

WHITE PAPER

SANBOLIC UNCOMPRESSED HIGH-DEFINITION VIDEO SOLUTION WITH CISCO MULTIPROTOCOL SHARED SAN

EXECUTIVE SUMMARY

Today, most video post production for standard-definition content has moved onto disk-based, non-linear editing (NLE) systems. These systems offer improved flexibility over linear, tape-based systems by allowing a workstation fast access to any part of the digital media file. The advent of NLE systems that manage media content as digital files also allows content to be managed over its lifecycle as an integrated process using data networking infrastructure. Content can be digitized, edited, enhanced with graphics and effects, broadcast, archived, and reused for new programming as digital files, greatly improving the work process.

Advances in shared storage infrastructure using shared storage area networks (SANs) have further improved the post-production work process. Shared SANs allow content to be digitized centrally, eliminate the need to move very large video files among workstations, reduce the time to get programming on the air by allowing multiple editors to work on a project simultaneously, and simplify versioning control. Several vendors have provided proprietary shared SAN solutions, which have become widely used for standard-definition video production.

The value of integrated workgroup NLE systems has not yet been realized for high definition (HD) content because of limitations of existing storage solutions. This is a primary bottleneck to expanding HD content available for broadcast. 1080i video (one standard for broadcast video) requires a minimum of 165 MB/Sec to each workstation. The requirements for 2K film-quality digital video approach 400 MB/Sec. As uncompressed 1080i HD video has eight or more times the bandwidth requirement of standard definition video, most existing shared SAN systems are unable to support the throughput requirements. Hence, most HD editing systems used today have single-station direct attached storage, or editing is done in compressed format, each of which has substantial cost, time, and or quality limitations.

CHALLENGE

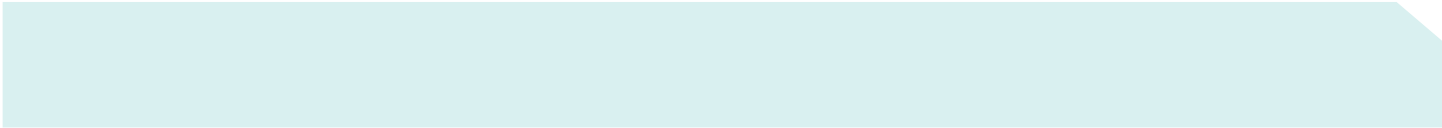
In the absence of a shared SAN that allows multiple workstations concurrent access to large content files, the post-production process is a sequential process (Figure 1). The major disadvantages of the solution are:

- File copy to local disks for each workstation may use network, tape, or physical transfer of disks
- A two-hour content file may take more than four hours to transfer using a Gigabit Ethernet network

Figure 1. HD Video Workflow Steps without Shared SAN



Each process step—digital capture, editing, adding effects and graphics, and rendering finished video—has to wait for the previous step to complete, and for the file to be transferred to local disks of the next workstation. As two hours of uncompressed 1080i video is well over a terabyte of data, this can be an extremely time consuming process, even with a Gigabit Ethernet network infrastructure. Many facilities output the intermediate project steps to tape, and then re-ingest the tape at the next workstation. In either case, the time of video, audio, and effects editors is poorly utilized, and the time to get content on air can be lengthened considerably.



One of the challenges in integrating this process into a workgroup SAN environment with concurrent shared access to storage is that the performance requirements vary greatly by process step:

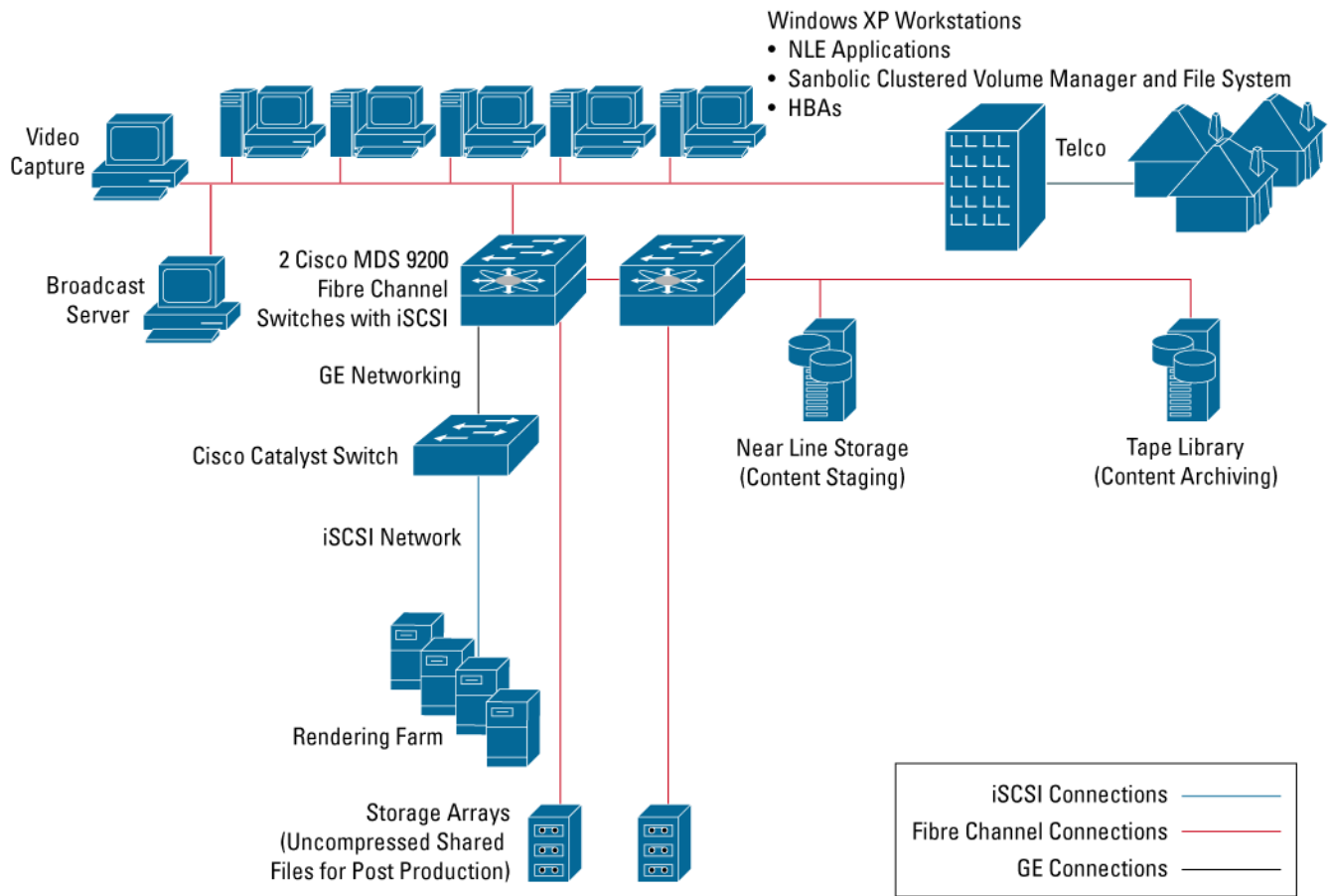
- Capture needs fairly low CPU power, but is very high in I/O requirements.
- Editing requires very high I/O bandwidths.
- Rendering requires very high CPU power and relatively lower I/O bandwidth. Processing is typically distributed across large numbers of inexpensive blade servers.
- Broadcast requires very high I/O bandwidth.

A workgroup shared SAN that streamlines the post production process for HD video and film has to address both technical and economic requirements. High I/O process steps need to be provided with guaranteed 165 MB/Sec per-station file access (or more for film projects). Yet it may be uneconomic to connect large numbers of inexpensive rendering servers to the SAN using the high-performance Fibre Channel networking required by ingest, editing, and broadcast stations.

SOLUTION

Sanbolic Inc. and Cisco Systems® solution for the NLE systems consolidates the post production process for uncompressed HD video onto a shared workgroup SAN that greatly improves the cost and time efficiency of the process (Figure 2). This solution is integrated using Cisco® MDS 9000 Family multiprotocol switches and LaScala and Melio storage management software from Sanbolic Inc, in conjunction with standard high-performance storage arrays. The resulting shared HD SAN is a very flexible and scalable platform for post-production and digital asset management. Source content is digitized once and available to all editing stations and rendering servers directly on the SAN. Finished content is encoded and written to the SAN, where is it available to a broadcast server or to VOD streaming servers within the Telcos for content delivery.

Figure 2. Sanbolic Cisco HD Video Architecture



Several primary features of Cisco and Sanbolic products are at the center of this solution:

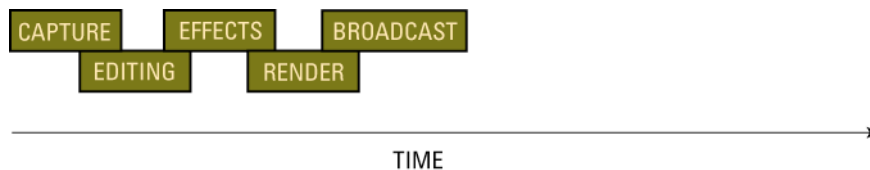
- The Cisco MDS 9000 Family of switches has the unique capability of provisioning the same storage logical unit numbers (LUNs) through multiple protocols: through Fibre Channel and internet Small Computer System Interface (iSCSI). By using the Cisco MDS 9000 Family multi-protocol switches, the networking infrastructure within the shared SAN can support extremely high I/O requirements of uncompressed HD or film quality files for ingest in editing, while cost effectively connecting many rendering servers into the SAN using standard Ethernet components.
- The Sanbolic LaScala Cluster Volume Manager provides the capability of creating storage volumes that can be centrally assigned to any workstation for workflow management and/or shared across multiple computers. The Volume Manager also efficiently aggregates I/O across multiple RAID controllers, creating very large volumes with I/O performance measured in gigabytes per second.
- The Sanbolic Melio Cluster File Systems support concurrent read and write access to shared files from multiple workstations across multiple computers.

These features combine to provide a shared SAN that greatly simplifies the management of multiple-terabyte content files and permits concurrent read and access to files from multiple workstations, whether the workstations are connected using Fibre Channel (FC) or iSCSI.

Figure 3 shows the workflow process in the Sanbolic and Cisco HD video solution, demonstrating that:

- No file copy is required
- All stations have concurrent access to content file, hence some process steps can be done simultaneously

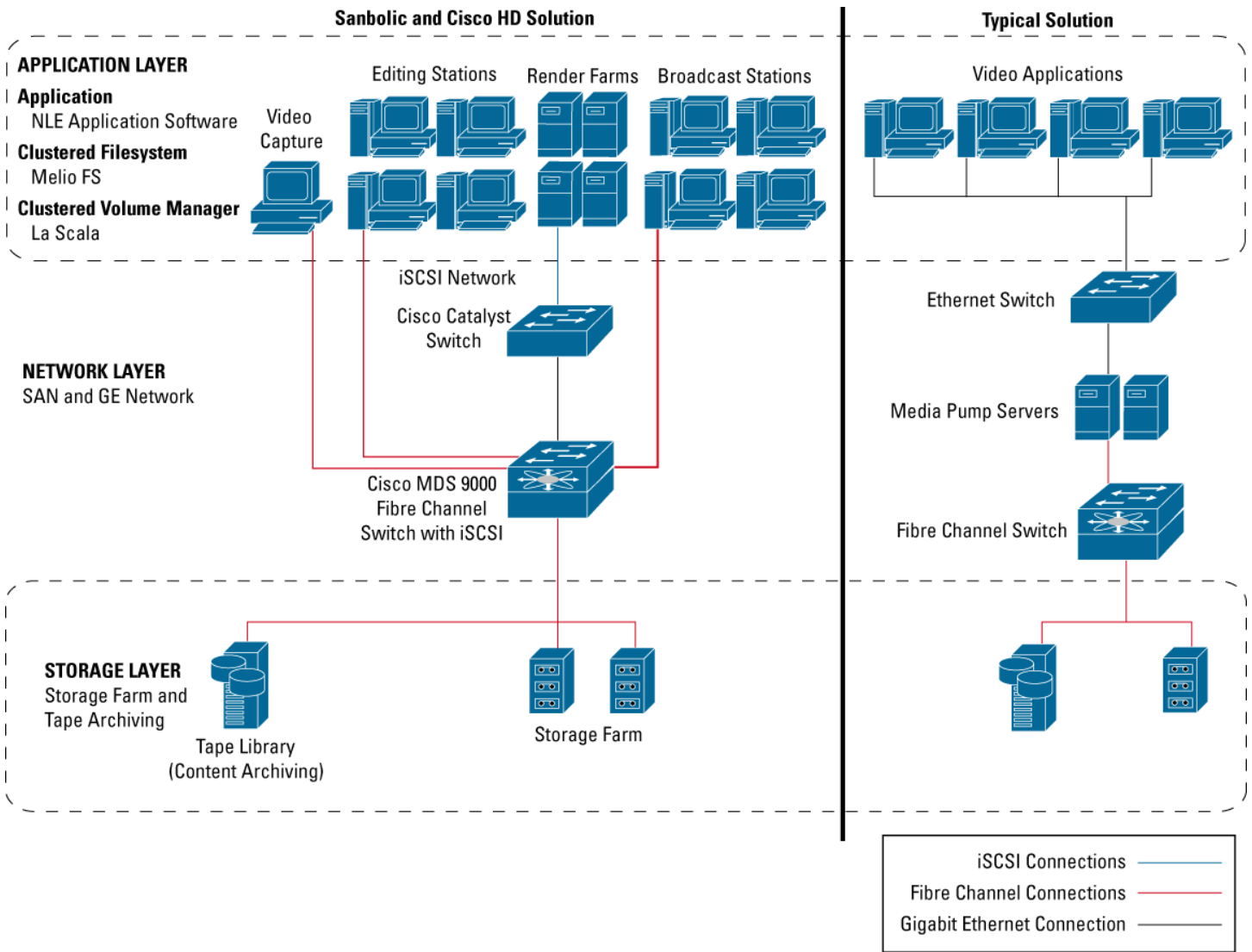
Figure 3. Sanbolic and Cisco HD Video Workflow Steps



The Sanbolic and Cisco solution greatly simplifies the work for post production, even when using very large HD or film-quality content files. Capturing can be done centrally, and files assigned to any workstation in seconds, eliminating long network- or tape-based file transfer processes. Many editing processes can now be performed simultaneously, provided the editing applications allow simultaneous access of the same file. The storage access for each workstation can be matched with I/O requirements. Capture, editing, and broadcast need high I/O throughput, hence will use Fibre Channel. Rendering needs high CPU capacity but lower I/O bandwidth, hence will use iSCSI for storage access and the rendering will be performed by an inexpensive but powerful farm of generic 1- rack-unit (RU) servers as shown in Figure 2.

In addition to these advantages, the Sanbolic and Cisco Solution also offers a completely tiered solution and reduces the implementation as opposed to the traditional solution by one tier, thereby reducing the complexity of the solution (Figure 4).

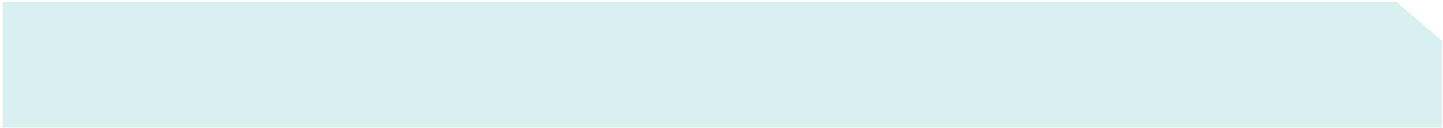
Figure 4. Two-Tiered Solution from Sanbolic and Cisco, and Traditional Three-Tiered Solution for HD Video



WORK PROCESS AND IMPLICATION FOR DATA TRAFFIC

Source content is typically captured by camera on tape, and must be transferred onto disk by one of the stations. Uncompressed 1080i video requires approximately 600 GB of storage for an hour of content. The digitizing process from tape is real time and is very sensitive to any bandwidth restrictions, which will cause frames to be dropped, making the file unusable. Guaranteed access to storage at a bandwidth of at least 165 MB/Sec is required to avoid frame drop, hence FC protocol is used to provide storage access for the capture stations.

After content is digitized it is available to any of the editing stations. Nonlinear editing systems use pointers to a timeline on the source content file to identify the parts of the file to be used in the project. A video editor will define the sequence and transitions between segments of the file, which is captured in the editing software as a template referencing the source content and the timeline. The audio editor references the same time. A story editor, graphics editor, and effects editor will overlay additional layers of information on the template. Each of these editors requires guaranteed bandwidth to the source content, or video will be jerky, frames will drop, etc. This implies that the FC protocol will be used for storage access.



The Sanbolic and Cisco solution can aggregate performance of multiple disk arrays to provide sustained throughput of more than 200 MB/Sec, per station (for 1080i) from shared volumes (up to several GB/Sec aggregate performance for a large installation). This allows smooth response even when scrubbing the timeline and avoids audio lag. After the template is completed, effects and transitions are processed into sequential frames of video images and re-imported into the timeline. Rendering is extremely process intensive, and is typically accomplished with a cluster of servers in a render farm. Storage bandwidth requirements are considerably less for rendering servers, because image processing is the bottleneck. Storage access of 1 to 15 MB/Sec per server is typically sufficient. Hence render farms are ideal for iSCSI over Cisco Catalyst 6000 Series switches and Category6 (CAT6) wiring, because render farms typically consist of large numbers of low-cost servers that do not require the performance of more expensive Fibre Channel connectivity.

CONCLUSION

In the monolithic, share nothing, proprietary, solutions, each workstation needs to be equipped with the maximum amount of anticipated storage and an additional buffer space for more storage. This is essential because there are multiple copies of the content that are copied over from system to system for each step of the HD processing. This creates an issue with version management, and additional capital investment for the extra hardware. The use of shared storage eliminates all these issues. Hence the shared storage architecture improves storage and asset utilization, thus reducing the cost of ownership for the entire solution.

The open systems, shared storage-based solution from Sanbolic and Cisco supports uncompressed HD video and other formats and can be expanded modularly to take advantage of the developments in the fields of storage and processors. In addition each function of the HD video process itself is modular in the solution, and can therefore be upgraded or changed without affecting the entire solution. This is a welcome contrast to the existing proprietary and expensive solutions available today.

The Sanbolic and Cisco solution provides a flexible, and high performance platform for deploying uncompressed HD video systems with the right blend of hardware and software components. It allows for shared access to digital content and provides the opportunity to secure and distribute the content in a seamless and timely manner.

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