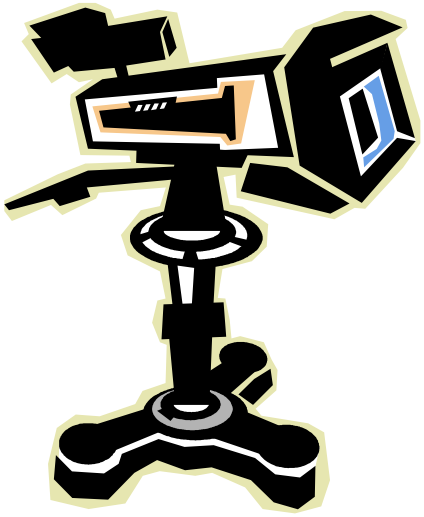
2016 Digital Storage for Media and Entertainment Report

-- 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

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

Table of Contents

Acknowledgements 10
The Author 11
Executive Summary 11
  Key Points 12
Introduction 15
Cinema and Video Formats 20
Media and Entertainment Professional Storage Survey 31
Content Creation and Acquisition 32
  Feature Film Acquisition 32
  TV Production 49
  Film Scanning 51
  Storage Capacity Projections for Digital Content Acquisition 53
Post Production including Editing and Special Effects 59
  Non-Linear Editing (NLE) 59
  Special Effects and Other Post Production 80
  Summary Post-Production Digital Storage Capacity Demand 80
  Storage Capacity and Storage Revenue Projections for NLE, Special Effects and Other Post Production Activities 81
Media and Entertainment Content Distribution 94
  Lower Bandwidth Richer Media Distribution Technology 96
  Local Broadcast 98
    Cable Distribution 104
    Satellite Headend 110
    TV Networks 110
  Digital Cinema 122
Hard Disk Drives Used in Digital Cinema 127
  Professional Media and Entertainment Internet Distribution 133
  Video on Demand (VOD) 144
Summary of Non-Archive Entertainment and Media Storage 154
Archiving and Digital Preservation 165
  Hard Disk Drives 165
  Magnetic Tape 167
  Optical Discs 172
  Cloud Archive Storage 175
  Survey Archive Results 179
  Digital Conversion of Older Analog Content 184
  Costs of Digital Conversion 185
  Costs of Long Term Storage 186
  Archiving of Digital Created Content 187
  Total Archive and Preservation Storage Projections 188
  Archiving Storage: Off-line, Near-Line, in the Cloud 188
  Uses of Archived Content—Making an Archive ROI 196
  Migration of Content to Avoid Format Obsolescence 196
Capacity Requirements by Market Segment 198

Storage Revenue Estimates by Market Segment 206
Storage Media Projections 214
Touch Rate Versus Response Time 214
Response time definition 214
Touch rate definition 214
Touch rate vs. response time 215
Technology regions 217
IO Object size curve 218
Media Projections for Media and Entertainment 219
Conclusions 231
Some Media and Entertainment Market Companies 235
NEWSLETTER SUBSCRIPTIONS 239

Table of Figures

Figure 1. Digital Entertainment Content Value Chain (An Accelerating Positive Feedback Loop) 15
Figure 2. Digital Entertainment Content Workflow. 16
Figure 3. Hybrid Motion Picture Production and Post-Production using Digital Intermediates 17
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 29
Figure 7. Uses and Flow of Metadata in the Entertainment Content Process 30
Figure 8. Sphericam 2 VR Video Camera Setup 36
Figure 9. GoPro 360-degree Video Camera Rig 36
Figure 10. Spherical Image Display 37
Figure 11. ARRI ALEXI Stereoscopic Video Camera Setup 38
Figure 12. Canon C300 DSLR Used for Professional Video 39
Figure 13. For-A Super Slo Mo Camera 39
Figure 14. BBC Image of an HNK Super Hi-Vision Camera 40
Figure 15. Sharp 8K X 4K LCD Display at 2012 CES 40
Figure 16. NHK 8K SHV Field Camera 41
Figure 17. Percentage of Various Recording Media in Professional Video Cameras 42
Figure 18. FOR-A Video Archive Recorder 43
Figure 19. Content Shot for an Hour of Completed Work 44
Figure 20. Panasonic Micro P2 Flash Module and Adapter 45
Figure 21. Panasonic P2 and Sony SxS Flash Memory Camcorder Modules 46
Figure 22. Sony SR Memory Flash Memory Camcorder Module 46
Figure 23. SanDisk CFast Compact Flash Card 47
Figure 24. Maxell iVDR Storage Module on a Sony Professional Camera 48
Figure 25. NHK Super High Vision Equipment Roadmap 50
Figure 26. Percentage Scanned into Different Digital Resolutions 52
Figure 27. Digital Content Acquisition Storage Capacity Projections 57
Figure 28. Annual Storage Capacity Growth for Digital Content Acquisition 58
Figure 29. Professional Non-Linear Editing Model System 59
Figure 30. DAS vs. Shared Storage and Number of People in a Post Facility 65
Figure 31. AWS Snowball Data Transport Solution 69
Figure 32. Example Render Farm Layout 70
Figure 33. Pixar Render Farm 71
Figure 34. Physical Distribution Media for Proxies or Completed Post Work 79
Figure 35. Post Production Storage Capacity Annual Demand (TB) 87
Figure 36. Projections for Post Production, CGI/FX New Storage Requirements 89
Figure 37. Price of Storage/GB for Facility Niche 91
Figure 38. Projection of HE/MR NLE Facilities Network Storage TAM ($M) 93
Figure 39. Toshiba On-Air Max Flash 96

Figure 40. Bit Rate Reduction Curve Showing Big-Rate Savings between H.264 and HEVC (Horizontal Axis indicates Quality Target Resolution) 97
Figure 41. Local Broadcaster Content Distribution Storage Capacity Analysis 102
Figure 42. Estimate of Local Broadcaster Distribution Network Storage TAM ($M) 103
Figure 43. Cable Head End Distribution Storage Capacity Analysis 108
Figure 44. Estimate of Cable Head End Network Storage TAM ($M) 109
Figure 45. Satellite Head End Distribution Storage Capacity Analysis 114
Figure 46. Estimate of Satellite Headend Network Storage TAM ($M) 115
Figure 47. TV Network Delivery Storage Capacity Analysis 119
Figure 48. Estimate of TV Networks Local Near-Line and Cloud Storage Capacity (TB) 120
Figure 49. Estimate of TV Networks Network Storage TAM ($M) 121
Figure 50. USB Hard Drive For Movie Distribution to Theatre (Mercado Theatre in Santa Clara, CA) 122
Figure 51. Schematic of a Play-To-Screen Server with Functional Blocks (Thompson Grass Valley) 124
Figure 52. Digital Cinema Projector 125
Figure 53. Schematic Digital Projector Showing IMB Containing Content Storage (a) and with content storage external to the IMB (b) 126
Figure 54. Integrated Media Block Containing HDDs 127
Figure 55. Annual New Storage Capacity for Digital Cinema 131
Figure 56. Estimate of Digital Cinema Storage TAM ($M) 132
Figure 57. Internet Content Distribution System (CDN) 133
Figure 58. Level 3's Content Delivery Network 134
Figure 59. Internet Content Delivery Storage Capacity Analysis 142
Figure 60. Estimate of Internet Content Delivery Network Storage TAM ($M) . 143
Figure 61. IBM Flash-based Content-Delivery Servers 145
Figure 62. Video on Demand Total Storage Capacity Model 150
Figure 63. Annual Growth in Video on Demand Storage Capacity 151
Figure 64. Estimate of VOD Storage TAM by Category ($M) 152
Figure 65. Estimate of Cloud and Conventional VOD Storage Capacity 153
Figure 66. Non-Archive Media and Entertainment Annual Network Storage TAM Estimate 155
Figure 67. Non-Archive On-Line Network Annual Storage TAM Estimate 156
Figure 68. Non-Archive Near-Line Network Annual Storage TAM Estimate 157
Figure 69. Non-Archive Direct Attached and Local Storage Annual TAM Estimate 158
Figure 70. Total Non-Archive Storage Annual TAM Estimate 159
Figure 71. Non-Archive Network Storage Capacity Annual Demand Estimate 160
Figure 72. Non-Archive On-Line Network Storage Capacity Annual Demand Estimate 161
Figure 73. Non-Archive Near-Line Network Storage Capacity Annual Demand Estimate 162
Figure 74. Non-Archive Direct Attached Storage and Local Storage Capacity Annual Demand Estimate 163

Figure 75. Non-Archive Total Storage Capacity Annual Demand Estimate 164
Figure 76. HDD Cartridge Products (iVDR and RDX) 165
Figure 77. Spectra Logic SMR HDD Archive Storage System 166
Figure 78. ATSC HDD Technology Roadmap 166
Figure 79. LTO Projected Tape Generations 169
Figure 80. LTO-7 Tape Cartridge 169
Figure 81. Uses for LTFS Tape in Media and Entertainment Workflows 172
Figure 82. Sony/Panasonic Optical Archive Roadmap 173
Figure 83. Sony Blu-Ray Optical Disc Cartridge and Drive 173
Figure 84. XenData Tape and Optical Disc LIbrary 175
Figure 85. Elements in an AXF Object Wrapper 177
Figure 86. Percentage of Digital Long-Term Archives on Various Media 181
Figure 87. Percentage of Tape Formats Used in Digital Archiving 183
Figure 88. Example Workflow for Analog to Digital Video Conversion. 186
Figure 89. Total Annual Digital Storage Demand Projections for Archiving and Digital Content Conversion & Preservation 193
Figure 90. Annual Near-Line and Off-Line Digital Storage for Content Archiving 194
Figure 91. Cloud vs. Local Archive Storage 195
Figure 92. Relationship Between Archive Content and Multiple Real-Time and Non-Real-Time Distribution Content 197
Figure 93. Media and Entertainment Cloud Storage Capacity Projections 205
Figure 94. Media and Entertainment Cloud Storage Revenue Projections 213
Figure 95. Touch rate versus response time indicating various types of uses . 216
Figure 96. Digital storage technologies regions overlaid on the Touch Rate/Response Time chart 217
Figure 97. Touch/Y and response time for 100% random IO in a 4 TB capacity HDD 218
Figure 98. Touch/Y and response time for 4 TB capacity HDD, LTO Tape and Blu-ray Discs 219
Figure 99. Media Annual Revenue Estimate Summary ($M) 223
Figure 100. Tape Cartridge Annual Unit Shipment Projections 228
Figure 101. Optical Disk Unit Annual Unit Shipment Projections 229
Figure 102. HDD & Flash Annual Unit Shipment Projections 230
Figure 103. Distribution of Storage Capacity for Entertainment Creation, Archiving, and Distribution Segments (2015) 231
Figure 104. Distribution of Storage Capacity for Entertainment Creation, Archiving, and Distribution Segments (2021) 232
Figure 105. Media and Entertainment Market Storage Revenue Share by Segment (2015) 233
Figure 106. Media and Entertainment Market Storage Revenue Share by Segment (2021) 233
Figure 107. Market Share of Storage Media by Storage Capacity Shipped (2015) 234
Figure 108. Market Share of Storage Media by Storage Capacity Shipped (2021) 234

List of Tables

Table 1. Example Resolution, Data Rates and Storage Capacity Requirements for Professional Media Content (assumes no chroma subsampling) 22
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 32
Table 6. Uncompressed Format Assumptions for 1 Hour of Full Resolution Raw Content 33
Table 7. Comparison of Professional Video Camera Media Trends 41
Table 8. Survey Question: What % of your Content is Born Digital 43
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 and 2016 Scanned Resolutions 52
Table 11. Feature Film Projection Assumptions 54
Table 12. TV Broadcast Assumptions 55
Table 13. TV Episodic Assumptions 55
Table 14. General Assumptions for Movie & TV Content 55
Table 15. Feature Film Scanning Digital Storage Requirements. 56
Table 16. Assumptions for Film Scanning Projections 56
Table 17 Professional NLE Bandwidth Requirements 72
Table 18 Proxy Distribution Media Trends 79
Table 19. Professional Post-Production Storage Assumptions 82
Table 20. Professional Post Production Storage Projections (High End) 83
Table 21. Special Effects and Other Special Production Activities Storage Projections 86
Table 22. World-Wide Post Facilities Capacity Growth Estimates (On-Line, Near-Line and DAS/Local) 88
Table 23. Post-Production Facility Spending Assumptions 90
Table 24. World-Wide HE/MR NLE Facilities Network Storage Spending Estimates 92
Table 25. Content Percentage on Physical Media for Content Distribution 94
Table 26. Additional Assumptions on Local Broadcast Content 99
Table 27. Estimate of WW Local Broadcast Storage Capacity Requirements and Spending 100
Table 28. Cable Head End Assumptions 105
Table 29. Estimate of WW Cable Head End Storage Spending 106
Table 30. Satellite Headend Assumptions 111
Table 31. Estimate of WW Satellite Head End Storage Spending 112
Table 32. TV Master Network Assumptions 116
Table 33. Estimate of WW TV Master Network Storage Spending 117
Table 34. Comparison of Costs for Distribution with Various Optical Media as well as Hard Disk Drives[3] 123

Table 35. Digital Cinema Expected Cost Reductions 124
Table 36. Digital Cinema Storage Estimate Assumptions 129
Table 37. Digital Cinema Storage Estimate 130
Table 38. Internet Content Delivery Assumptions 139
Table 39. Estimate of WW Internet Content Delivery Storage Spending 140
Table 41. VOD Capacity Model Assumptions 147
Table 42. Video on Demand Storage Capacity Model (TB) 148
Table 42. Percentage Growth Rate of Archival Media Types 182
Table 43. 2006 Estimated Costs for Archiving Motion Picture Materials on HDD Arrays and a Tape Library for Year 1 (1 TB)[29] 187
Table 44. Assumptions for Archiving and Digital Preservation 191
Table 45. Archiving and Digital Conversion and Preservation Storage Projections 192
Table 46. Annual New Capacity Projections by Media and Entertainment Market (Petabytes) 199
Table 47. Annual New Direct Attached and Local Storage Capacity Projections by Media and Entertainment Market (Petabytes) 200
Table 48. Annual New Total Networked Storage Capacity Projections by Media and Entertainment Market (Petabytes) 201
Table 49. Annual New On-Line Networked Storage Capacity Projections by Media and Entertainment Market (Petabytes) 202
Table 50. Annual New Near-Line Networked Storage Capacity Projections by Media and Entertainment Market (Petabytes) 203
Table 51. Annual Cloud Storage Capacity Projections by Media and Entertainment Market (Petabytes) 204
Table 52. Total Entertainment and Media Storage Revenue Estimate ($M) 207
Table 53. Direct Attached and Local Storage Entertainment and Media Storage Revenue Estimate ($M) 208
Table 54. Total Network Storage Entertainment and Media Storage Revenue Estimate ($M) 209
Table 55. On-Line Network Storage Entertainment and Media Storage Revenue Estimate ($M) 210
Table 56. Near-Line Network Storage Entertainment and Media Storage Revenue Estimate ($M) 211
Table 57. Off-Line Storage Entertainment and Media Storage Revenue Estimate ($M) 212
Table 58. Media Unit Storage Capacity and Price Assumptions 222
Table 59. Detailed Annual New Media Unit Breakdown by Application 224
Table 60. Annual New Media Unit Summary 227

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, 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 Crosthwalt, 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 has worked for over 30 years in the data storage industry at companies such as Ampex, Polaroid, Seagate, Maxtor, Micropolis, Syquest, 3M and other companies. He founded Coughlin Associates in 2000. He has over 100 publications and 6 patents to his credit. Tom is active with IEEE Region 6, the IEEE Magnetics Society, the IEEE Consumer Electronics Society, SNIA, SMPTE and other professional organizations. He is the founder and organizer of the Annual Storage Visions Conference as well as the Creative Storage Conference. He is also the general chairman of the Flash Memory Summit. Coughlin Associates provides market and technology analysis, technical reports and white papers, as well as Data Storage Technical Consulting services. For more information go to www.tomcoughlin.com.

Executive Summary

This report is the fourteenth report on data storage and emerging applications and the twelfth 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 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 2016. We have 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.

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.
- The slow down in areal density growth for HDDs will slow the historical $/GB decline probably through the projection period.
- 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 Blu-ray optical cartridges are increasing and this will 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 2015 to 2021 entertainment and media digital storage TAM (without archiving and preservation) will increase by about 4.1 X (from $17.9 B to $73.83 B).
- Between 2015 and 2021 media and entertainment storage revenue is expected to grow 3.7 X (from $24.6 B to $92.1 B).

- In 2015 post-production is estimated to have been about 34% of the total storage revenue, followed by archiving and preservation and content distribution at 27% and content acquisition at 12%.
- In 2021 the projected revenue distribution is 41% content distribution, 25% post production, 20% for archiving and preservation and 14% for content acquisition.
- Between 2015 and 2021 we expect about a 6.2 X increase in the required digital storage capacity used in the entertainment industry and about a 5.6 X increase in storage capacity shipped per year (from 71,632 PB to 401,215 PB).
- The greatest storage capacity demand in 2015 is for digital conversion and preservation as well as archiving of new content (85.3%). Content acquisition follows at 7.8% with post-production at 4.4% and content distribution at 2.5%.
- By 2021 we expect 70% of archived content to be in near-line storage, up from 51% in 2015.
- In 2015 we estimate that 62.7% of the total storage media capacity shipped for all the digital entertainment content segments was in HDDs with digital tape at 27.0%, 6.5% optical discs and flash at 3.9%.
- By 2021 tape has been reduced to 18.6%, HDDs shipped capacity is 69.2%, optical disc capacity is down to about 2.3% and flash capacity percentage is at 9.9%.
- Media revenue is expected to increase about 2.45 X from 2015 to 2021 ($3,217 M to $7,871 M).
- 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 290 Exabytes of new digital storage will be used for digital archiving and content conversion and preservation by 2021
- 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 25 X between 2015 and 2021 (4,826 PB to 130,152 PB)
- Cloud storage revenue will exceed $20.2 B by 2020
- 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 54% utilization in 2016
- 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.

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.

ORDER FORM FOR THE 2016 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: 408-978-8184 Fax: 866-374-6345
Email: info@tomcoughlin.com

NEWSLETTER SUBSCRIPTIONS

The Digital Storage Technology Newsletter is a Quarterly Publication of Coughlin Associates. It is published quarterly. Subscriptions for 2015-2016 are $199 and can be made using the form below. Subscription entitles subscriber to membership of Entertainment Storage Alliance, www.entertainmentstorage.org and $100 discount for Storage Visions & Creative Storage Conferences (call 408-978-8184 or email tom@tomcoughlin.com).

✂ Cut or tear here ✂ ✂ Cut or tear here ✂

ORDER FORM

NAME: _____

TITLE: _____

COMPANY: _____

ADDRESS: _____

CITY: _____

STATE: _____ZIP: _____

TELEPHONE: _____FAX: _____

E-MAIL:_____

☐ Quarterly PDF Newsletter Fee: $199 (no shipping or tax)

☐ Check Enclosed

☐ Visa Credit Card Number:_____

☐ Mastercard Expiration Date: _____

☐ American Express Signature: _____

Make checks payable to: **Coughlin Associates.**

Mail to: 1665 Willowmont Ave., San Jose, California 95124
Tel: 408-978-8184, Fax: 866-374-6345