

Content Aware Tape Will Play a Leading Role in Professional Video Applications

Thomas Coughlin
Coughlin Associates
www.tomcoughlin.com

The Industry is Moving from Analog to Digital Production Workflow

Magnetic video tape has been a key technology for entertainment and video creation for over 20 years. Video tape recorders and analog magnetic tape editing and archiving systems are still the mainstay of many television and newsrooms archives. Analog magnetic tape meeting proper specifications and under the right storage conditions has been shown to have an archival life of at least 30 years. The re-use and preservation of historical video records has relied upon the reliability of analog magnetic tape archives.

Analog content has significant inefficiencies in a world that is moving rapidly to digital content creation. Content creators have to look for cost effective means to move into the digital content creation and editing world. In the older analog world schematically shown in **Figure 1** most of the operations are manual and require actual physical movement of analog tape assets between steps in the work flow. Maintaining analog magnetic tape archives requires mostly manual labeling techniques and manual selection of tapes in shelved storage. These operations are subject to errors and slow down the creative process while adding additional pressure to production deadlines.

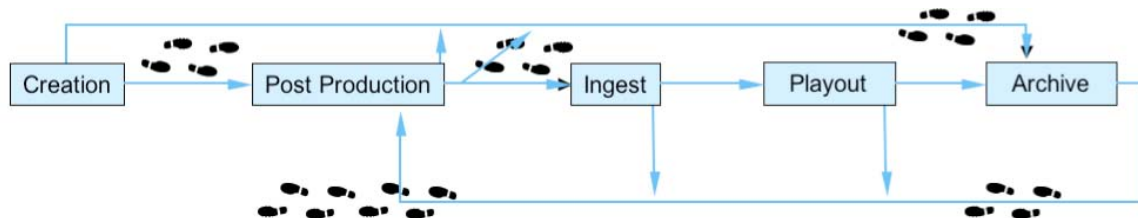


Figure 1. Analog Video Production Environment Showing Inefficiencies.

In an environment where video elements need to move around faster than real time and content creators expect to use metadata to find anything instantly, the videotape technology of the past won't work. Using a digital workflow increases the efficiency and lowers the costs of production. It also makes re-use of existing video and entertainment assets much easier and cost effective using digital content metadata and networking technologies. **Figure 2** is a representation of a digital video production workflow.

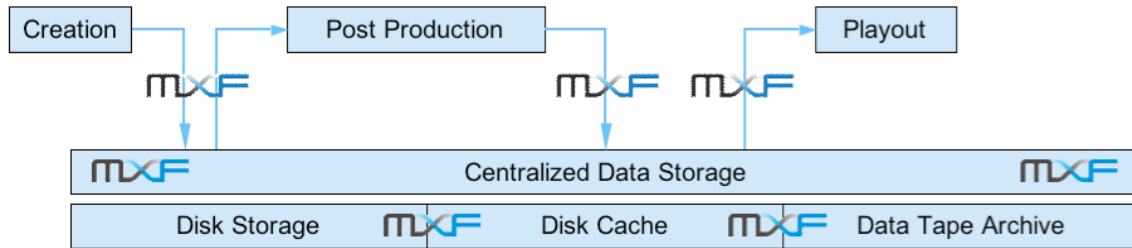


Figure 2. Digital Video Production Environment Including a Digital Tape Archive

The Material Exchange Format (MXF) is a SMPTE standardized applications independent format for data exchange of video and audio with associated content “essence” and metadata. Using MXF metadata tags that are stored with the actual essence of video and audio content, digital assets can be organized and accessed much more readily. Furthermore some of the metadata information creation can be automated, reducing the efforts needed for organizing and maintaining an archival database.

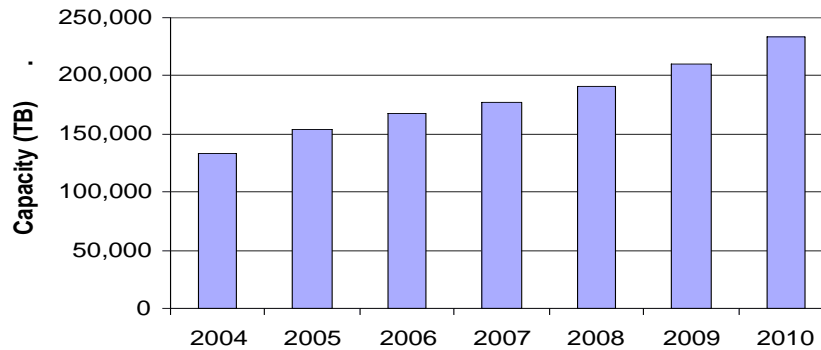
Using MXF and storage tiering technologies developed for the corporate Information Technology (IT) storage industry allows cost effective networking and sharing of digital assets throughout a production and editing environment. In the corporate digital storage industry digital tape is well established as an archival media and can be incorporated in library systems to provide automated access to historical assets. Storage tier architectures allow for the storage of digital content in storage devices that provide the most cost effective solutions to meet the access requirements for digital assets based on for instance content age or frequency of access.

Significant Growth Expected for Magnetic Tape in the Entertainment Market¹

Coughlin Associates projects that total tape unit usage in the entertainment market will increase close to 3-times between 2004 and 2007 due primarily to the increase in digital content archiving and backup. **Figure 3** shows our projections for digital storage capacity demand for film and broadcast archiving between 2004 and 2010. Digital archiving capacity demand will increase close to 4-times between 2005 and 2010 (a 42% annual increase).

¹Material in this section is from **2005 Entertainment Content Creation and Digital Storage Report**, available from Coughlin Associates, www.tomcoughlin.com

Figure 3. Storage Capacity Estimates for Film and Broadcast Archiving¹



The Quantum SDLT 600A with DLTxchange Creates Content-Aware Tape Storage

Digital tape drives using magnetic tape can provide reliable transfers faster than real time; the ability to store multiple formats and resolutions, including HD; a proven archival life; and a reliable technology platform derived from the IT environment.

The DLT family of tape backup and archiving systems is proven, highly reliable and cost effective. It is one of the most successful tape drive platforms ever built, with more than one hundred million tape cartridges and 2 million drives in use.

Leveraging this DLT technology, Quantum has developed a video-centric data tape drive system called the SDLT 600A® with DLTxchange™ that reduces cost and improves workflow, simply and effectively. The unique combination of being MXF-aware and attached to the network via gigabit Ethernet with built-in FTP access, gives the SDLT 600A with DLTxchange an SDI video-like interoperability. This offers professional video users the well known benefits of data tape in combination with some of the flexibility they have always enjoyed with videotape.

The data tape format of the SDLT 600A includes a specialized file system on the tape, making any cartridge (or specific frames on a cartridge) accessible and readable anywhere, anytime by any platform and any operating system. When a tape cartridge is initially loaded into the SDLT 600A, the tape table of contents is loaded into RAM memory within the drive. The user can then view the table of contents via standard Ethernet connectivity, and browsers such as Window Explorer or other FTP clients. With this accessibility the user can specify which files to transfer or in the case of a partial file restore which time segments of a sub clip to restore, the drive will then access those specific files. Previously with video tape, the user would have to access the entire file and view the contents and then determine which segments to restore, which is a very manual intensive and time consuming process. **Figure 4** shows how DLTxchange technology can be used to access all video and audio formats, and time code sub-clip access across any platform and operating system.

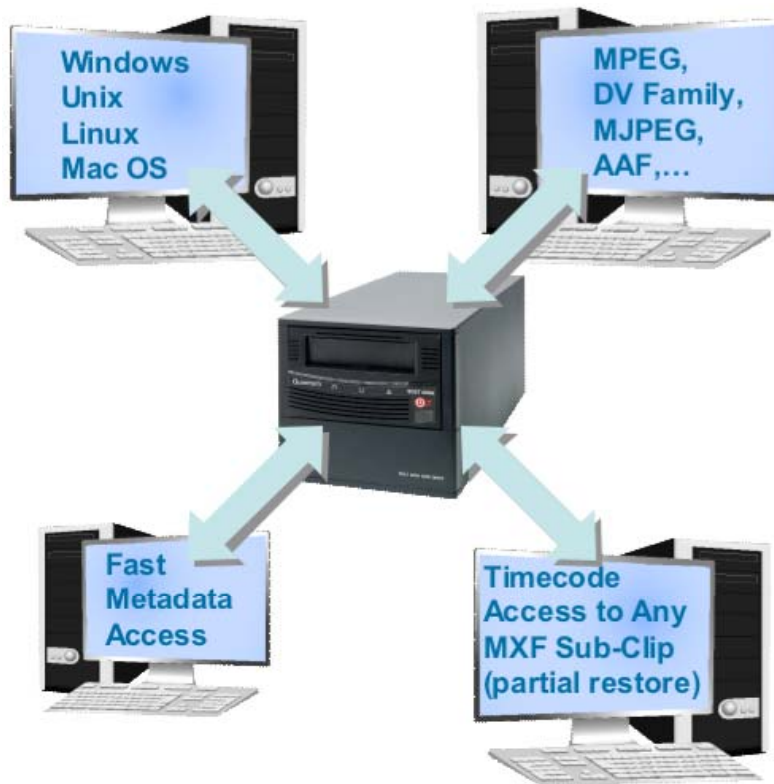


Figure 4. DLTxchange is “MXF Aware” Allowing Multimedia File Access and Search

Quantum’s SDLT 600A with DLTxchange utilizes Super DLTtape™ IIA media with a 300 GB native capacity and a 36 MB/s native data transfer rate. As previously stated the SDLT 600A has a Gigabit Ethernet interface and a directly mountable file system accessible through FTP with fast access to the file metadata and partial file transfers possible. Some additional features of the SDLT 600A and SDLT IIA media are:

- By allowing a wide range of devices to access the drive via MXF over the facility’s network, the drive becomes “working storage” for any workstation user, regardless of the software application that runs the post-production system.
- The SDLT 600A allows faster than real-time access to common format HD and SD-content since the tape drive data transfer rate is higher than the compressed video data rate. As an example, 100 Mb/s HD (such as DVCPRO-HD) content can be transferred about 3x faster than real time and 25 Mb/s SD content (such as DV25) can be transferred about 12x faster than real time.
- With a tape-based, network-attached data storage solution, facilities can easily access the assets located on any of their data tapes.
- Video and audio files on rugged data cartridges offers a reliable method to transfer content to and from play out servers in mobile environments, such as mobile trucks at sporting events or breaking news stories at remote locations. Super DLTtape™ IIA media can be easily moved between libraries, stand-alone drives and even video facilities.

- Risks associated with vendor and application dependencies can be reduced because each cartridge has a built-in file system which is accessible to all applications.
- In a disaster recovery situation tapes from the archive can be put in any drive to get content on-air or to any broadcast application

Quantum reports that their SDLT product family will have regular updates of higher storage technology and data rates. **Table 1** shows the Quantum SDLT roadmap for native storage capacity and how much of various resolution video capacity can be stored per cartridge for reasonable assumptions on the data storage rate.

Table 1. SDLT Tape Storage Capacity Roadmap vs. Hours of Common Broadcast Video Resolution Content

SDLT Generation	Native Storage Capacity (GB)	SD Capacity (Hours) [25 Mb/s] (e.g. DV25)	HD Capacity (Hours) [100 Mb/s] (e.g. DVCPRO-HD)
SDLT 600A	300	26.7	6.7
DLT-S4A	800	71.1	17.8
DLT-S5A	1,600	142.2	35.6
DLT-S6A	~3,250	288.9	72.2
DLT-S7A	~6,500	577.8	144.4

Quantum SDLT 600A Lowers Storage Costs

The most obvious benefit of tape over all random-access storage technologies (such as optical disks or hard disk drive storage systems) is cost. Magnetic digital tape is more cost-effective than other storage technologies such as optical disks and hard disk drive arrays and with the large files produced for SD and HD storage this fact should not be overlooked. Tape also provides a long lived shelf storage medium and is an effective and reliable way to physically transfer content. This is especially important when a physical medium is needed or when networks are too slow, incompatible, or non-existent.

Super DLTtape IIA cartridges offer lower costs than videotape, when based upon hours of content capacity. The SDLT 600A with DLTxchange will cost approximately 2/3 of the price of traditional VTR equipment. The equivalent cost of 300GB worth of videotape for popular videotape formats are \$479.47 and \$436.27 respectively which is 3-4X the cost of a Super DLTtape IIA 300Gb cartridge.

Quantum has a long history of backward compatibility for their tape storage products and this makes it possible to mix older cartridges with new cartridges in an archive situation, making an ordered format transfer possible.

Summary

The entertainment and broadcasting industry movement from analog to digital production workflow is well underway. The last remaining bastions of analog content are analog videotape archives and production environments based on analog videotape. Moving video production from analog magnetic videotape systems to SDLT 600A digital tape drives with SDLT IIA tape cartridges creates a cost-effective archive solution with the proven archival reliability of tape. With the DLTxchange technology, broadcasters and content creators have the ability to work with content stored on the SDLT IIA tape as universally accessible data files using MXF metadata.

An SDLT 600A archive system offers significant cost advantages per GB of storage capacity than analog videotape while at the same time it offers multiple platform and operating system access to the data using MXF metadata. This combination of tape transportability, archivability and file-based content-aware storage allows use of this storage solution in automation environments as well as shelf-based storage and also allows ready access and use of digital tape content in disaster recovery situations. The SDLT 600A can readily be used as part of the storage hierarchy in a network storage environment.

The Quantum SDLT product family will have regular updates of higher storage capacity and data rates over the coming years. Format obsolescence can be slowed due to the downward read compatibility of SDLT tape technology. As entertainment and broadcast content resolution increase these tape capacity and data rate increases will allow continued support for faster than real time archival storage and access for the demanding environment of this fast developing industry!