92. Example Workflow for Analog to Digital Video Conversion. ....	192
Figure 93. Total Annual Digital Storage Demand Projections for Archiving and Digital Content Conversion & Preservation.....	199
Figure 94. Annual Near-Line and Off-Line Digital Storage for Content Archiving .....	200
Figure 95. Annual Archive Object Storage for Content Archiving .....	201
Figure 96. Cloud vs. Local Archive Storage .....	202
Figure 97. Relationship Between Archive Content and Multiple Real-Time and Non-Real-Time Distribution Content .....	204
Figure 98. Media and Entertainment Cloud Storage Capacity Projections .....	212
Figure 99. Media and Entertainment Object Storage Capacity Projections .....	213
Figure 100. Media and Entertainment Cloud Storage Revenue Projections.....	222
Figure 101. Media and Entertainment Object Storage Revenue Projections....	223
Figure 102. Touch rate versus response time indicating various types of uses	226
Figure 103. Digital storage technologies regions overlaid on the Touch Rate/Response Time chart.....	227
Figure 104. Touch/Y and response time for 100% random IO in a 4 TB capacity HDD .....	228
Figure 105. Touch/Y and response time for 4 TB capacity HDD, LTO Tape and Blu-ray Discs .....	229
Figure 106. Media Annual Revenue Estimate Summary (\$M) .....	233
Figure 107. Tape Cartridge Annual Unit Shipment Projections.....	238
Figure 108. Optical Disk Unit Annual Unit Shipment Projections.....	239
Figure 109. HDD & Flash Annual Unit Shipment Projections .....	240
Figure 110. Distribution of Storage Capacity for Entertainment Creation, Archiving, and Distribution Segments (2016) .....	241

Figure 111. Distribution of Storage Capacity for Entertainment Creation, Archiving, and Distribution Segments (2022) .....	242
Figure 112. Media and Entertainment Market Storage Revenue Share by Segment (2016).....	243
Figure 113. Media and Entertainment Market Storage Revenue Share by Segment (2022).....	243
Figure 114. Market Share of Storage Media by Storage Capacity Shipped (2016) .....	244
Figure 115. Market Share of Storage Media by Storage Capacity Shipped (2022) .....	244

## List of Tables

Table 1. Example Resolution, Data Rates and Storage Capacity Requirements for Professional Media Content (assumes no chroma subsampling) .....	23
Table 2. Some 4K and Beyond Camera Codecs .....	24
Table 3. Feature Film Metrics (24 fps, 10-bit color, 4K Bayer Format) .....	25
Table 4. Percentage of Survey Participants in Content Market Segments.....	32
Table 5. Survey Participant Location .....	33
Table 6. Uncompressed Format Assumptions for 1 Hour of Full Resolution Raw Content .....	33
Table 7. Comparison of Professional Video Camera Media Trends .....	42
Table 8. Survey Question: What % of your Content is Born Digital.....	44
Table 9. Comparison of 2010, 2012, 2013, 2014, 2015 and 2016 Hours Shot for an Hour of Completed Content .....	45
Table 10. Comparison of 2010, 2012, 2013, 2014, 2015, 2016 and 2017 Scanned Resolutions.....	55
Table 11. Feature Film Projection Assumptions .....	57
Table 12. TV Broadcast Assumptions .....	58
Table 13. TV Episodic Assumptions .....	58
Table 14. General Assumptions for Movie & TV Content.....	58
Table 15. Feature Film Scanning Digital Storage Requirements.....	59
Table 16. Assumptions for Film Scanning Projections.....	59
Table 17. Assumptions for Storage Systems Capacity Projections.....	59
Table 18. Professional NLE Bandwidth Requirements .....	74
Table 19. Proxy Distribution Media Trends .....	82
Table 20. Professional Post-Production Storage Assumptions .....	85
Table 21. Professional Post Production Storage Projections (High End) .....	86
Table 22. Special Effects and Other Special Production Activities Storage Projections.....	89
Table 23. World-Wide Post Facilities Capacity Growth Estimates (On-Line, Near-Line and DAS/Local).....	91
Table 24. Post-Production Facility Spending Assumptions.....	93
Table 25. World-Wide HE/MR NLE Facilities Network Storage Spending Estimates.....	95
Table 26. Content Percentage on Physical Media for Content Distribution.....	96



Table 27. Comparison of Costs for Streaming Content with HDDs and SSDs ....	98
Table 28. Additional Assumptions on Local Broadcast Content .....	102
Table 29. Estimate of WW Local Broadcast Storage Capacity Requirements and Spending.....	103
Table 30. Cable Head End Assumptions.....	108
Table 31. Estimate of WW Cable Head End Storage Spending .....	109
Table 32. Satellite Headend Assumptions.....	114
Table 33. Estimate of WW Satellite Head End Storage Spending .....	115
Table 34. TV Master Network Assumptions .....	119
Table 35. Estimate of WW TV Master Network Storage Spending .....	120
Table 36. Comparison of Costs for Distribution with Various Optical Media as well as Hard Disk Drives .....	126
Table 37. Digital Cinema Expected Cost Reductions .....	127
Table 38. Digital Cinema Storage Estimate Assumptions.....	132
Table 39. Digital Cinema Storage Estimate.....	133
Table 40. Internet Content Delivery Assumptions .....	142
Table 41. Estimate of WW Internet Content Delivery Storage Spending .....	143
Table 42. VOD Capacity Model Assumptions .....	149
Table 43. Video on Demand Storage Capacity Model (TB).....	150
Table 44. Percentage Growth Rate of Archival Media Types.....	188
Table 45. 2006 Estimated Costs for Archiving Motion Picture Materials on HDD Arrays and a Tape Library for Year 1 (1 TB) <sup>29</sup> .....	193
Table 46. Assumptions for Archiving and Digital Preservation.....	197
Table 47. Archiving and Digital Conversion and Preservation Storage Projections.....	198
Table 48. Annual New Capacity Projections by Media and Entertainment Market (Petabytes).....	206
Table 49. Annual New Direct Attached and Local Storage Capacity Projections by Media and Entertainment Market (Petabytes).....	207
Table 50. Annual New Total Networked Storage Capacity Projections by Media and Entertainment Market (Petabytes).....	208
Table 51. Annual New On-Line Networked Storage Capacity Projections by Media and Entertainment Market (Petabytes).....	209
Table 52. Annual New Near-Line Networked Storage Capacity Projections by Media and Entertainment Market (Petabytes).....	210
Table 53. Annual New Object Storage Capacity Projections by Media and Entertainment Market (Petabytes).....	211
Table 54. Annual Cloud Storage Capacity Projections by Media and Entertainment Market (Petabytes).....	211
Table 55. Total Entertainment and Media Storage Revenue Estimate (\$M).....	215
Table 56. Direct Attached and Local Storage Entertainment and Media Storage Revenue Estimate (\$M) .....	216
Table 57. Total Network Storage Entertainment and Media Storage Revenue Estimate (\$M).....	217
Table 58. On-Line Network Storage Entertainment and Media Storage Revenue Estimate (\$M).....	218

Table 59. Near-Line Network Storage Entertainment and Media Storage Revenue Estimate (\$M) .....	219
Table 60. Object Storage Entertainment and Media Storage Revenue Estimate (\$M) .....	220
Table 61. Off-Line Storage Entertainment and Media Storage Revenue Estimate (\$M) .....	221
Table 62. Media Unit Storage Capacity and Price Assumptions.....	232
Table 63. Detailed Annual New Media Unit Breakdown by Application.....	234
Table 64. Annual New Media Unit Summary.....	237

## Acknowledgements

These reports are the result of extensive interviews with many people and companies from throughout the entertainment content value chain as well as in-depth analysis of historical trends and future technology drivers. Companies contacted included storage component and systems companies as well as companies that incorporate storage into their content creation applications. The list of companies contacted is extensive and the data we gathered over several months is pretty comprehensive, not all of it is included in this report. Our thinking and projections were shaped by many inputs.

In particular we would like to thank the following companies and organizations for their help and information over the years: Aspera, Atempo, ATTO, Avere, Avid Technologies, BitCentral, DataDirect Networks, CET, Chosun Group, Dell, Discovery Channel, Dolby, EBU, Edit Share, EFILM, ESPN, Facilis, Fox, Front Porch Video, G-Tech (part of Western Digital), Harmonic, HDS, HGST (part of Western Digital), IBM Media and Entertainment Division, IMT, Iron Mountain, Isilon/EMC, LaCie, LSI, LTO Consortium, Maximum Throughput, Mediakive, Media Technology Market Partners, Micron, NetApp, NASCAR, NBC Universal, NetApp, Oracle, Panasonic, Paramount, Plastercity Digital Post, Promise Technology, Qlogic, Quantum, Rorke Data, SanDisk, SeaChange, Seagate Technology, SGI, Sony, SpectraLogic, Sun/Oracle, Technicolor, Turner Broadcast, Versus, Warner Bros, Western Digital and Xendata. We also thank all the speakers whose presentations have influence this report from the Creative Storage Conferences, SMPTE Conferences, the NAB show, IBC and the Storage Visions Conferences.

Also thanks to the following individuals for their help over the years—and the total list is much more extensive than this: Al Kovalik, Alex Grossman, Brad Giles, Brad Winett, Clyde Smith, Colin Dixon, David Baril, David Crosthwaite, David Trumbo, Fred Fourcher, Geoff Stedman, Nicholas Lim, Jim Lindner, John Morgan, Felix Poulin, Pete Fasciano (for much discussion on earlier editions), Randall Dark, Rob Kobrin, Ron Tarasoff, Claus Trelby, Jim Wheeler, Joe Wojdacz, Steve Zivanic, Paul Koopman, Scott Rinehart, Steve Canepa, Tom Inglefield, and Wayne Arvidson.

## The Author



Tom Coughlin, President, Coughlin Associates is a widely respected digital storage analyst and consultant. He has over 36 years in the data storage industry with multiple engineering and management positions at high profile companies.

Tom has many publications and six patents to his credit. Tom is also the author of Digital Storage in Consumer Electronics: The Essential Guide, which was published by Newnes Press. Coughlin Associates provides market and technology analysis (including reports on several digital storage technologies and applications and a newsletter) as

well as Data Storage Technical Consulting services. Data abstracted in this paper are from the **2017 Digital Storage for Media and Entertainment Report** from Coughlin Associates. Order information on this report can be found at: [www.tomcoughlin.com/techpapers.htm](http://www.tomcoughlin.com/techpapers.htm).

Dr. Coughlin is active with SMPTE, SNIA, the IEEE and other professional organizations. Tom is the founder and organizer of the Annual Storage Visions Conference ([www.storagevisions.com](http://www.storagevisions.com)) as well as the Creative Storage Conference ([www.creativestorage.org](http://www.creativestorage.org)). Tom has been the chairman of the annual Flash Memory Summit. He is a member of the Consultants Network of Silicon Valley (CNSV). For more information on Tom or his publications go to [www.tomcoughlin.com](http://www.tomcoughlin.com).

## 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 feed-forward 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 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.



# **2017 DIGITAL STORAGE FOR MEDIA AND ENTERTAINMENT REPORT**

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.

## **ORDER FORM FOR THE 2017 DIGITAL STORAGE FOR MEDIA AND ENTERTAINMENT REPORT (PDF)**

NAME: \_\_\_\_\_  
TITLE: \_\_\_\_\_  
COMPANY: \_\_\_\_\_  
ADDRESS: \_\_\_\_\_  
CITY: \_\_\_\_\_ STATE: \_\_\_\_\_  
ZIP: \_\_\_\_\_  
TELEPHONE: \_\_\_\_\_  
FAX: \_\_\_\_\_  
E-MAIL: \_\_\_\_\_

☐ Company License \$7,000

☐ Visa    ☐ Mastercard    ☐ American Express

Credit Card Number: \_\_\_\_\_  
Expiration Date: \_\_\_\_\_  
Signature: \_\_\_\_\_

Make checks payable to: Coughlin Associates  
Mail to 1665 Willowmont Ave., San Jose, CA 95124  
Telephone: 408-202-5098 Fax: 866-374-6345  
Email: [info@tomcoughlin.com](mailto:info@tomcoughlin.com)