Case Study





Time is the Enemy in Film Restoration.

The Pixel Farm, Ltd. Provides Fast, Efficient Automated Tools to Accelerate Film Restoration, Visual Effects, and Digital Image Editing, featuring LSI® RAID technology and JBOD Enclosures

The Challenge:

Film Restoration efforts around the world are working against the clock to save the artistically and culturally important content found on older, deteriorating film stocks. Until recently, the film restoration process was labor intensive and could take years to completely restore a single title. Thousands of titles, representing millions of feet of film are slowly turning to dust.

The Solution:

The Pixel Farm combines sophisticated digital tools with leading I/O technologies from LSI to automate many of the tedious manual processes that had been a routine part of film restoration.

The LSI 6Gb/s MegaRAID SAS 9280-16i4e controller, combined with the LSI 600 series JBOD, provide the performance, capacity, and value to deliver data to today's powerful multicore processors and accelerate digital video tools like PFClean.

The Result:

The time to digitize, restore, and remaster a feature length film has gone from months to days as a result of the intelligent integration of sophisticated software from The Pixel Farm, powerful multicore processors, and high performance RAID and JBOD technologies from LSI. For over a hundred years clever and creative people have been making and showing moving images on film to audiences for fun, education, and profit — from the Lumiere brothers to the Coen brothers.

Dust and Flame

Until the 1950s most film work was done on nitrate based film in part due to the luminescence and range of blacks and grays that the stock's silver content enabled. Unfortunately, time has taught us nitrate based film stock is a volatile, some say dangerous, medium because of its flammability. An entire mythology has grown up around the highly combustible nature of the film and the many theater, studio, and archive fires that have occurred over the years involving nitrate film stocks.

For almost as long as there have been moving picture shows, there have been restoration efforts aimed at moving the images off nitrate based film stock before it crumbles to dust or bursts into flame. Before digital tools were widely available, film restoration was a mind-numbing, labor intensive process of manually fixing defects like dust, scratches, and faded color, one frame at a time. A one-hour film could have as many as 86,000 frames. Most feature length titles have over 100,000 frames. A single restoration could take years.

"We looked at the Herculean effort being made in film restoration labs around the world and decided we could help," claims Michael Lancaster, Managing Director of The Pixel Farm.

Modern Tools

"At The Pixel Farm we believed film restoration would benefit from the latest generation of high performance digital tools and technologies that modern original productions have begun to use to ingest, color correct, edit, add effects or titles, and render out at today's high resolution, large screen, and 3D formats. We introduced PFClean to begin addressing those needs," Lancaster continued.

PFClean is a digital image restoration tool that automates the removal of dirt, dust, scratches, and excessive graining in older films. Before tools like PFClean from The Pixel Farm, difficult, time consuming, frame-by-frame manual and chemical processes were required to remove artifacts and defects. A complete suite of edit, Visual Effects (VFX), and digital imaging (DI) tools now compliment PFClean's rich feature set.

"We were the first in our marketplace to effectively utilize the performance available in today's multicore processors," Lancaster claimed. "Our portfolio of restoration, VFX and DI applications are very cleverly written. Effectively utilizing the increased compute power allows us to develop very sophisticated features like motion estimation and automated dustbusting, both of which are very CPU-intensive.

"We chose The Pixel Farm's turnkey systems to boost our productivity. Having a client base including ITV, The British Film Institute, and Icon Entertainment requires us to produce the best possible results to ever shortening deadlines compounded by ever growing back catalogues.

The automated toolset and pure performance of the PFClean Turnkey System in conjunction with LSI storage is just phenomenal. The labor savings and productivity improvements have redefined the game for us.

Steve Boag Managing Director of Cineimage London



Carelessly Stored Film Stock Using systems with LSI technology, even these carelessly stored film stocks might be restored to their original luster.

"We were also first to use GPU acceleration, and that, combined with effective use of multicore processors allowed us to offer more powerful solutions to our customers for film restoration, enabling them to access, process, and render remastered titles back to disk in a fraction of the time it had taken in the past.

Feed the Beast

"But in pushing the limits of what could be done with modern CPUs and GPUs, we created another problem, how to 'feed the beast', how to keep data flowing to the processor cores fast enough to use all that compute power. In order to deliver the full potential of our applications, we needed I/O technology that would compliment the performance capabilities of the processor chipsets. We evaluated a number of possibilities and selected LSI for both its 6Gb/s MegaRAID® SAS 9280-16i4e controllers and high-density 600 series JBOD enclosures. We determined that storage technology from LSI would enable us to deliver the best performance possible and an important set of additional features," Lancaster said.

Performance

"When we're specifying a system for a client we assume a minimum data I/O rate of 12MB/ frame, 24 frames/sec, or almost 300MB/sec for a single stream of 8 bit, 2K uncompressed video. The impact on the bitrate increases by a factor of four when we assume 4K pixel width. In these cases we plan around a required I/O bandwidth of 1GB/sec or approximately 1.2 Tb/sec throughput," Lancaster offered.

Capacity

He went on to add, "Aside from the performance features of the LSI I/O technology, the scalability we could achieve by integrating LSI JBOD enclosures is a feature our clients value highly. We recently configured a set of restoration workstations for a major client using the MegaRAID SAS 9280-16i4e controller, matched to a pair of LSI 600 series JBOD enclosures with twelve 3.5-inch hard drives in each enclosure. That combination of power and capacity really helps drive efficiencies in the labs and post production houses we support.

"Our client in the example above was converting 1,200 titles of nitrate film stock to 10-bit, 4K uncompressed files, and the performance and capacity of the LSI-based storage handled it with ease, and in record time, too.

Density

"Along with the tremendous performance capabilities of the current 6Gb/s LSI Mega- RAID SAS 9280-16i4e, the density of the LSI 600 series JBOD allows us to consolidate all the drives we need to deliver the performance required in 8U of rack space. Some of our competitors are filling an entire rack to get the same results. In many cases we have an advantage simply because we deliver the functionality in a smaller footprint. Many of our restoration clients are very tight on space in their machine rooms.

Value

"Delivering the requisite performance with fewer moving parts also makes us a greener solution, one that takes less power to drive, requires fewer BTUs to cool, and reduces machine room footprint, and our clients appreciate that.



Nitrate Film Decomposition showing the loss of image on the film

One of the challenges facing film restoration teams is restoring original images. Top studios and labs across Europe use turnkey systems from The Pixel Farm, which include 6Gb/s I/O technology from LSI



Late Stage Film Stock Nitrate Decomposition For some film stock, it is simply too late. For others, systems based on The Pixel Farms' Software and LSI I/O technology offer the best hope for restoration.

"The bandwidth available from the LSI 6Gb/s MegaRAID SAS 9280-16i4e, the capacity and density we can achieve with LSI 600 series JBODs, and today's multicore CPUs, are driving savings for clients that they could only have dreamed about a few years ago. Older generation technology would have run to 5x the cost for the functionality we can now deliver for about \$50K USD today," Lancaster concluded.

In the race against time to restore early motion pictures, The Pixel Farm offers a series of tools to make the restoration teams more fleet of foot. The performance of applications like PFClean is driven by the intelligent use of multicore processors and I/O technologies from LSI. High performance digital tools and leading I/O technologies from LSI give film restoration teams their best chance yet to preserve one of our most important art forms for future generations.

Benefits

LSI 600 Series 6Gb/s SATA + SAS JBOD Enclosures

- Highly scalable storage for businesses with growing storage requirements
- 2U modular rack design for easy integration
- Hot swap and redundant components for increased system availability
- Fully tested and qualified with 6Gb/s LSI MegaRAID®, 3ware® RAID controllers and HBAs
- Supports SATA and SAS hard drives and SSDs for greater flexibility

LSI MegaRAID SAS 9280-16i4e 6Gb/s SATA + SAS Controller

- 6Gb/s I/O performance, highly scalable RAID data protection
- 16 internal ports for maximum storage capacity inside the server enclosure
- 4 external ports for scalability up to 240 hard drives in cascaded JBOD enclosures from LSI
- PCIe 2.0 host interface for accelerating large streaming applications that require high-bandwidth

"With the technology we have from LSI, we feel like storage has finally caught up with HPC style systems using the processing power of today's multi core CPUs and GPUs," said Michael Lancaster, Managing Director at The Pixel Farm. "As back catalogues in archives and libraries continue to grow, performance is an ever important factor as productivity and throughput has to increase to accommodate the restoration requirements of global film restoration. Working with LSI has helped us bridge that performance gap and meet the needs of our customers.

Michael Lancaster Managing Director of PixelFarm London

About The Pixel Farm

The Pixel Farm manufactures and markets innovative imageprocessing technologies that meet the demands of professionals working in the motion picture, broadcast TV, and interactive entertainment industries.

The company, headquartered in the UK, was established in 2002 by a management team with decades of experience in developing some of the world's most advanced 2D and CG effects systems.

Our products – which address VFX, DI, and restoration – are well-known and well-loved by digital artists worldwide, as they seamlessly integrate into the most demanding post-production environments, whilst supporting creativity and maximizing productivity. For more information, come on out to The Pixel Farm at www.thepixelfarm.co.uk

Components and Configuration

Product Overview – LSI



Product Overview – PixelFarm

The Pixel Farm.

The LSI MegaRAID SAS 9280-16i4e 6Gb/s controller provides a new level of performance, reliability, and availability to businesses that are facing storage challenges driven by unprecedented data growth. The MegaRAID SAS 9280-16i4e, with sixteen internal and four external ports, supports both internal drive storage and external JBOD expansion for up to 240 SATA or SAS drives.

The 600 series of JBOD storage enclosures from LSI are key storage building blocks for deploying affordable, scalable, and highperformance storage solutions. Designed to meet the needs of relentless data growth and reliability, LSI 6Gb/s SATA and SAS JBOD enclosures support a "start small, grow big" strategy by enabling users toconnect these 2.5-inch and 3.5-inch enclosures to LSI storage adapters for extremely scalable storage.

All of the Pixel Farm's systems run a customized Linux distribution to provide a robust and powerful platform. Every aspect of the system, from processors to disk storage, has been tested and optimized.

All systems, regardless of their price, take advantage of the latest 6Gb/s SAS storage performance offered by The Pixel Farm's close links to LSI to provide RAID 5 protected storage. Each system with LSI I/O technology is designed to provide a minimum of uncompressed 2K playback and review performance.

In addition, enterprise computing class components help provide a safety net against failure, such as easily swappable boot media, hot swappable hard drives in the storage arrays, and redundant, hot swappable power supplies.

Build Today

You can use the same LSI RAID and JBOD technology as The Pixel Farm for your high performance, high capacity requirements today.

For more information email channelsales@lsi.com or visit lsi.com



For more information and sales office locations, please visit the LSI website at: www.lsi.com

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