FACILIS TECHNOLOGY
108 Forest Ave, Suite 200, Hudson, MA 01749
T: +1.978.562.7022 F: +1.978.562.9022
E-Mail: info@facilis.com

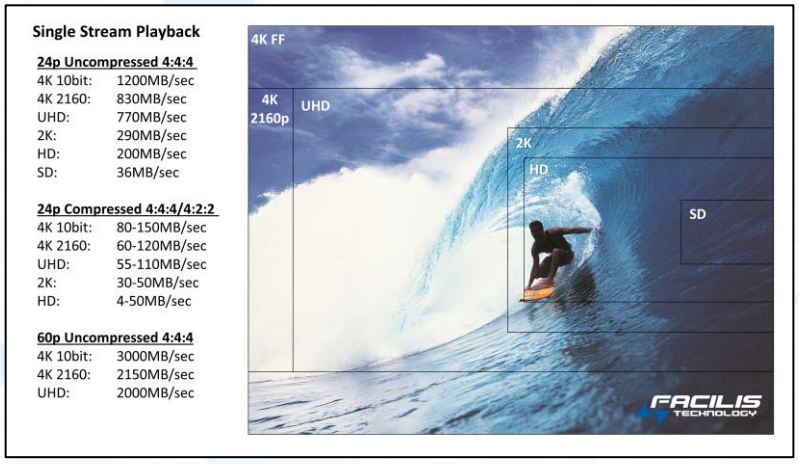
Post Production for UHDTV – Is Your Facility Ready?

Overview

For postproduction companies keeping a watchful eye on the constant evolution of acquisition formats and delivery standards, staying ahead of the curve can be quite an exercise. This document will look at the challenges of dealing with this constantly changing landscape where bigger is always better in the eyes of clients. We will explore the challenges of maintaining workflow efficiency and profitability through optimized shared storage infrastructure. In particular, we will examine the impact of current and future high-resolution formats as part of UHDTV's evolution.

UHDTV and Evolving Acquisition Formats

Not too long ago, postproduction facilities were happy to take any project format that came through the door, knowing that they would convert all media to a "house codec" so that their editing and finishing applications would perform in a predictable manner. Over time, Apple, Avid, Adobe, and other creative toolsets have evolved to manage various camera native formats in the same project. However, dealing with these formats exposes the limitations of the surrounding infrastructure. Networking, and shared storage components in particular, are often not prepared for the demands that these formats can make on system bandwidth.



So, why would you want to work in camera native formats? First, modern production crews have the capability to shoot in high-resolution formats like 2160p, 4K, and even 6K. Having already paid for the equipment and talent, it's unlikely that the clients will be happy to go all the way from postproduction to delivery in 1080 - never seeing the original pristine footage. Aside from the perception of image quality during post, there's sometimes a real need to have access to the native images. Productions delivering 1080 are often shooting in larger formats to give post extra latitude for framing and repositioning as the story requires. Likewise, colorists will demand the image directly from the camera sensor, so they can decompress and debayer those images and have the greatest control. Also, there are workflows that require 4K-6K throughout post, so any frame or segment can be extracted for compositing, blown up for cinema projection, or printed on a billboard at the touch of a button, and without a conform back to the camera masters. Finally, programs delivering in HD will often archive a full resolution version of their program for better shelf life and resale of their content in the future.

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Even with all of the reasons outlined above, 4K+ camera-native workflows are still the exception. 1080 HD acquisition is still the standard for online content, corporate video and sports productions, just to name a few. Many crews won't be using 4K+ cameras, and content is often being repurposed from SD or HD stock. All of these situations allow the facility to offer a compressed HD workflow that will be easier on the infrastructure and the budget. So, the right compromise is a system that can deliver high bitrate native and uncompressed formats when needed, while remaining appropriately sized and priced for popular compressed HD workflows. Consider size and price: some SAN providers will stack a bunch of boxes together and claim to deliver 40 streams of 4K or 6K native formats. While that is impressive, it's not what most post facilities are really asking for. Anyone can build a big wall of storage that supports just about any workflow… for a price. However, when facilities only occasionally require high-bitrate raw and uncompressed full end-to-end workflows, the value is in the ability to conform and finish in these formats without dedicating your machine room to that uber-SAN.

Saying Yes To Any Project

A successful project-driven facility has to be ready to turn around a job quickly, in the proper format, with scale-out capabilities and finishing power. Boutique post production facilities are known for their flexibility in handling anything that comes through the door, but with these new formats and deliverables, is that still feasible?

The fastest technology available to deliver multiple streams of high-resolution media comes in the form of Solid State Drives (SSDs) they deliver GB/s speeds, but command a premium price with reduced capacity compared to spinning disks. Traditional "spinning disks" are cheaper, support higher capacities, and come in different flavors from 15K RPM SAS drives to 7200 RPM SATA drives, which when combined, can provide great bandwidth for most workflows.

To make best use of the available technology, some storage vendors deploy two uniquely different types of storage. Online "tier 1" storage for high-res workflows and slower "tier 2" nearline storage for offload of tier 1 data. In this way, each storage subsystem has a different purpose based on its performance. However, tier 1 storage is often comprised of expensive and lower capacity SAS 15K drives, or even dedicated SSD arrays, which are overkill for the common compressed HD workflows taking place in most facilities. For these projects, the SATA drives in tier 2 can be used for direct data access, so they simply become a secondary tier 1. Another method is the use of SSDs as a front-end cache to other, lower performing storage drives. This requires a lot of intelligence to predict what should be cached and it's easy to get it wrong. This technique could still leave the facility with degraded performance for all but the most active project on any given day.

There is another approach to utilize this advanced storage technology, while leveraging existing components in the most efficient way possible.

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The Hybrid Solution

By combining support for both editorial and finishing workflows in one enclosure, a hybrid shared storage solution delivers the best bang for the buck. With both SSDs and spinning disks, this single crate of mixed drive technology is virtualized at the block level for consistent performance. This combination has the speed to power the most intense 4K+ workflows, and since the two storage arrays are shared in the same enclosure, it's easy to selectively mirror SSD content on the spinning disks to efficiently make use of the space and bandwidth while still protecting data.

The combination of new technology SSDs and spinning hard drives allows a facility to deliver scale-out collaboration when it is required as well as finishing performance when it is needed. With internal data transferring at 1 GB/s, space on the high-bandwidth but lower capacity SSD group can be made available quickly by offloading to higher capacity spinning disks. This elegant solution is made possible by advanced system architecture, designed around the workflow of project-based postproduction. Virtual volumes are created on a per-project basis, utilizing either the SSD or HDD groups. Any client can access volumes from both groups, across any connection method. Managing access to the SSDs in this way not only maximizes their performance, but also ensures optimal longevity over the life of the drives.

Connectivity and Flexibility

Because the optimal storage system should to be able to support editorial and finishing operations simultaneously, it is important that a storage system be easily configured to provide both shared file-level access and high-bandwidth block-level access (DAS emulation) as projects evolve. If it ever becomes necessary to completely switch storage systems and transfer data between offline editing and finishing, the time represents non-billable hours for not only the facility, but for the employees as well.

Now let's consider the connectivity between clients and the storage server. While 1Gb and 10Gb Ethernet are the most popular methods for connecting collaborative workgroups, there is also a place for higher bandwidth connections when engaged in a finishing workflow. Fibre Channel is very easy to deploy, and may already exist in many facilities. With speeds up to 16Gb/sec on a single port, this connection method offers tremendous bandwidth for the most demanding finishing workflows. A shared storage system capable of delivering both Ethernet and Fibre Channel connectivity simultaneously clearly has advantages over systems that offer only one or the other.

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Guaranteed Storage Performance and Consistency

Maintaining consistent performance to all clients is a top priority for any post workflow. As such, a shared storage system built for media production needs to be optimized beyond what basic RAID or drive arrays can provide. With large files to read and write, along with the randomization of multiple streams and clients, traditional hard drive systems reach the limit of performance too quickly. Additionally, if things start slowing down as the system approaches full capacity, it's always going to happen at the absolute worst time. Consistent performance is something that must be built into the design of a SAN, regardless of how many clients attach, or how full it is.

The best way to guarantee performance is by using block-level virtualization. The result of this virtualization is a pool of storage, for use in allocating project-based volumes. In this virtualized mode, the storage system writes data in a pattern across the entire group, on all of the disks, and is not bound by the speed, portion or sector (position) on any given disk.
At a higher level, optimizations of the shared file system provide client workstations with as much of the speed available from the virtual pool as possible. Utilizing virtual volumes in this way yields the absolute fastest shared storage connectivity possible.

Most importantly, all of this performance, flexibility, and full capacity usability can be achieved without adding any complexity for the end user.

4K — Only a Bump in the Road

As media creators tool up for the 4K challenges they're facing now, it's equally important to plan for the future. How do you leverage the infrastructure you have to tackle the myriad of transcode and collaboration requirements, while delivering the bandwidth and functionality to stay on schedule and budget?

There's much talk about 4K, 6K, and even 8K, however it's important to remember that the UHDTV specifications include much more than simply stipulating the number of pixels across the screen. The future plans for handling "anything that comes through the door" must also include strategies to accommodate High Frame Rates of 60, 120, and even 240 frames per second (HFR), and additional data to carry information for High Dynamic Range (HDR) and an expanded color gamut. Over time, as all or some of these characteristics get rolled into mainstream acquisition, the sizes of files and corresponding bandwidth requirements can increase exponentially. For a modern postproduction facility, it's clear that this will tax the storage infrastructure in new ways and has the potential to disrupt all of the hard-won efficiencies of HD production. All of these challenges represent UHDTV's ultimate future.

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Conclusion–Future Proofing your Storage Investment

Investments made today in storage architecture need to include plans for going beyond merely 4K; into 8K, higher frame rates, and new color spaces. Each of those challenges is spelled out in the UHDTV specification and will be phased in over time. This constant evolution of acquisition formats requires exponential bandwidth handling for at least some clients on the network. The key is therefore to invest in storage that offers the maximum flexibility so that there is no need to move media between different storage systems when schedules are tight, forcing teams to wait while everything is reconfigured. With shrinking budgets and schedules, those are exactly the areas where downtime can be costly. A truly valuable shared storage environment gives you choices for connectivity, choices for multi-user collaboration, and choices for the fastest possible speed when finishing programs at the highest data rates.

In order to maximize productivity, it takes careful planning to avoid roadblocks. Wherever possible, system administrators should leverage the infrastructure they currently have, while ensuring client workstations can maintain flexibility with fully collaborative and ultra-high performance feature sets. The technology is available, it doesn't have to cost a small fortune, and it doesn't have to be complicated.