2014 Survey Summary for Storage in Professional Media and Entertainment

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Introduction

Digital storage plays a significant role in the professional media and entertainment industry. Digital storage for the M&E industry has demand characteristics often very different from typical IT storage because of the performance requirements of real-time video in capture, editing and post-production as well as distribution. On the other hand, the ever growing archive of long-tail digital content and increasing digitized historical analog content is swelling the demand for cold as well as warm archives using tape, optical discs and hard drive arrays.

In March through May of 2014 Coughlin Associates, Inc. conducted a survey of professional media and entertainment professionals on various digital storage topics. The survey was broken down into several segments: content capture, editing and post-production, content delivery as well as archiving and digital preservation. The Society of Motion Picture and Television Engineers (SMPTE), Digital Production Buzz, Hollywood Post Alliance, European Broadcast Union, Post Magazine, Postperspective.com and other organizations assisted by soliciting survey participants. Digital Production Buzz helped with the 2012, 2013 and 2014 surveys and that group represents many smaller facilities. As a result, these surveys include a greater number of smaller facilities than earlier Coughlin Associates surveys.

Coughlin Associates wished to conduct the survey in order to discover new trends for storage in the industry and improve the accuracy of the company's annual report on digital storage for the media and entertainment industry. This summary contains some of the results from that survey and where appropriate we will compare the 2014 results from those of a similar survey in March to May 2013, May and June of 2012; February, November and December of 2010 and March of 2009.

Of the 216 people that started the survey, 201 completed at least some part of the survey (93.1%). All of the people surveyed worked with professional media and entertainment content. 118 were involved in content capture, 123 were involved in digital editing or post-production, 66 were involved in content distribution and 89 were involved in long term digital archiving or digital preservation.

Table 1 shows the percentage of survey participants in various professional content market segments and **Table 2** show the general locations of the survey participants. Note that the "other" category in Table 1 included responses such as sports, education, content restoration, documentaries, and audio production.

The following sections of this document give some of the results of the survey for each of the major survey sections described above. Note that the results given in this survey are representative of the full data but they are often a simplification of the more complex survey results. The full survey, including a more complete analysis of the survey results as well as some multi-factor dependencies is available from Coughlin Associates as part of the 2014 Digital Storage in Media and Entertainment report (www.tomcoughlin.com/techpapers.htm).

Table 1. Percentage of survey participants in content market segments.

TV Episodics	42.7%
TV Other	45.0%
Feature Film	37.4%
Short Features, Commercials and Trailers	50.3%
Corporate Video	38.6%
Web Casts	27.5%
Games	2.9%
Other (please specify)	18.1%

Table 2. Survey participant locations.

US or Canada	67.3%
Mexico or Latin America	1.2%
Europe	23.4%
Africa	1.2%
Japan or Korea	1.2%
China or Rest of Asia	2.3%
Australia	3.5%
Antartica	0.0%

Content Capture

Professional video cameras are undergoing rapid evolution, driven by higher resolution content as well as multi-camera content capture, including

stereoscopic content capture. In addition, the physical storage media for professional cameras is undergoing rapid evolution as film and magnetic digital tape is impacted by the rapid file access convenience of hard disk drives, LTO and other format LTFS tape and optical discs, and the ruggedness of flash-based solid-state storage. **Figure 1** shows the percentage of various recording media used by the 2014 survey recipients in professional video cameras.

Figure 1. Percentage of various recording media in professional video cameras.

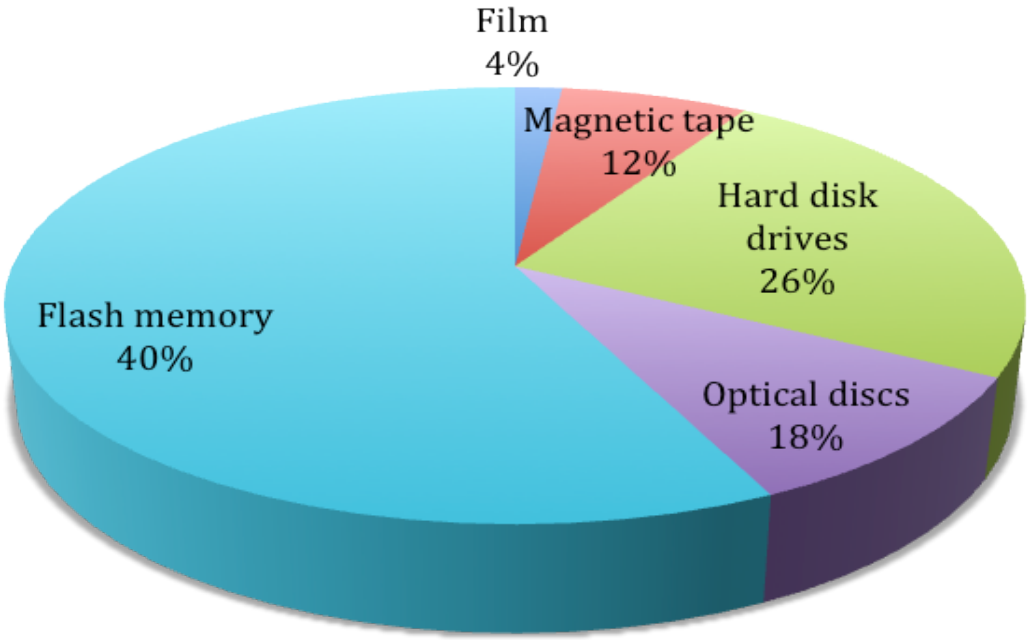


Table 3 compares the results from the 2009, 2010, 2012 and 2013 surveys with those from 2014. Flash memory is the clear leader in professional video camera media, increasing from 19% in 2009 to 40% in 2014 (with survey results as high as 59% in 2013) while magnetic tape show a consistent decline over the same period, in particular, magnetic tape declines from 34% to 12%. Optical discs increased from 2009 to 2010 but experienced a decline in the following years to 7% in 2013 (but the 2014 survey showed this at 18%, similar to 2010). Film shows a general decline with 15% usage in 2009 to 1% in 2013 (and 4% in 2014). The trend with declining film use follows the trend towards completely digital workflows.

Table 3. Comparison of Professional Video Camera Media Trends

Year	Magnetic Tape	HDD	Optical	Flash 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	12%	26%	18%	40%	4%

In 2014 93.3% of the survey respondents that participated in this section reuse their recording media (compared to 84.5% in 2013, 86% in 2012, 79% in 2010 and 75% in 2009). In 2014 74.2% of respondents said they archive their camera recording media (compared to 81.4% in 2013, 85% in 2012 and 77% in 2010). It appears that archiving the original recording media may be a practice in decline (especially with expensive reusable media such as flash memory cards). Digital storage on tape, hard disk drives or flash storage allows reuse of media.

In the professional Media and Entertainment Survey we asked how much of the participants content was born digital and got the responses shown in **Table 4**. We included responses for the same ranges from the 2013, 2012 and 2010 survey. In 2014 81.1% said that over 80% of their content is created in a digital format vs. 75% in 2013, 80% in 2012 and 63% in the 2010 survey.

Table 4. Survey Question: What % of your Content is Born Digital

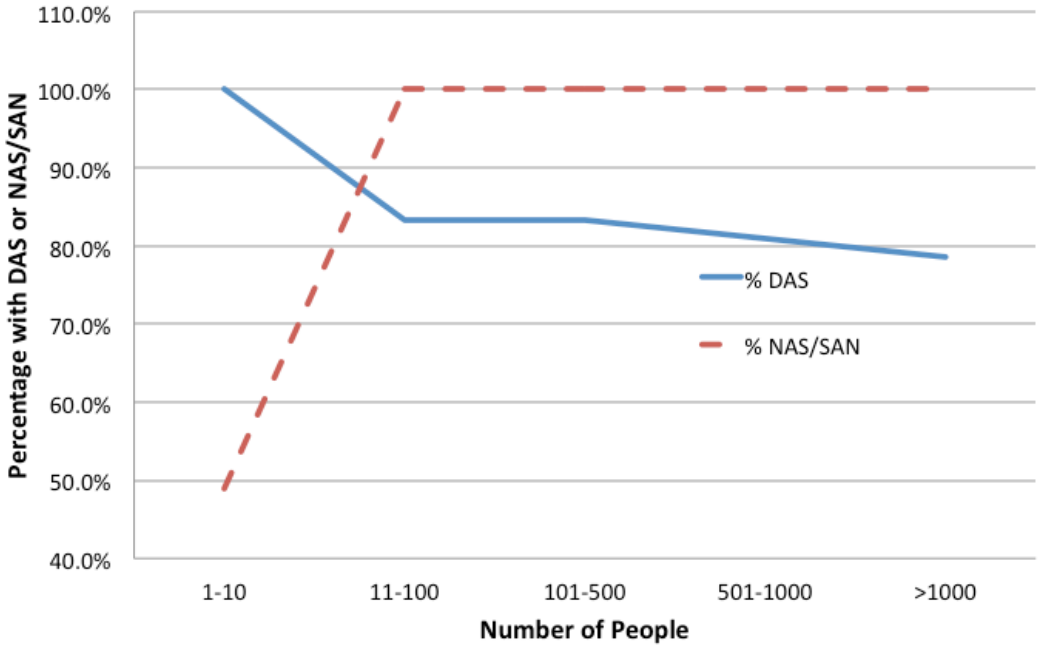
Percent Born Digital	2010	2012	2013	2014
<10%	3.9%	0.9%	1.1%	0.0%
11% to 20%	1.3%	0.4%	0.0%	1.1%
21% to 30%	3.2%	0.0%	0.0%	1.1%
31% to 40%	3.2%	2.6%	1.1%	2.1%
41% to 50%	5.2%	2.2%	3.3%	2.1%
51% to 60%	5.2%	1.7%	2.2%	1.1%
61% to 70%	5.8%	3.1%	6.5%	4.2%
71% to 80%	8.4%	8.3%	10.9%	7.4%
81% to 90%	16.1%	10.9%	15.2%	15.8%
91% to 100%	47.7%	69.9%	59.8%	65.3%

Digital Editing and Post Production

Figure 2 shows that for the 2013 survey participants there were a general increase in the use of shared storage (SAN/NAS), and a decrease in DAS

storage as the number of people working in a post-production facility increases. 100% of the participants in larger facilities (greater than 10 seats) used shared storage. Even in the largest facilities 80% of the respondents used DAS as well as NAS.

Figure 2. DAS vs. Shared Storage and Number of People in a Post Facility



When participants were asked about their use of direct attached and network storage in digital editing and post-production, the survey showed the following summary statistics in 2014:

- 87.7% had DAS (compared to 87.3% in 2013, 92% in 2012, 91% in 2009 and 83.8% in 2010)
  - Over 86.5% of these had more than 1 TB of DAS (compared 88% in 2013, 78% in 2012, 96% in 2010 and 52% in 2009)
  - 1 to 5 TB was the most popular DAS size (31.1%)
  - 22.3% of these had more than 50 TB of DAS storage (compared to 18.3% in 2013)
  - 6.8% had more than 500 TB of DAS storage (this was 7% in 2013)
- 75.0% had NAS or SAN (compared to 70.9% in 2013, 53.8% in 2012, 81% in 2010 and 2009—probably due to the addition of many smaller post-production facilities in the later surveys, 49.6%, 53.4% and 67% were in 1-10 people facilities in 2014, 2013 and 2012 respectively (compared to about 26% in 2010)
  - 49.4% had 50 TB or more of network storage (compared to 57.8% in 2013)

  - About 11% had more than 500 TB of NAS/SAN storage (this was the same as in 2013)
  - In 2012 about 48% had more than 16 TB of NAS or SAN (compared to 44% in 2009 and 58% in 2010)
- Many survey participants had considerable storage capacities in both DAS and NAS/SAN.

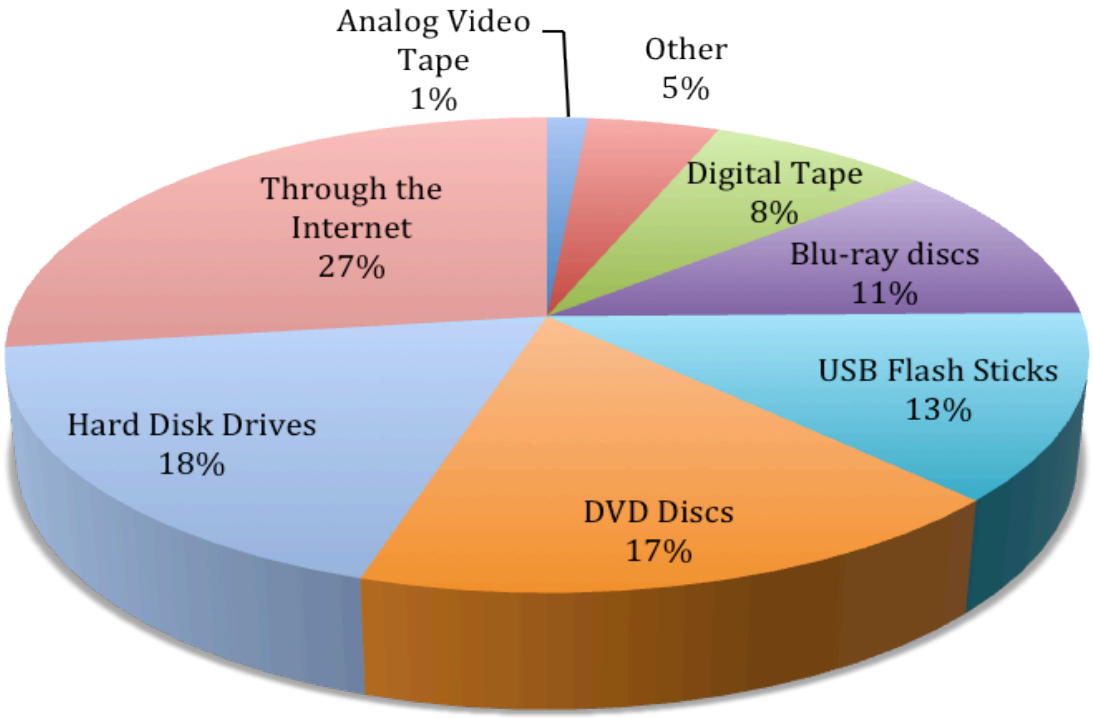
In the 2012, 2013 and 2014 surveys we asked whether survey participants used cloud-based storage for editing and post-production. In 2014 25.6% of responding participants said yes versus 24.7% in 2013 and 15.1% in 2012. In 2014 28.1% of the respondents said that they had 1 TB or more storage capacity in the cloud vs. 23% in 2013 and 26.7% in 2012.

Table 5 compared the 2009, 2010, 2012, 2013 and 2014 survey results for distribution media used for proxies or completed editing work. Note that in the 2014, 2013 and 2012 surveys we added proxy distribution through the Internet as a response option. In 2014 we included USB Flash Sticks. Analog tape and digital tape show a relative decline over the years. Optical discs declined in 2014, following the long-term trend. HDDs are lower in 2014 than 2013 and earlier years. Internet distribution was 27% in 2014 and 2013 and 29% in 2012. It appears to be the dominant method for proxy distribution. **Figure 3** is a pie chart of the 2014 survey proxy distribution media results.

Table 5. Proxy Distribution Media Trends

	2009	2010	2012	2013	2014
Other	11%	17%	5%	5%	5%
Analog video tape	10%	6%	2%	2%	1%
Blu-ray discs	9%	11%	10%	12%	11%
Digital tape	24%	18%	11%	11%	8%
Hard disk drives	24%	25%	19%	22%	18%
DVD discs	23%	23%	24%	21%	17%
USB Flash Sticks					13%
Through internet	NA	NA	29%	27%	27%

Figure 3. Distribution format for proxies or completed work.



Content Distribution

Distribution of professional video content has many channels. It can use physical media for getting content to digital cinemas or to consumers or it can be done electronically using broadcast, cable or satellite transmission; or through the internet or mobile phone networks. **Table 6** gives responses for the percentage of physical media used by the survey respondents for content distribution in 2014, 2013, 2012 and 2010 (for the 35, 29, 82 and 62 respondents that used physical content distribution media in 2014, 2013, 2012 and 2010 respectively). Note that these are the average for the survey population giving their percentage for each physical media and do not and should not be expected to add to 100%. DVD discs, HDDs and Flash Memory are the most popular distribution formats.

Table 6. Average Percentage content on physical media for professional content distribution

Media	2010	2012	2013	2014
Digital tape	59%	34%	32%	20%
CD or VCD discs	13%	18%	23%	4%
DVD discs	48%	79%	67%	51%
Blu-ray discs	18%	24%	10%	21%
Hard disk drives	45%	51%	55%	52%

Flash memory or SSDs	25%	24%	22%	28%

Following are survey observations for electronic content distribution (such as video on demand).

- Average hours on central content delivery system was about 1,142 hours in 2014 (up from 1,900 hours in 2012, 700 hours in 2010 and 200 hours in 2009). In 2013 this was 2,275 hours but this was skewed by one participant with >8,000 hours on their central content delivery servers.
- There were 688 hours ingested monthly in 2014 (this was 837 hours in 2013, 500 hours in 2012, 200 hours in 2010 and 150 hours in 2009). The 2013 data was also skewed high by one survey participant.
- In 2013 43.2% of respondents had more than 5% of their content on edge servers (this compares to about 42% in 2013, 24% in 2012, 54% in 2010 and 46.8% in 2009)
- About 21.4% used flash memory on their edge servers (this was 12% in 2013, 14% in 2012, 16% in 2010 and 20% in 2009)

High-speed enterprise solid-state drives (SSDs) and other solid-state storage technology for edge content delivery were in decline from 2009 through 2013 but they seem to have recovered in 2014.

Digital Archiving and Preservation

Today most new entertainment and media content is born digital and it is natural that this content should be preserved in digital form. This requirement places new demands on format preservation for long-term digital archives as well as management and systematic format refreshes during the expected life of a digital archive. In addition, the cost of analog content digitization and preservation in a digital format has gone down considerably and many digitization projects are proceeding apace. The growth of digital content archiving will swell the amount of content available for repurposing and long tail distribution. It will also swell the amount of storage and storage facilities required to store these long-term professional content archives.

Following are some observations from the professional media and entertainment survey on trends in digital archiving and content preservation. The ease of capturing and storing digital content has encouraged many facilities and organizations to store more of their raw captured content and even copies of all their distribution formats.

Following are some detailed results from the 2014 survey, compared to the 2013, 2012, 2010 and 2009 surveys.

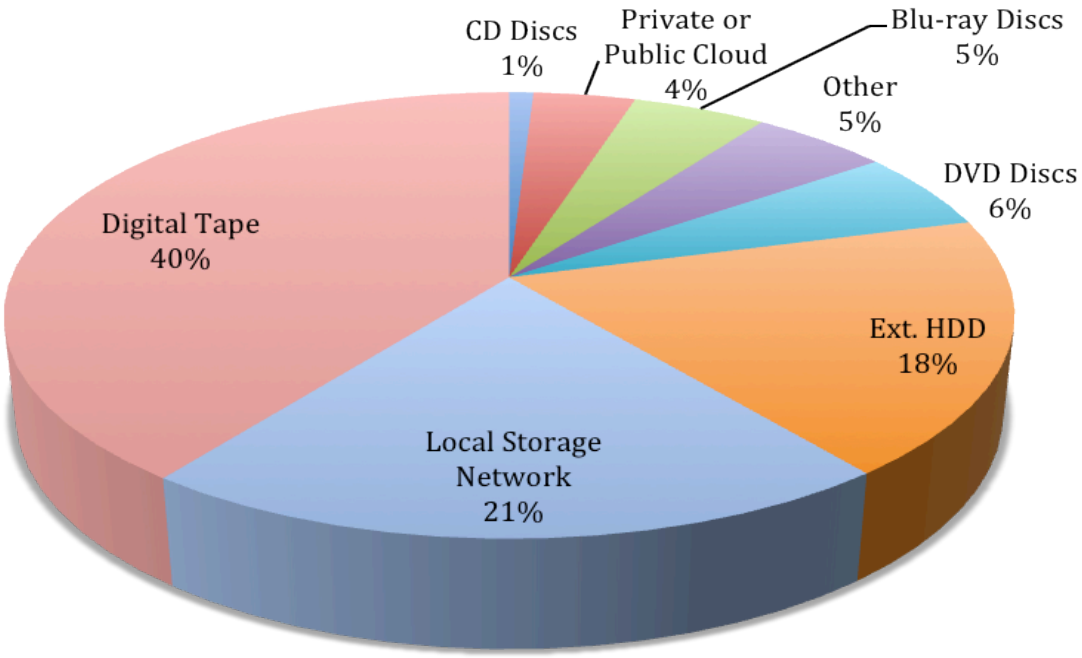
- 41.9% had >2,000 hours of content in a long term archive in 2014 (compared to 43.8% in 2013 and 18% in 2012—note large number of smaller survey participants in 2012. This was 52% in 2010 and 44% in 2009,
- 46.5% archived all the content captured from their cameras in 2014 (this was 48.6% in 2013, 63% in 2012, 34% in 2010 and 40% in 2009)
- 69.4% archived copies of content in all of their distribution formats in 2014 (this 56.9% in 2013, 71% in 2012, 57% in 2010 and 55% in 2009)
- 44.3% digitally archived all content captured from their dailies in 2014 (this was 37.7% in 2013, 40% in 2012 and 24% in 2010)
- 40.8% digitally archived all content captured from rough cuts in 2014 (this was 46.6% in 2013, 46% in 2012, and 23% in 2010)
- 38.6% digitally archived all content captured from their intermediaries in 2014 (this was 46.3% in 2013, 8% in 2012 and 30% in 2010)
- In 2014 about 21.5% of the survey respondents have an annual analog conversion rate of 2% or less (compared to 27% in 2013 and 56% in 2012)
- In 2014 67.3% of the respondents said that their annual archive growth rate was >6% (this was 65.3% in 2013).
- The average rate of conversion is about 7.0% (this was 7.6% in 2013). This is within the general range observed in 2012, 2010 and 2009)
- 35.1% added 1,000 hours or greater to their archive annually in 2014 compared to 34.4% in 2013, 9.3% in 2012 and 39% in 2010. (The 2012 results was probably due to the inclusion of many smaller producers)
- About 33.3% had >2,000 hours of unconverted analog content in 2014 (compared to 24.2% in 2013, 18% in 2012, 54% in 2010 and 48% in 2009)
- In 2014 14.3% of participants had over 5,000 hours of unconverted analog content (this was 3% in 2013)

Professional media and entertainment content was traditionally archived on film or analog videotapes. Today the options available for archive media to store digital content depend upon the preferences and existing infrastructure of digital archive facilities. **Figure 6** gives the percentage distribution of archive media used by the survey participants.

Among the survey participants Digital Tape was the most common storage media (40% in 2014 compared to 43% in 2013, 23% in 2012, 36% in 2010 and 33% in 2009). Local Storage Networks were the next most common at 21% in 2014 (this was 8% in 2013 and 12% in 2012). External Hard Disk Drives are the next most common at 18% in 2014 (the similar category in earlier years was labeled Hard Disk Drives and was 31% in 2013, 28% in 2012, 24% in 2010 and 25% in 2009). Optical discs of all sorts were about 12% in 2014 (compared to 8% in 2013, 28% in 2012, 21% in 2010 and 23% in 2009). For the 2014, 2013 and 2012 surveys we added archiving in a private or public cloud and found that 4% used a private or public cloud in both 2014 and 2013 (this was 5% in 2012. For

the "other" category we had 5% in 2014 (compared to 6% in 2013, 4% in 2012, 19% in 2010 and 18% in 2009).

Figure 6. Percentage of Digital Long-Term Archives on Various Media



We are guessing that in the earlier surveys archiving on local or remote network storage was a significant part of the "other" archive methods. Presumably many of the HDDs used for archiving are in arrays for warm (near-line) archives and that storage in a local network or in the cloud is likely on hard disk drives as well (making likely HDD archiving about 43% of the total, note though that there are now LTO LTFS based cloud storage systems using tape so the HDD number could be a bit lower). These numbers are abstracted from the actual response distribution since many facilities may use one or more archive storage media.

Table 7 gives the average projected growth rate for these archive storage media based upon the 2014, 2013, 2012, 2010 and 2009 surveys. This data is a simplification of the complete results from the survey.

The growth rate of digital tape is less than that of hard disk drives if we include external HDDs and local network storage. Hard disk drives, either in local storage systems and devices or through network and remote storage appears to be getting a significant growth spurt. Note though that there are LTO tape based cloud archives now being introduced to the market, so actual cloud archive storage will likely be split between tape and HDDs. It is also clear from the survey that there is a segment of this market that will continue to rely on optical media for digital archives.

Table 7. Simplified percentage growth rate of various archival media types.

	2014	2013	2012	2010	2009
Digital Tape	57.7%	64.5%	56.8%	76.1%	69.2%
CD Discs	12.5%	12.9%	20.1%	56.6%	63.5%
DVD Discs	18.8%	21.0%	34.5%	32.7%	32.7%
Blu-ray Discs	15.6%	16.1%	26.6%	26.5%	25.0%
Hard Disk Drives		48.4%	69.8%	21.2%	26.9%
Ext. Hard Disk Drives	42.4%				
Local Network Storage	39.1%	29.0%	24.5%		
A Private or Public Cloud	23.4%	19.4%	17.3%		
Other	12.5%	9.7%	12.2%	19.5%	27.9%

Some other observations from the archive and preservation section of the survey:

- About 25.4% never update their digital archives in 2014 (compared to 42.4% in 2013, 44% in 2012, 39% in 2010 and 41% in 2009)
- About 77.9% used different storage for archiving and working storage in 2014 (this was 81.8% in 2013, 71% in 2012, 77% in 2010 and 75% in 2009)
- About 67% copied and replaced their digital long term archives every 10 years or less in 2014 (this was 47% in 2013, 50% in 2012)
- 40% said that they would use a private or public cloud for archiving content in both 2014 and 2013

2014 DIGITAL STORAGE FOR MEDIA AND ENTERTAINMENT REPORT

This updated and expanded report is the ninth 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 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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About the Author

Tom Coughlin, President, Coughlin Associates is a widely respected digital storage analyst and consultant. He has over 30 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 ***2014 Digital Storage for Media and Entertainment Report*** from Coughlin Associates. Order information on this report can be found at: www.tomcoughlin.com/techpapers.htm.

Dr. Coughlin is active with SMPTE, IDEMA, SNIA, the IEEE and other professional organizations. Tom is the founder and organizer of the Annual Storage Visions Conference (www.storagevisions.com), a partner to the annual Consumer Electronics Show as well as the Creative Storage Conference which is held in Culver City, CA (www.creativestorage.org). Tom is also the chairman of the annual Flash Memory Summit. He is a Leader in the Gerson Lehrman Group Councils of Advisors and a member of the Consultants Network of Silicon Valley (CNSV). For more information on Tom or his publications go to www.tomcoughlin.com.

