Quantum

WHITE PAPER

GROWING BEYOND XSAN

Next-Generation Workflow Storage Architecture

CONTENTS

INTRODUCTION

Collaboration is at the heart of any digital media workflow. The earliest digital workflows employing non-linear editing were very expensive solutions, and often limited to one or two editors working alone on projects. However, although the cost was high and applications were limited, adoption grew rapidly due to the then revolutionary advantage of allowing editors to quickly make or undo changes. This digital process also introduced greater flexibility for special effects and titling, and soon led to complementary applications allowing audio sweetening, and color correction. This had an unforeseen effect that actually introduced slowdowns in the production process and created a serious need for better collaboration. Once again, the only solution was to use a closed or proprietary system, which was not only cost-prohibitive for most users, but overly complex to deploy and maintain.

In 2004, Apple changed all of that. Apple's introduction of Xsan gave editors the ability to collaboratively access, edit, and share files. Considering Apple's dominance in the non-linear editing market at that time—and the fact that Xsan was not only eminently more affordable than solutions from Avid, Quantel, or SGI—Xsan was easy to install and use, and quickly became the default solution for any broadcast or post-production house requiring shared, high-speed file transfers. Above all, Xsan showed the productivity and power possible with a predictable, shared storage environment that assured that there were no dropped frames while editing.

Xsan not only provided workflow efficiency—it delivered the consistent, high-bandwidth performance required to capture audio or video data from tape to digital. It was at the forefront of truly collaborative non-linear workflows. While it continued to evolve over the year and led the way to tapeless workflows, Apple began moving away from enterprise-class products, eliminating first the Xserve RAID, and then in 2010 the Xserve, the 1U form-factor server that was the basis for the Xsan Metadata Controller (server).

This decision left a lot of people wondering about the future of Xsan, considering the three- to four-year lifespan of server systems such as the Xserve that functioned as the metadata server, and questioning how they would maintain an Xsan workflow in their facilities.

Fortunately, the Xsan client continues to be supported and actively developed by Apple and is included at no charge in the Macintosh operating system, and Apple provides operating system upgrades for the Xserve.

However, the population of Xserves is aging, and Apple offers no enterprise-class server alternative or replacement—so the clock is ticking for the more than 100,000 estimated Xserve-based Xsan deployments.

Providing an Xsan-client-compatible storage solution that will leverage their existing investment for content production has become a high-priority issue for broadcasters and post-production houses.

The good news is that there is a solution that is technically superior, 100% compatible with Xsan, and built on a rock-solid foundation for a future-proof collaboration workflow environment—and that is the StorNext® shared storage file system from Quantum. When considering adopting a StorNext environment for your Xsan clients, it is important to consider several key areas.

WHY XSAN HAD IT RIGHT

When preparing for an Xsan upgrade, it's important to remember the reasons that Xsan gained high adoption rates. When building video workflows, the focus is on the ability to easily access and efficiently share large video files at different steps in the workflow. With the adoption of non-linear editing, specialists in color, VFX, audio, or other digital transformations would request access to the same file at the same time. Not only would they need access to the same file, but they could also be requesting the file from different workstations or other clients. It is important for these files to be sent and received in a sequential manner without frame loss. The result is that there is a supreme focus on the latency and bandwidth between editing stations and storage devices.

Using a transport protocol such as Fibre Channel guarantees uninterrupted data movement and provides guaranteed in-order delivery. Fibre Channel is the only practical protocol and low-cost, commercially available physical transport layer that can provide this.

Having a rich, native file system client provides significantly lower file system overhead and reduces overall latency, allowing the client to achieve the best performance possible on their hardware.

While the highest theoretical level of performance can be achieved by directly attached disk, Direct Attached Storage does not allow video files to be shared across a distributed environment and does not allow true collaboration.

Other tasks that rely heavily upon the storage infrastructure are content ingest, transcoding, and rendering. Ingesting raw files to the shared storage environment so that those files can be edited has always been a critical path in production workflows. For years, it was accepted that little could be done to decrease the time to transfer footage—raw or compressed—from source to primary storage. The transition from SD to HD presented new challenges at every step along the workflow, with one of the most critical early concerns being the amount of time needed to ingest the much more demanding, larger HD content. This concern is valid and is even more critical with the advent of 4K content. With uncompressed data rates of 1GB/s for RAW RGB for 10-bit 4K, or 110MB/s for compressed Apple ProRes 422, the demand on the storage network architecture is the biggest challenge. Even if the primary system can handle the footage, the near-line and tape archives must also be ready to absorb the dramatically increasing amounts of data. These increasing demands—added to the existing necessity and requirements of real-time editing and the need for a high-bandwidth, high-speed, highly reliable, and zero-frame-loss system—make a true, collaborative shared production environment such as Xsan a necessity, not an option.

EXTERNAL FACTORS INFLUENCING STORAGE SELECTION

Media workflows have been in a state of constant evolution since the first non-linear editing systems were released. Since then, a series of events made possible by the new digital, file-based workflows such as the migration from tape to tapeless, SD to HD, increased volume of content captured from cameras and other devices, the sheer number of ingest types, increased delivery methods, and shorter production schedules have only increased pressure on those responsible for making sure that the technology can meet the demands of their users and of fulfilling their business goals.

The rise in 4K production greatly amplified the concerns faced in the SD to HD migration. With 4K cameras widely available, almost all Hollywood studios are capturing content in 4K today and studying 8K already. Like the HD format before it, 4K resolution dramatically increases the volume of storage required throughout media workflows. Given the constant need to strike a balance between functionality and budget, a practical approach to adopting 4K-capable storage workflows is to design and implement tiered storage networks that can manage the ingest of very large, raw original content, near-line storage of work in process (WIP) content, and a retrievable archive of finished content for future monetization. The challenge lies first in the data path as 4K demands significant bandwidth. Consider that the required streaming performance for large files starts at 3.5MB/s for SD and 165MB/s for HD; with 4K, the requirement leaps to 1210MB/s. While storage vendors are salivating at the thought of managing all that data, they must also manage its movement throughout the workflow.

4K is not the only factor driving Xsan upgrade conversations. The reality of cloud production is here to stay with both Avid and Adobe providing cloud-enabled versions of their editing suites, and more cloud-based applications expected to follow. Cloud storage presents economies that cannot be ignored as compute-intensive activities such as transcoding and rendering move to the cloud. Cloud by its very nature implies virtualization, which is in essence an abstraction of the physical location of the servers or storage, but transparently enables capacity. This not only rationalizes the use of cloud resources for transcoding and rendering, but also for the storage needed to capture related output. As cloud storage grows, the ability to manage the transfer of assets into and out of the cloud as part of a holistic storage management program will become a necessity.

DEFINING A FLEXIBLE STORAGE ARCHITECTURE

The combination of video editing and 4K is driving a heated discussion of storage architectures. As companies investigate Xsan alternatives, they quickly enter a debate as to the benefits or detriments of the two accepted storage architectures: Storage Area Network (SAN) or Network Attached Storage (NAS). In fact, it is more practical to understand the benefits that different network and storage protocols bring throughout any workflow. With that knowledge it is possible to define an architecture that addresses needs that may be a hybrid configuration including high-throughput SAN clients, LAN-based or IP clients, heterogeneous operating systems, fast disk, secondary disk, and cost-effective data tape (LTO/LTFS).

Each storage architecture provides its own benefits. Any facility using Xsan already understands the value of SAN architecture; they long ago left behind dropped frames and the need to regulate users on the network that is common with pure scale-out NAS deployments. A shared SAN solution delivers high-performance storage with true, shared file system functionality to eliminate storage silos and allow the collaboration required in media workflows. A SAN addresses the media industry requirement to effectively manage continually increasing file sizes due to increasing visual resolution

and the volume of file copies made during the production process. In addition, Fibre Channel is the only technology that can guarantee in-order delivery throughout an entire network, which results in better latency. With these features in mind, SAN architecture is typically best suited to high-bandwidth activities such as editing, which requires multiple streams of content transferring in and out in real time, and for content ingest where time and quality of content are top priorities.

The optimal storage architecture is one that takes advantage of the best network and/or storage resources given the task at hand. Any workflow environment will have also implemented an IP-based network to connect and enable file sharing between LAN clients. There are devices that can control data access through the management of user privileges, file locking, and other security mechanisms. Use of heterogeneous clients is possible through the use of a file system layer such as Network File System (NFS) or Common Internet File System (CIFS). While this architecture is not the most beneficial for functions that are bandwidth-intensive or require sequential stream, an IP network is practical for managing file transfers to transcoding or rendering farms.

A combination of Fibre Channel and IP (LAN) networks is practical in terms of fulfilling high-speed performance and managing costs. It aligns the right technology with the appropriate phase of the workflow.

GROWING BEYOND XSAN

While the vast majority of Xsan deployments grew out of the need for collaborative production, digital media creation and delivery have continued to evolve.

Today we must consider not only the initial use and monetization of content, but the value of growing and maintaining an owned-content pool and that accumulating content's remonetization potential. The consumer expectation and demand for 'any content, anywhere, at any time, in any format' has significantly raised the appetite for new content, but has also provided a means to redistribute and remonetize existing content—and deliver it in many new forms and formats.

It is no longer acceptable to build ad-hoc production environments and maintain a mostly inactive repository of previously monetized content. We must instead think in terms of a more active archive and a true inventory of assets and content that is available for re-use into fresh content production and monetization workflows as quickly as possible.

This raises the question of what a modern version of an Xsan storage architecture should look like today and into the future.

Today, an effective storage architecture must also address the selection of the storage itself—a selection that will accommodate current and future consumer demand for a greater amount of content, both new and previously viewed. We must assume that content is to be maintained in the highest-quality format possible to accommodate ever-greater resolution demands including 4K and 8K, and that this content must not only be readily available, but also stored more securely and at a lower cost than current on-line storage can provide.

While storage costs have historically decreased, customers may be tempted to just continue with ad-hoc SAN growth. It is important to understand how sharply the volume of media assets being stored has increased. Coughlin Associates anticipates that media storage needs, for content acquisition alone, will grow from ~185TB in 2014 to almost ~567TB in 2018. When looking at NLE post-production, Coughlin predicts that, in 2018, 70% of content stored will be 4K, with a demand for networked storage in excess of 1000TB.

As a result, the concept of a tiered storage strategy is more important than ever. Simply put, tiered storage means using the best storage based on need. It is about coping with new production demands by managing the cost of storage while providing necessary performance. In general, disk is more expensive than tape, yet disk provides the required speed for handling the production demands of episodic TV, reality TV, or film production. A tiered storage architecture provides systematic use of online or primary storage versus near-line or secondary storage. One can think of a lower-cost tier of storage providing an extended on-line capability, as long as the storage solution can provide a seamless experience between the tiers and match the performance requirements needed for video production. Of course, this is not something that a typical enterprise IT storage solution can provide. The storage architecture, now more than ever, must be media-optimized—especially with the challenge of 4K production, greater collaboration on ingest and delivery, and the extended on-line capabilities of a lower-cost storage tier—and one that should have the capability to grow to several Petabytes if needed.

Workflow processes that need fast access to assets and content as they are called up often require the use of on-line, disk-based storage. However, as the data gets older and files are accessed less often, companies can reap significant cost advantages by moving previously used content to lower-cost, more resilient storage, or often off site for deeper archive onto tape. It is critical that the inventory of content be easily accessed quickly, but also that a copy of this often irreplaceable content be maintained in deep storage at a different location. This is often called vaulted data tape.

The addition of Media Asset Managers has provided a simple and effective methodology to manage and present content and assets both in production and into short-term and deep, long-term archives. A combination of all these technologies and methodologies can provide an efficient and cost-effective upgrade to existing Xsan environments and maintain the open architecture flexibility that Xsan provided while meeting today's—and future—workflow needs.

ASSESS YOUR ENVIRONMENT

When evaluating options for an Xsan upgrade, there are several basic tasks that should accomplished to make an informed choice:

- Perform an inventory of your SAN infrastructure.
- Perform an Xsan audit—gather details about Spotlight requirements, Native Extended Attributes, Client OS versions & types, ACLs, quotas, case-insensitive volumes, etc.
- Quantify your current bandwidth capabilities vs. future performance and storage needs (don't forget the impact of 4K!).
- Identify any new clients that will be part of the upgrade.
- Identify a data archive and data migration plan.

By establishing this foundation of current and expected needs of your environment, you will be able to better evaluate the different options for upgrading your Xsan environment.

Questions that should be a part of this assessment include:

- How much bandwidth do you require and at what latency? This will be determined by your type of work, amount of ingested content, number of users, and whether you deliver to one or many outlets.
- Will you be acquiring content in 2K, HD or 4K, 8K? 4K content requires 4X the bandwidth and streaming rate of HD.
- How much scalability do you need and how does your system achieve the necessary scalability? Are you a broadcast, sportscast, or a post-production facility? The volume and number of files moving through your workflow will vary accordingly.
- Does your system maintain consistent streaming performance?
- What third-party applications does your workflow utilize?
  - How will your storage solution integrate with them?
  - Does your system allow for selection of new third-party applications?
- Do you have tools to simplify Xsan migration?

RECOMMENDATIONS

A view of a typical post-production environment reveals a large variety of storage needs—all dependent on the critical task at hand. It also serves as a reminder that these workflows reflect a variety of platforms with different operating systems and varying network performance and interoperability requirements. Storage sits at the core of any workflow, with a combination of local, near-line, and archive needs that must be addressed.

Reviewing the capabilities that differentiated Xserve and Xsan for non-linear editing, we see architectures that allowed distributed Mac clients to connect to LAN (IP)-based networks and SAN-connected clients enabling shared file access, interoperability across systems, as well as the necessary latency when accessing near-line or archived files.

Today's workflows have increasing demands due to the adoption of 4K, multiple ingest types, multiple delivery options, and greater complexity in workflow operations. With file sizes in the tens of Terabytes, requiring streaming rates in excess of tens of Gigabytes per second, network and storage architectures must address performance, latency, and cost concerns. When combining these needs with the desire to upgrade Xsan, key criteria should include:

- Heterogeneous support:
  - High-speed collaboration across different operating systems (Windows, Linux, Mac OSX).
  - Integration and interoperability with media applications including ingest, media asset management, edit, VFX, transcoding, and rendering.
- Topology:
  - Being flexible in network design helps to future-proof a storage infrastructure and provides the capability to utilize the most efficient network design needed at the time—typically a combination of FC SAN and IP LAN—without sacrificing performance.

- High-Throughput Streaming Performance:
  - Latency is critical for managing ingest of extremely high volumes of footage in the least amount of time.
  - High-speed access to full-resolution content whether in local, near-line, or archive storage is critical to achieve optimal productivity.
- Cost-Effective Availability:
  - Tiered storage will lower your storage costs through use of policy-based storage and the use of the best hardware given user need. Consider:
    - » Disk storage for low latency, high-performance streaming access to content.
    - » Object storage for near-line access to content.
    - » Tape storage for offsite archive and data protection.
- Ease of Use:
  - Setting up and managing media workflows should not be overwhelming. Integrated deployment and management tools and simple user interfaces will easy install, upgrade of clients or servers, allow you to automate and check status of tasks and troubleshoot performance issues, improve productivity, and simplify storage management, and lower the overall administration costs of your workflow, not to mention provide great assistance in troubleshoot in the event of a problem.

Re-think your workflow to eliminate storage architectures addressing only one aspect of your workflow such as editing or transcoding. Instead, consider the endpoints of Ingest and Delivery, and consider a cohesive storage strategy fulfilling all Work-in-Process requirements for I/O, bandwidth, interoperability, and most importantly, creativity.

SUMMARY

Xsan changed the nature of the modern non-linear editing workflow by addressing the need for simple, intuitive interfaces and technology that addressed the need for shared, fast access to large amounts of data, typically in a sequential streaming fashion. While Apple's end-of-life announcements caused the initial review of Xsan environments, the demands of high-resolution content on video editing remain the primary driver for broadcast and post-production facilities reviewing their storage architectures.

It is only through pragmatic assessment of business goals such as production commitments, delivery channels, and all-important budgets—combined with technology requirements such as content formats, workflow tools, and storage demands—that media companies will determine the optimal solution to future-proof their workflows. The best solution will be:

- Open – Enabling a combination of IP and FC networking.
- Heterogeneous – Providing interoperability between best-of-breed workflow platforms running on a variety of different operating systems.
- Intelligent – Providing tools to simplify deployment and management of stored assets across tiered storage devices.
- Flexible – Offering a range of storage devices or appliances to meet the demands of near-line, off-line, or offsite archive.

Apple Xsan introduced unparalleled collaboration, and the natural evolution of that shared, creative workflow is a solution that improves collaboration and capabilities while maintaining an Xsan investment and delivering the consistency and flexibility needed for unlimited growth.

ABOUT QUANTUM

Quantum is a leading expert in scale-out storage, archive and data protection. Its StorNext 5 solutions power modern workflows, enabling high-performance, real-time collaboration and keeping content readily accessible for future use and re-monetization. More than 100,000 customers have trusted Quantum to address their most demanding content workflow needs, including top studios, major broadcasters and new, cutting-edge content creators. With Quantum, customers can Be Certain™ they have the end-to-end storage platform to manage assets from ingest through finishing, and into delivery and long-term preservation. See how at **www.stornext.com**.

www.stornext.com/xsan • 800-677-6268

Quantum

WP00196A-v01 July 2014