

BEST PRACTICES FOR MANAGING VIDEO WORKFLOWS

How media and entertainment companies are innovating and improving production, post-production, distribution, and archival data strategies

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The secret? LTO tape storage with LTFS

Introduction

Over the past decade, there has been a considerable increase in the amount of data generated by media and entertainment companies due to the transition from traditional media workflows to fully digital environments. This trend will continue to accelerate as the industry moves from HD to 4K, and soon to 8K, recording. A single digital 4K camera alone can record up to 1.5 TB for every hour of filming.

Because editing digital files requires very high bandwidths across the post-production workflow, a high-performance networking and storage infrastructure is necessary. The industry has also seen a proliferation of files and formats: each day's shoot creates a series of files, all of which must be indexed, backed up, distributed to post-production, and then archived. Technologies that were once largely confined to the IT world, such as RAID disk arrays (redundant array of independent disks), Fibre Channel networks, and high-performance flash disks, are now being used for post-production workflows.

Increasingly, creative professionals who want to improve workflow efficiency dramatically need a storage technology that is:

- Cost-effective
- Nimble enough to be used at remote locations but scalable to extremely large capacities
- Highly reliable
- Open enough to allow the interchange of files without proprietary bottlenecks

That's why leading content providers such as Funimation, Lucky 8, and Pontecorvo Productions are investing in LTO technology with LTF5 tape storage. LTO tape, a high-capacity storage medium, together with LTF5, a non-proprietary self-describing open tape format, offer an ideal solution for these companies, providing them with measurable improvements in performance, speed, and workflow.

This ebook will share best practices from these companies and detail how and why they selected LTO technology and LTF5-based solutions.

How LTO Technology and LTF5 Manage Every Stage of Content Creation/Management

The combination of LTO technology and LTF5 improves workflows for each of the four key areas in this industry:

- 1. Production.** LTO technology with LTF5 protects original content with on-site backup copy, reduces camera media inventory costs, and enables the interchange of content between production sites and post-production.
- 2. Post-Production.** LTO technology with LTF5 offers a low-cost storage solution for work-in-progress, scales to meet large capacities, provides a standard means of interchange across the post-production ecosystem, and gives users the ability to offload less active content from expensive, high-performance flash disks.
- 3. Distribution.** LTO technology with LTF5 supports the transfer of large amounts of digital content at low cost and serves as the de facto standard for submission of content—to studios and between business partners.
- 4. Archiving.** LTO technology with LTF5 is ideal for long-term storage due to its durability, reliability, and low cost of operation. It scales to meet very large capacity requirements and supports rapid restoration for the repurposing of content.

"One of the exciting aspects of LTF5 is that it makes tape as easy to use as disk," says Brad Johns, founder of Brad Johns Consulting LLC, a storage consulting firm. When a tape is being

"The ecosystem that exists in the media and broadcast industry means that users really need to be able to exchange files in a fast, simple way. LTF5 provides that."

— Fred Moore, Horizon Information Strategies

accessed using an LTFS infrastructure, the user interface is similar to that of a USB flash drive, where the user sees a directory of folders and files.

“You can sort through [data] quickly, you can drag and drop files. It really opened up the tape market to the new markets beyond traditional backup and recovery,” adds Fred Moore, a consultant with storage consultancy group Horison Information Strategies.

In the Trenches for Creatives: Production, Post-Production, Distribution, and Archiving

As the modern combination of LTO technology and LTFS has continued to innovate, multiple industry workflows are benefiting—including production, post-production, distribution, and archiving.

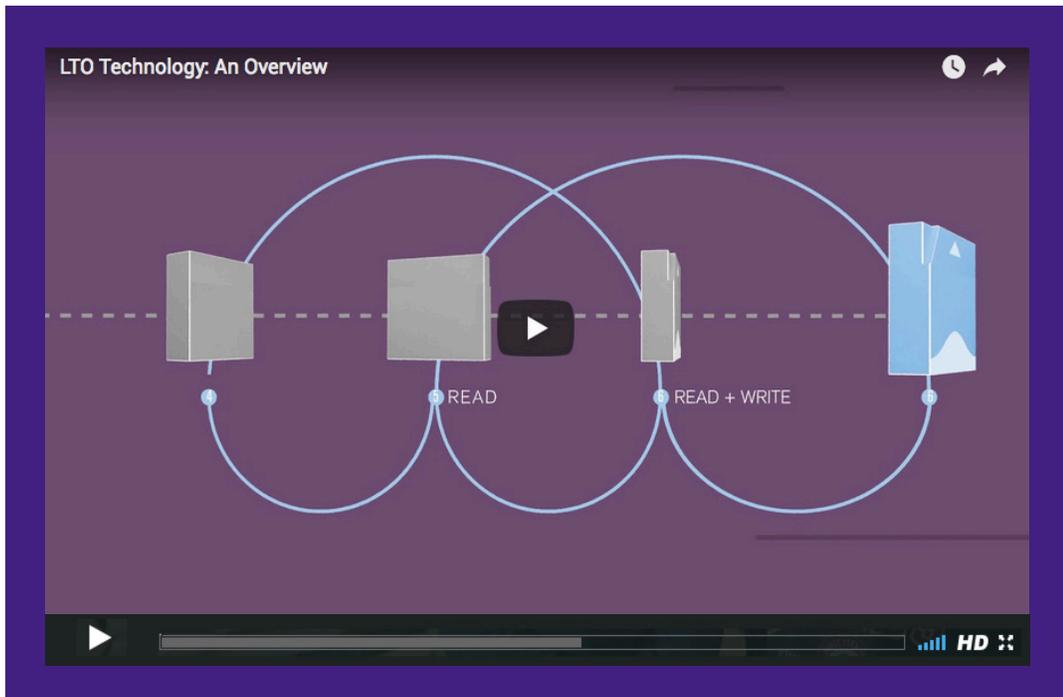
PRODUCTION

For production, one of the biggest challenges is protecting and managing each day’s files in a cost-effective way. LTO technology and LTFS address this challenge by utilizing LTO tape with LTFS to offload camera media while concurrently performing error checking, verification, and indexing.

Seattle-based Pontecorvo Productions is in the business of creating documentaries, many of which are shot in remote locations. In its quest to explore nature, science, and culture, the production firm shoots extensively in 4K. When the crew is on location in a remote locale like Yosemite National Park or the mountains of Japan, the in-the-field production can last

Benefits of LTO Technology with LTFS Across the Industry

 <p>Production</p>	<ul style="list-style-type: none"> • Protect production with on-site backup copy • Reduce camera media inventory cost • Low-cost, high-capacity interchange with post-production
 <p>Post-Production</p>	<ul style="list-style-type: none"> • Low-cost storage for nearline work in process • Scales to meet very large capacities • Standard interchange across the post-production eco-system
 <p>Distribution</p>	<ul style="list-style-type: none"> • Supports transfer of very large amounts of digital content at low costs • Widely accepted across studios • Low-cost, high-capacity
 <p>Archive</p>	<ul style="list-style-type: none"> • Low-cost, highly-reliable archive storage • Scales to very high capacities • Rapid restore supports repurposing of content



Each day's filming represents a significant investment. The footage needs to be backed up quickly, and duplicate copies must be made. In the past, hard drives were used, but these drives proved to be too heavy to drag into the field and too expensive to ship, and they weren't able to withstand the rigors of long-distance travel.

To solve this dilemma, [Pontecorvo Productions](#) implemented a portable workstation with an LTO tape-drive solution from [1 Beyond](#) to offload footage directly from the camera media to LTO media. This footage was simultaneously uploaded to the internal hard drive for review. After review, a second copy of the tape was made from the hard drive itself.

This new solution resulted in sizable cost savings. Since they were offloading audio and video quickly after each shoot, the Pontecorvo team were able to reduce their camera media inventory. In addition, LTO tape cartridges are less expensive than hard drives.

An unexpected benefit also came in the form of insurance. Insurance companies viewed the use of LTO tape for production backup and archives more positively, and therefore they reduced the cost of their insurance premiums. "The use of LTO technology and LTFS, in combination with the 1 Beyond solution, [proved] to be a great way to deal with the data management challenge of remote production," Johns says.

POST-PRODUCTION

The storage and workflow requirements of post-production are unique: post-production work demands a very high performance infrastructure, and the material being processed must be properly stored and protected.

**POST-PRODUCTION**

Funimation migrated from legacy disk, optical, and TAR tape to a very cost efficient intelligent archive engine and LTO LTF5 environment for backup and archive.

The combination of LTO technology and LTF5 is ideal for post-production because it offers cost-effective data management of many large files. The LTO technology and LTF5-based solutions offer an intelligent front end to the content and eliminate proprietary software dependencies so that content can be manipulated on any number of workstations. As a result, it's an ideal media for sharing content with partners throughout the entire production process.

In addition, the combination of LTO technology with LTF5 can automate intelligently the backup of work-in-process files. Less active files can migrate automatically to low-cost LTO technology and LTF5 storage throughout the post-production process, or users can identify those folders with content that has changed and automatically back up new content overnight.

For [SIM Group](#), a post-production technology and services provider, the challenge was to come up with a storage solution that could be used easily by local production teams and that would also protect the group's media assets in a secure manner.

SIM—which specializes in on-set data management, digital dailies editorial system rentals, and data archiving—could not always afford to send their own production team out on production shoots. So they often looked to local production resources to handle camera media offload and backup of dailies. But that meant they needed a solution that was simple to use and required minimal training.

SIM Group also wanted a flexible solution that allowed them to support widely varying workloads; sometimes they would have many projects, and at other times just a few. They were looking to maximize their production efficiencies while safeguarding customers against unanticipated costs. The firm wanted to protect each day's production to reduce the need for any reshoots.

To accomplish these goals, SIM Group implemented a workstation application from [Imagine Products](#) to transfer camera media to LTO with LTFS tape. The solution allowed SIM Group to index camera originals—including thumbs, proxies, and metadata—automatically, and to scale their usage of the system as their workloads fluctuated. A streamlined setup such as this requires only a workstation and an LTO tape drive, which makes it simple enough for non-IT staff to operate the system smoothly.

“Before LTFS came along, a lot of time and money was put into figuring out how to de-archive other companies’ tapes,” says Jesse Korosi, director of workflow services at SIM Group. “With LTFS tapes being recognized in so many different software options, post companies like ours are saving money not having to build out a new workflow/system for every job we receive that needs to be de-archived.”

For post house [Funimation](#), the challenges were a bit more complicated.



Funimation is a rapidly growing independent post studio with a wide range of services: licensing, production, and distribution, as well as an in-house production facility with translation services. Their infrastructure is unique and vast, and it must support influx of content, post-production, distribution, and re-purposing of content on a massive scale. To remain competitive, Funimation required a high-capacity, high-performance storage infrastructure that’s reliable, scalable, and cost-effective.

Their solution was to migrate from legacy disk/optical/TAR (Tape ARchive) tape to an intelligent archive solution from StorageDNA that includes an LTO and LTFS tape library for backup and archive. The solution proved its scalability as soon as it was installed, as Funimation began migrating more than 3PB of original content. It also meets Funimation’s scalability requirements by growing around a petabyte each year. The intelligent archive capabilities within

LTO and LTFS solutions provide fast restore of content for repurposing and offer metadata indexing ability in those cases where data has been damaged previously.

The biggest draw of this solution for Funimation is the cost savings. Costs for using LTO-7 technology and LTFS are as low as \$0.02/GB which can be 50 times less expensive than online storage options. "Tape storage in general is the lowest cost storage of any type of storage," says Johns. "[LTO technology with LTFS is] an open storage format, so you're not locked into anything proprietary. The media itself can last up to 30 years. And it doesn't use any energy when it's not being used."¹

The high restore speeds available for LTO tape mean that LTO-7 can restore data at up to 300MB per second.² This is a key requirement when post work demands that large amounts of content be restored for further editing. Johns points out that the recall of sequential files from tape is faster than it is from traditional disk storage. For both Funimation and SIM Group, LTO technology offers a flexible storage solution. LTO libraries that can scale to thousands of tape cartridges with many petabytes of data are available.



DISTRIBUTION

For delivering content, the major workflow challenge is moving material cost-effectively across a distributed ecosystem. Often the size of the files ranges up to hundreds of terabytes, making an efficient distribution strategy critical.

While high-speed networks are falling in price, they're usually too expensive for anything other than the final distribution of content to the final consumer. LTO technology with LTFS tape, meanwhile, is not only the lowest-cost media available, but it's also cost-effective for data

¹ "HPE Ultrium Quick Specs" <https://www.hpe.com/h20195/v2/getpdf.aspx/c04154430.pdf>

² "Ultrium LTO-7 Questions and Answers," <https://www.lto.org/2015/10/lto-7-specifications-questions-answers/>

transmission. A single flat-rate box can hold up to 28 LTO-7 tapes, providing up to 168TB of native capacity that can be shipped anywhere in the US overnight for only a few hundred dollars.

The challenge for [Lucky 8](#), a production company based in New York, was to install a storage and workflow solution that would allow it to handle the amount of content it produces and stores for [Discovery Communications](#). Lucky 8 develops and produces a range of series and specials, from documentaries to formatted reality content, in genres that span comedy, science, food, and adventure.

For Discovery, Lucky 8 must finish programs and deliver the original footage on LTO tape with LTFS in a specific format. In order to meet these requirements, Lucky 8 installed a portable workstation and supporting software. The software automatically checks tapes for compliance with Discovery's standards. This on-site quality control, Lucky 8 says, saves time. Lucky 8's automated file-based workflow scenario also requires minimal training and incorporates an inexpensive in-house archival solution.

Distribution also requires consistency and reliability. Lucky 8 and other distribution companies have found that LTO-7 tape media has a documented bit error rate that translates to one error event in every 200,000 LTO-7 cartridges.³ Likewise, LTO drives support native hardware encryption for protecting vital content.

ARCHIVING

Archiving has always been a key use case for tape storage, and with LTFS it has become a lot easier. The core challenge for archiving is finding a means to secure cost-effective storage for massive amounts of content for very long periods of time while also maintaining an index of this content.

LTO technology with LTFS has a number of features that make the solution particularly attractive for archival use. Since it doesn't require an external power source when not in use, energy costs are significantly reduced. A study conducted by the Clipper Group found that the energy savings in an LTO solution with LTFS (compared to a disk solution) pay outright for the cost of the tape library, media, and drives. Tape continues to provide the lowest cost storage available, with LTO-7 cartridges available at approximately two cents per GB.

The open format of LTFS also eliminates the need for proprietary software to access the content. This may reduce the cost of supporting and maintaining proprietary software over extended periods of time. Perhaps most significantly, LTO tape has a long media life.

For one non-profit organization tasked with preserving some of the world's most important cultural heritage sites digitally, the stakes were high. [CyArk](#), based in Oakland, California, uses advanced recording technologies like 3D laser scans and time-of-flight cameras to preserve heritage sites, like an ancient Incan village or a landscape in the Peruvian Andes, digitally.

Using these technologies, CyArk creates terabytes of irreplaceable data that they need to store at the lowest possible cost with high levels of security and reliability. The company installed an intelligent active archive solution that includes a NAS front end with an LTO with LTFS tape library on the back end.

The combination of LTFS with LTO tape has created a non-proprietary storage medium that is transforming workflows for M&E companies.

³ Ultrium LTO: Get the Facts*, https://www.lto.org/wp-content/uploads/2014/07/LTO_Get_The_Facts_10_15.pdf



ARCHIVE

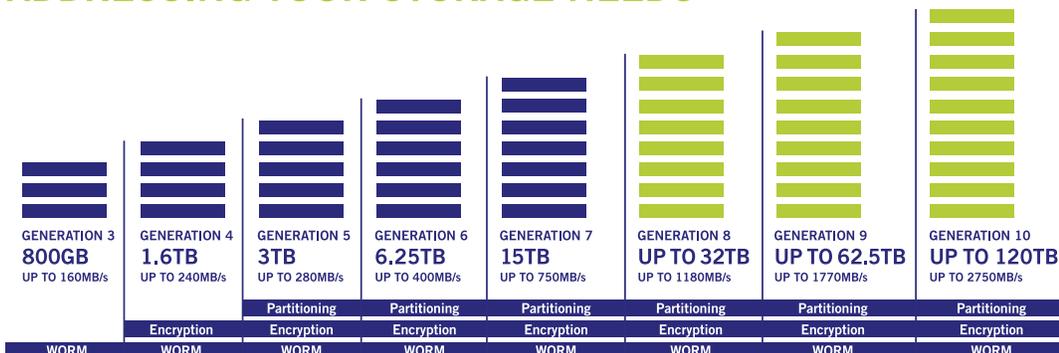
To create high-resolution 3D scans of heritage sites, the non-profit CyArk relies on an intelligent active archive solution with an LTO and LTFS tape library.

This intelligent archive solution is scalable and maintains the integrity of content through authenticated access with data integrity checks at the file level. CyArk is confident that the data written on the tape is exactly that which was read. “We know data is secure. We know it’s safe, and that empowers us to be able to do what we want to do as a company,” says Elizabeth Lee, director of CyArk operations. “Success is always accessing every file perfectly, never losing any file. Now we can bring new partners on board and easily share our information with them.”

Summary

More media and entertainment companies are seeing the advantages of the combination of LTFS with LTO tape, which has a unique ability to accommodate massive amounts of storage, address high-performance networking, handle myriad formats, and tackle evolving methods of content distribution—whether in production, post-production, distribution, or archiving.

LTO ULTRIUM ROADMAP ADDRESSING YOUR STORAGE NEEDS



Note: Compressed capacities for generations 1-5 assume 2:1 compression. Compressed capacities for generations 6-10 assume 2.5:1 compression (achieved with larger compression history buffer). Source: The LTO Program. The LTO Ultrium roadmap is subject to change without notice and represents goals and objectives only. Linear Tape-Open, LTO, the LTO logo, Ultrium, and the Ultrium logo are registered trademarks of Hewlett Packard Enterprise, IBM and Quantum in the US and other countries.

While LTO technology began as a backup and archive solution, the technology has developed to offer higher capacities, scalability, portability, and a long archive life.

Now, the combination of LTFS with LTO tape has created a non-proprietary storage medium that is transforming workflows for M&E companies. LTO technology with LTFS can boost efficiencies, cut costs, and creatively manage data through all the steps of the production and archive process. LTO technology with LTFS can offer improvements over other types of storage technologies, such as:

- Lower cost per GB
- High capacity
- Fast performance
- Reduced energy costs
- Portability
- Greater reliability
- Better longevity
- Scalability
- Compatibility
- Clear improvements in workflow

What's ahead? LTO Generation 10 will offer cartridge capacity of 48TB.⁴ Media professionals should consider whether an LTO with LTFS solution will offer the key improvements—in terms of cost, security, reliability, and scalability—they're seeking. Potential users should begin by identifying day-to-day tasks that create bottlenecks or slowdowns and making a list of the workflow inefficiencies their organization is looking to solve.

With subsequent generations promising to offer increased speeds and capacity, LTO technology with LTFS looks well positioned to drive workflow improvements across the media, entertainment, and broadcast industries.

Continued growth will come in the form of LTO's next generation of tape specifications: Generation 8, Generation 9, and Generation 10. ■

Ultrium LTO Technology

Nearly two decades ago, three powerhouses from the tape storage community—Hewlett-Packard Enterprise, IBM, and Quantum—came together to develop Linear Tape-Open, or LTO, technology. Today, LTO technology is the industry's go-to open tape solution because of its high capacity, high performance, and high data integrity capabilities.

LTO technology combines the advantages of a linear multichannel, bidirectional format with enhancements in servo technology, data compression, track layout, and error correction code to maximize capacity, performance, and reliability. LTO technology has been utilized in enterprise-wide data protection that accommodates a range of tape storage requirements, from single server to complex networked environments, for fast performance and high-capacity needs to address service-level agreements and data protection.

Continued growth will come in the form of LTO's next generation of tape specifications: Generation 8, Generation 9, and Generation 10.

More information can be found at www.lto.org.