DataDirect NETWORKS

White Paper

DataDirect Networks Storage Technology for Digital Media Applications

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Introduction

Whether doing post production for a feature-length film or TV series, creating commercials, reporting on news and entertainment, or hosting and delivering real-time streaming video - organizations working with digital media are facing serious challenges when it comes to storage. The volume and size of images, audio, and video being created, stored, and served is exploding, fueled not only by the digitization of virtually all film and video and moving it to higher resolution formats but by consumers all over the world watching video on a variety of devices and contributing to the burgeoning social networking sites.

More content is being kept online and will remain online for increased periods of time, especially by news organizations that often need immediate access to archived video clips. Streaming video and post-production in HD, 2K, and 4K resolutions; 3-D animation and visualization; cable and broadcast playout; video-on-demand (VoD); IPTV; and near-line storage and media asset management are all driving the need for responsive storage that delivers exceptional performance, massive capacity, uncompromising reliability, and scalability. As file sizes and resolutions increase, the storage and data access issues facing digital media companies will likewise escalate.

An ideal storage system for digital media environments would provide:

- a single, shared pool of storage containing all digital content
- Native support to all applications and systems that are part of the workflow
- Scale performance to enable parallel workflows for multiple concurrent projects
- Uninterrupted content delivery, eliminating dropped frames and delays
- Scale capacity to retain all content, regardless of number of projects
- Easy-to-use, cost-effective and transparent to the users

DataDirect Networks S2A™ (Silicon Storage Architecture™) storage arrays form the foundation for scalable, cost-effective file storage systems for today's digital, file-based media workflows. The S2A storage arrays also provide unparalleled performance combined with unique features designed to eliminate corrupt data or dropped-frames during play-out.

Built upon DDN's Silicon Storage Architecture™(S2A™) technology the xSTREAMScaler File Storage system virtualizes the underlying storage infrastructure and provide a single, scalable storage space to applications. It is available in three models: - the S2A6620 for entry-level and mid-level environments, the S2A9700 for high-capacity environments and the S2A9900 for the highest-performance requirements.

DDN storage systems enable today's digital media workflows to capture and serve massive amounts of high-resolution digital and streaming content, provide shared, ultra-fast access to a common pool of data, and minimize data center footprint and storage costs for enormous archives. As the storage

provider of choice for more than 400 digital media companies worldwide, DataDirect Networks has a thorough understanding for the needs of digital media professionals and the ability to deploy the right-sized, turn-key solution for any media workflow.

DataDirect Networks Storage Solutions for Digital Media

The need for data access and stability in the digital media production and broadcast market is unlike that of any other industry, due to massive file sizes, the need to share content among multiple users on different platforms, and the need for real-time streaming video delivery at ever-increasing resolutions.

While traditional storage systems – including most so-called scale-out or parallel storage systems – are designed around enterprise applications such as email, databases or home directories – DDN developed a purpose-built architecture that was specifically designed to support large-scale, reliable streaming and parallel workflows. Providing storage systems that eliminate dropped frames, deliver thousands of broadcast-quality streams and enable dozens of concurrent HD editing bays has been a specialty of DDN since the beginning - proven by hundreds of Rich Media deployments world-wide.

Digital media production and broadcast environments often require large file, sequential access, driven by throughput or storing millions of files and petabytes of capacity in a single namespace. DataDirect Networks' storage systems are designed as intelligent storage appliances that integrate key functions previously found in separate storage network elements and software components. This approach vastly simplifies the storage network, lowers overall costs, eases management, and provides large gains in performance and reliability.

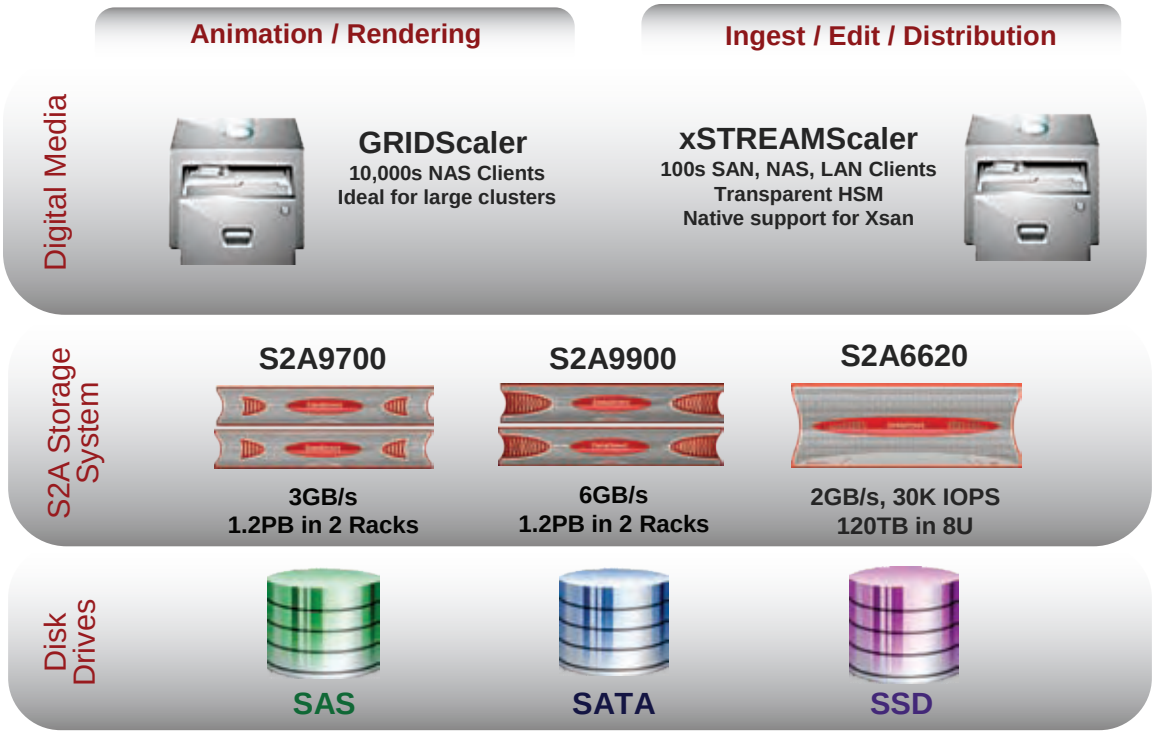

Figure 1: Overview of DDN Storage Solutions for Digital Media

DataDirect Networks Storage Arrays	DDN S2A6620	DDN S2A9700	DDN S2A9900
Capacity	Up to 120TB per array	Up to 1.2PB per array	Up to 1.2PB per array
Performance	Up to 2GB/s per array	Up to 3GB/s per array	Up to 6GB/s per array
Real-time Simultaneous Access 4K/2K/HD/SD Streams (actual)	0/3/5/30	1/7/11/59	4/17/26/142
Real-time Simultaneous Access	327/234/163/81		1,572/1,123/ 786/393
Archive Capacity 4K/2K/HD/SD Hours of Content (actual)	20/81/124/670	202/807/ 1,241/6,699	202/807/ 1,241/6,699
Archive Capacity	7,409/5,292/ 3,704/1,852	74,088/52,920/ 37,044/18,522	74,088/52,920/ 37,044/18,522

Figure 2: DDN S2A Arrays for Digital Media

Post-Production

In post-production, where a variety of processes including ingest of raw film for digitization, color grading, dust removal, editing, special effects, compositing, and real-time film write-out at 2K or 4K resolution can entail the work of many artists, editors, and colorists, duplicate copies of the digital content can create a storage access and management nightmare. The logistics of shepherding this fragmented content through the post-production pipeline can consume significant amounts of manpower and time, and open the door to any number of errors, human or otherwise. This situation is bound to escalate when a 90-minute feature film in 4K resolution can generate 16TB or more of data. When working under notoriously tight production deadlines, these issues can seriously undermine a production house's ability to maintain a competitive edge.

The diversity of operating systems and platforms found in most post-production environments can also be a challenge when constructing a shared storage environment, with Mac, Windows PCs, SGI, Linux- and Unix-based workstations, and other specialty equipment often needing access to the same content. The S2A is an open system, supporting any operating system, file system, or other platform likely to be found in post houses, enabling the use of the right equipment for the job and eliminating the need for proprietary file systems or storage applications. In addition, the S2A's parallel host access delivers exceptional performance in shared file system environments. This ability of multiple hosts to access the same storage at the same time is critical to enabling real-time collaborative workflows that cut down overall project cycle times.

There are four key aspects to storage solutions for Post-Production workflows:

Simplicity

Traditional workflow environments have used local or dedicated storage for individual systems and applications. In the worst case – which is all too common - every system has its own storage, thus requiring physical file transfers between workstations. Sometimes a shared storage system is used for part of the workflow, however manual file transfers and even transcoding is required to move content from one storage island to the next.

The xSTREAMScaler File Storage System provides dramatically improved simplicity for post production workflows. All systems – from ingest through editing and compositing to distribution - have direct, concurrent, real-time access to all content. This eliminates the need to manually move content in and out of various islands and promotes true collaboration between the creative teams.

Concurrency

In typical post production environments the storage infrastructure can support work on a small number of projects – or often only one project when high resolutions above HD are required. This leads to serial workflows, creative downtime and increased cost as multiple storage systems are being deployed to enable separate, parallel workflows. The xSTREAMScaler File Storage System enables parallel, concurrent workflows, easily scaling to support 30 concurrent HD editing stations, 4x 4K workflows in film post-production, 40fps film scanning at 4K resolution and more.

Scalability

Post-production data centers quickly reveal one of the factors driving unnecessary equipment cost – a collection of disparate storage systems from numerous vendors that were purchased as demands in capacity and performance increased. These systems cost administrative time, cause disruption in workflows as content is moved back and forth between them – and last but not least are the most inefficient way of using expensive datacenter space, power and cooling resources.

At the core of the xSTREAMScaler offering are DDN's award-winning streaming-optimized SAN storage systems, which are each capable of delivering unrivaled storage performance and supporting up to 30 concurrent Final Cut Pro workstations at ProRes HD resolution or multiple 4K concurrent streams from a single array. The xSTREAMScaler technology scales these systems incrementally within a single namespace to deliver scalable streaming performance – powering everything from the smallest boutique workflows to leading broadcasting stations and post-production facilities using from 10 TB to multiple patebytes in capacity, eliminating disruptive upgrades and outdated systems in the data center.

Connectivity

The xSTREAMScaler File Storage systems provide native SAN connectivity for Apple's Xsan shared file system, including clients such as Apple's Final Cut Pro®, as well as Windows, Linux and UNIX clients. This enables a seamless, digital workflow from ingest through editing, rendering and playout, all from one storage system. In addition the xSTREAMScaler system also provides LAN connectivity for Windows, Linux and UNIX clients that don't require the level of low-latency and highest performance that SAN connectivity can provide – at a much lower infrastructure cost. The DDN S2A storage arrays that form the foundation for DDN's file storage solutions can support SATA, SAS , SSD or mixed disk technology and connectivity options ranging from Fibre Channel to Infiniband and Ethernet – creating the most flexible storage infrastructure foundation for digital media workflows.

DataDirect Networks' storage solutions for digital media provide easy-to-manage, common storage repositories that can be shared by multiple users simultaneously, each enjoying full speed high-performance access to the data. This storage infrastructure greatly simplifies post production workflows, providing a single instance of digital content that can be accessed by many users. This streamlined production pipeline can drastically reduce errors, shorten production time, and promote creativity. It offers the additional benefits of reduced complexity and administrative overhead.

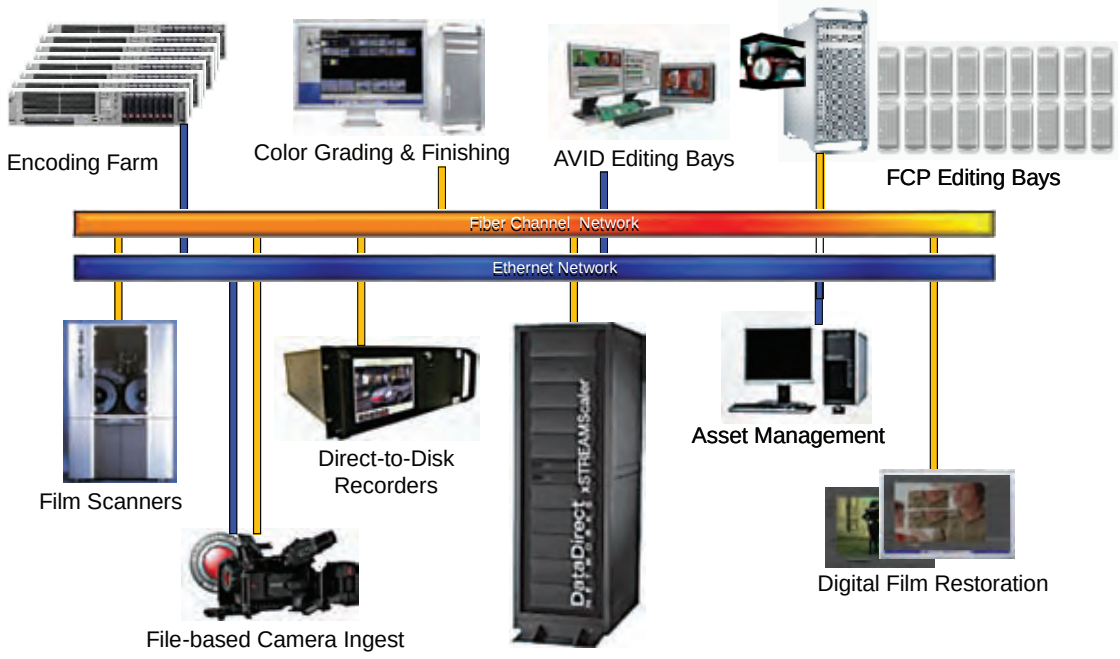

Figure 3: A parallel real-time post-production workflow utilizing DataDirect Networks' xSTREAMScaler storage system

Broadcast and Cable

Cable and broadcast companies are also grappling with a number of issues. Faced with the FCC's mandate to transition to all-digital content, these organizations must deal not only with creating, managing, and broadcasting current high-definition (HD) digital content, but also with transferring existing film-based archives to digital file-based content. Cable, broadcast, and telecommunications providers have an increasingly difficult to reach and technology-savvy audience, with viewers no longer just watching TV, but using their computers, cell phones, and a growing variety of mobile devices to watch their favorite shows.

Media companies must now translate their broadcasts into a variety of formats, including several broadcast video formats, web streaming formats, and mobile device formats to reach these elusive viewers. With standard definition (SD) programs averaging about 15GB and HD programs reaching 40-50GB, the amount of storage required is enormous. Ingesting the content, creating multiple copies, storing it, and guaranteeing flawless streaming delivery without dropping frames is a formidable challenge that must be overcome by these companies to remain competitive.

There are four key aspects to storage solutions for broadcasting workflows:

Simplicity

Traditional broadcasting environments often use a number of closed, proprietary systems that require content to be transcoded and reviewed in every step of the process. With the proliferation of open systems and applications, broadcasting workflows can be greatly simplified – if they can access content in a shared repository.

The xSTREAMScaler File Storage System provides dramatically improved simplicity for broadcasting workflows. All systems – from ingest through editing and compositing to distribution - have direct, concurrent, real-time access to all content. This eliminates the need to manually move content in and out of various islands and significantly accelerates the delivery of content to consumers.

Predictability

Typical broadcasting environments are quickly compromised when individual systems fail or slow down, driving the need to create multiple redundancies in the workflow.

DDN's storage systems deliver real-time performance and uncompromising reliability for 24x7 workflows. The storage pool can lose multiple drives, drive channels, connecting cables or transceivers, or even entire disk enclosures, without suffering data loss, dropped frames or performance degradation. This enables predictable broadcasting workflows, regardless of distribution channels from traditional play-out to VoD and IPTV.

Scalability

Broadcasting data centers quickly reveal one of the factors driving unnecessary equipment cost – a collection of disparate storage systems from numerous vendors that were purchased as demands in capacity and performance increased. These systems cost administrative time, cause disruption in workflows as content is moved back and forth between them – and last but not least are the most inefficient way of using expensive datacenter space, power and cooling resources.

DDN's xSTREAMScaler storage systems provide not only the performance needed to support multiple distribution channels, they also provide the scale needed to store 10,000s of hours of SD and HD content, enabling customers to build extensive digital content libraries that can accommodate decades of broadcast footage.

Connectivity

The xSTREAMScaler File Storage systems provide native SAN connectivity for Apple's Xsan shared file system, including clients such as Apple®Final Cut Pro®, as well as Windows, Linux and UNIX clients. This enables a seamless, digital workflow from ingest through editing, rendering and playout, all from one storage system. In addition the xSTREAMScaler system also provides LAN connectivity for Windows, Linux and UNIX clients that don't require the level of low-latency and highest performance that SAN connectivity can provide – at a much lower infrastructure cost. The DDN S2A storage arrays that form the foundation for DDN's file storage solutions can support SATA, SAS, SSD or mixed disk technology and connectivity options ranging from Fibre Channel to Infiniband and Ethernet – creating the most flexible storage infrastructure foundation for digital media workflows.

DataDirect Networks' storage solutions for digital media provide easy-to-manage, common storage repositories that can be shared by multiple users simultaneously, each enjoying full speed high-performance access to the data. This storage infrastructure greatly simplifies broadcasting workflows, providing a single instance of digital content that can be accessed and repurposed by many users. This streamlined production pipeline can drastically reduce errors, shorten production time, and promote creativity. It offers the additional benefit of reduced complexity and administrative overhead.

The exceptional performance, centralized data repository, and rock-solid reliability saves systems administration time and allows organizations to invest capital into the business rather than replicating data across multiple slower, less reliable systems.

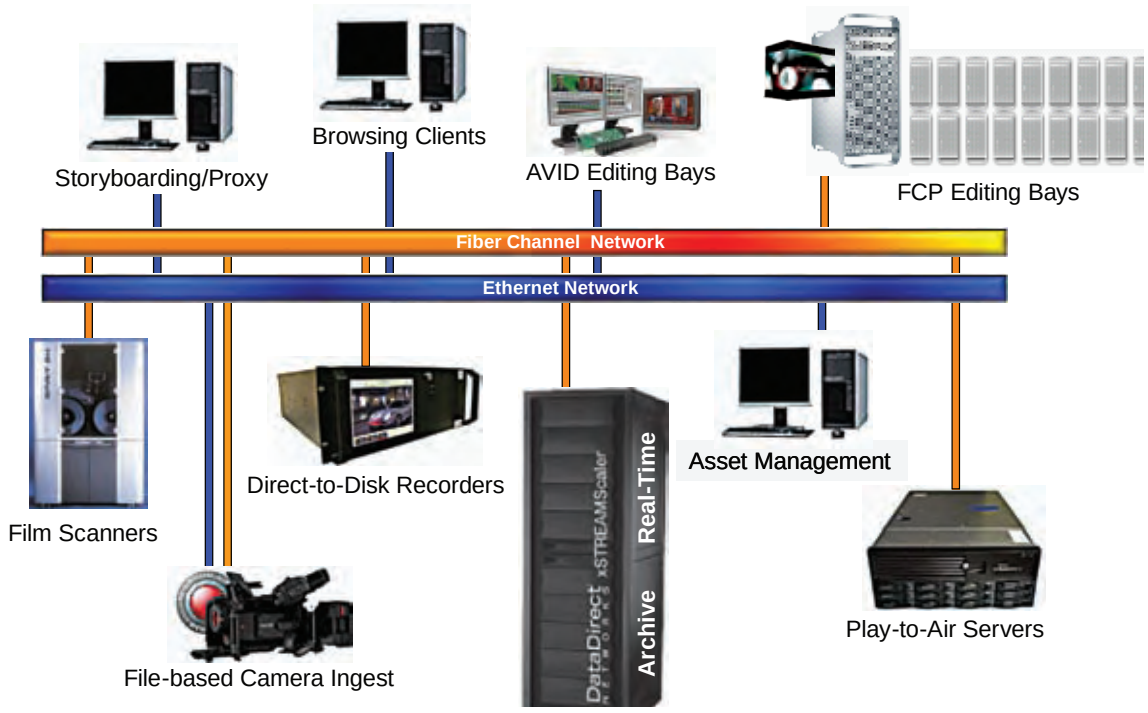

Figure 4: An end-to-end digital Broadcasting workflow including real-time collaboration and long-term content archive

Archive and Media Asset Management

For many organizations in broadcasting and post-production the decision to introduce digital media archives is obvious – maintaining content in an easily accessible, cost-effective way is critical for the leverage of future revenue streams and the protection of digital assets. Furthermore, many organizations are digitizing existing analog video archives for restoration projects and re-purposing of content, thus generating new revenue.

Digital media archives vary in size, from a few dozen TB in a smaller post-production house that wants to protect currently active projects against data loss to large content owners and Broadcasting archives with decades worth of content going into the multi-PB range. Implementing a cost-effective, transparent archiving infrastructure becomes critical.

DataDirect Networks has implemented a number of technologies that enables cost-effective archives. The use of large capacity disk drives with lower power consumption and very high storage density disk shelves form the foundation of an efficient archive. Eliminating the silent data corruption inherent to SATA drives, DDN arrays continually check the parity information on all reads in real-time with no performance degradation, ensuring that the data delivered back to the application is correct. DDN arrays also continually monitor the health of disk drives and are able to perform partial repairs, dramatically reducing the need to replace or rebuild complete drives. This makes it possible to use SATA drives for high-capacity archive applications.

DataDirect Networks also provides D-MAID (Dynamic Massive Array of Idle Disks) – a technology that automatically spins down disk drives that are not actively in use. This reduces power consumption and cooling requirements in data centers, often eliminating or reducing the needs for major changes in datacenter facilities to accommodate digital archives.

	Active	Dynamic MAID*
300TB (300 x 1TB SATA	7.1 kW	4.5 kW
600TB (600 x 1TB SATA	13.5 kW	8.29 kW
1.2PB (1200 x 1TB SATA	26.1 kW	15.8 kW
1.2PB Dynamic-MAID Savings		Up to $36,000/yr

Figure 5: Typical D-MAID Energy Savings

With DataDirect Networks providing some of the highest-density storage systems in the market, storing multiple Petabytes in just a few datacenter floor tiles, it quickly becomes apparent why it is the technology provider of choice for many media archives. Furthermore, the flexibility to provide both real-time, high-end streaming and long-term, high-capacity archives in the same system is a very compelling argument for customers implementing or improving media facilities.

Summary

In order to become and remain competitive, digital media companies must simplify their workflows to deliver error-free and increasingly large digital content in a timely manner. Whether it is a post-production facility delivering a feature film or a broadcast company reaching its next-generation audience through multiple formats, the storage infrastructure can make or break an effective digital media delivery pipeline.

DataDirect Networks helps ensure that production deadlines can be met and reliable play-to air deliveries executed by providing unrivaled simplicity, maximum scalability and unmatched concurrency for digital media workflows. In addition, the ability to scale performance and capacity as media environments grow, gives customers the confidence that however they seek new opportunities – DDN can support their evolving workflows.

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