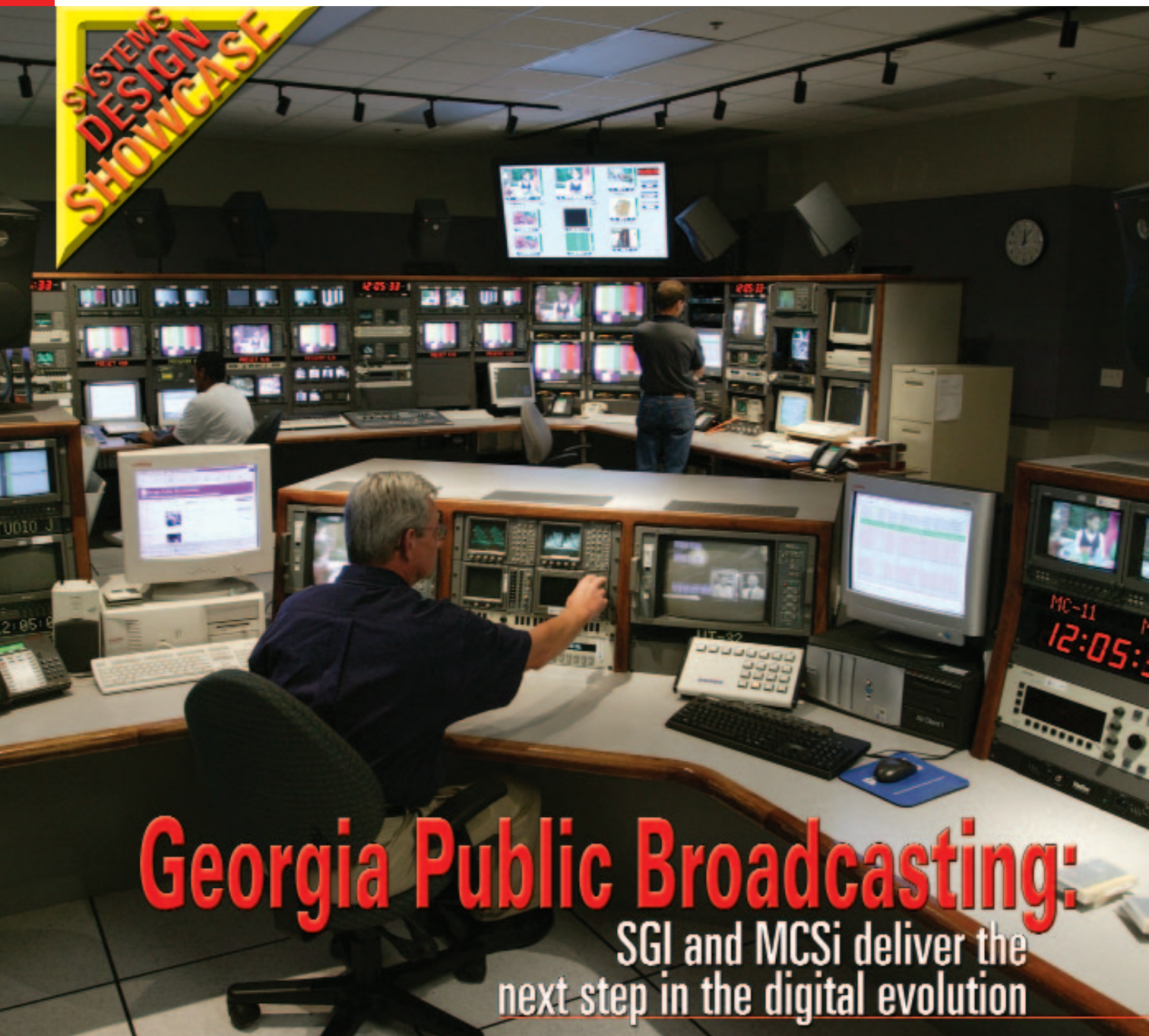


Broadcast Engineering®

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**SYSTEMS
DESIGN
SHOWCASE**



Georgia Public Broadcasting:
SGI and MCSi deliver the
next step in the digital evolution

BY BILL BUHRO

The public broadcasting system in the United States is one of the leaders in transitioning its member stations and infrastructure to a digital format. Atlanta-based Georgia Public Broadcasting (GPB) wanted to go further. GPB provides multiple channels of television and radio public broadcasting and a rapidly growing Internet streaming media service to educators throughout Georgia. The service is to be provided to public and private schools as well as parents home-schooling their children.

In early 2002, GPB issued a request for proposal and the Broadcast Solutions Group of systems contractor MCSi with SGI Professional Services responded. The architecture from SGI needed to meet not only broadcast playout requirements, but also the common data management, shared storage and archiving infrastructure that the station envisioned for both its broadcast and non-broadcast data. The station also desired to build a highly reliable centralized storage environment that would support both the Internet service and the broadcast operation. The result of the SGI and MCSi collaboration was an IT-based open digital infrastructure that met the station's enterprise-level storage requirements and transformed its videotape-based broadcast workflow into a simple yet effective, full-digital dataflow incorporating media management. The total cost of ownership advantages of this open, digital infrastructure are just now beginning to be realized.

At the core of any good architecture is a good foundation. In this case, the foundation is the storage infrastructure. To determine what type of infrastructure best met the facility's needs and anticipated growth, MCSi and SGI first evaluated its broadcast workflow requirements, and then gathered requirements for the IT department and the educational media technology group. Foremost on each group's mind was reliability. This along with many



Horace Eberhart is shown working on GPB's main disk storage environment, the Hitachi Data Systems 9980V.

other requirements drove the decision to recommend an enterprise-class RAID storage system coupled with a redundant Fibre Channel storage area network fabric.

Central storage and storage infrastructure

The team proposed Hitachi Data Systems 9980V central storage as the main disk storage environment. It was chosen for its many enterprise-class performance, redundancy and high-availability features. It has no single point of failure and is designed to grow seamlessly to dozens of terabytes.

Next was the requirement to connect all the participating departments – broadcast, IT and educational streaming media – to that central storage. Further considerations included the varied locations of the people who would be using the system, what type of files they needed to access, when they needed to access them, and what type of workgroup and desktop environments they were using. After the team evaluated user and workgroup

versally supported. These included SGI IRIX, Windows, Macintosh, Linux and other Unix environments. All clients needed shared access to the data stored in the central repository. Client I/O needs varied from 56kb/s to over 600Mb/s.

With the many types of operating systems needing access, the team suggested a battle-proven 64-bit heterogeneous shared file system, SGI CXFS, for storage area networks (SAN). Implementing a shared file system allows platforms of varying operating systems to attach to the central storage – either by network or Fibre Channel – and see that storage just as though it were local to that desktop or workstation. It facilitates a high-availability data infrastructure, meaning it is developed and constructed in such a way that there's no single point of failure in the SAN architecture. GPB is the first U.S. broadcaster to install an SGI CXFS shared file system as part of a digital infrastructure.

The next challenge was determining the balance between the data that was required by the various departments, and its storage. The team had to decide how much data or material should be kept online vs. how much could be conveniently accessed from nearline, as well as how much would be archived. The type of material ranged from legacy productions, to a large library of materials in the educational media organization, to backup data from the IT department. During the team's analysis, it became clear that a nearline tape robotic system would be required. Several tape robotic systems were evaluated, and the ADIC Scalar 10K was selected, with LTO-2 tape media.

The internal user organization includes several hundred people. This

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criteria, it became apparent that the current mixture of platforms used by all of the sectors would need to be uni-

internal user group provides data access to thousands of teachers and educators around the state through its

Internet services. This large number of users, all of whom have different levels of familiarity with the information residing in the infrastructure, dictated the need for media management. The project team enabled automated operations with regards to the movement of data within the storage infrastructure, to allow the material to be easily found and maintained.

The facility's media management requirements went beyond what is commonly used in the IT world, which is a hierarchical storage management solution (HSM). HSMs typically have little user interface associated with them; they simply respond to a set of migration rules for moving data between online, nearline and offline storage. With input from SGI and MCSi, GPB selected the Masstech Group MassStore product, which manages and has access to the broadcast data infrastructure. In addition, it provides the interface for moving broadcast data between the various storage systems.

These systems include three types of servers: SGI Media Server for broadcast MPEG-2 video servers, Virage Solution Server, and Masstech MPEG-4 proxy

server, interfacing with the Hitachi Data Systems disk storage system and the ADIC robotic tape system. (See Figure 1.)

Broadcast operations

The station chose the SGI Media Server for broadcast to be the workhorse for their digital on-air playback. The Media Server's ability to ingest and playout a variety of standards-based file formats – i.e. MPEG-2 I-frame, MPEG-2 Long GOP, DVCPRO 25 and 50, and IMX/D-10, as well as its support for the new MXF file exchange format – ensure that the facility will be able to handle any of today's popular compressed video formats. The station chose MPEG-2 I-frame as its air master format, which will easily facilitate its transition to direct ATSC digital transmission.

The SGI Media Servers are used for on-air playback at the facility. As mission-critical applications, they are connected directly to the central storage infrastructure through a high-speed, high-availability 2Gb Fibre Channel redundant SAN fabric. These on-air servers are used in a protected configu-



Buster Hampton works on the MassStore, which manages and accesses the broadcast data infrastructure while providing the interface for moving broadcast data between the various storage systems.

ration for playing to air all four of the station's 24-hour broadcast feeds to more than two million viewers weekly. To achieve the eventual goal of eliminating as much videotape in the workflow as possible, several channels of the Media Server for broadcast have been allocated for ingesting content into the centralized storage. Under control of Harris automation and a Masstech media management system, the four-channel national program feed is directly ingested as multiple program transport stream (MPTS). SDI contribution material is also ingested from other satellites, live sources and videotape, while manual controls allow for "rushes" or ad hoc recording.

Post production

The station's post-production facilities utilize Avid Media Composers, Symphony and Avid Xpress editing suites. They will be integrated with the centralized storage in the next phase of the project, which is underway.

SGI is currently assisting with the evaluation of the Avid environment to determine the best methodology to interface with the centralized infrastructure. One

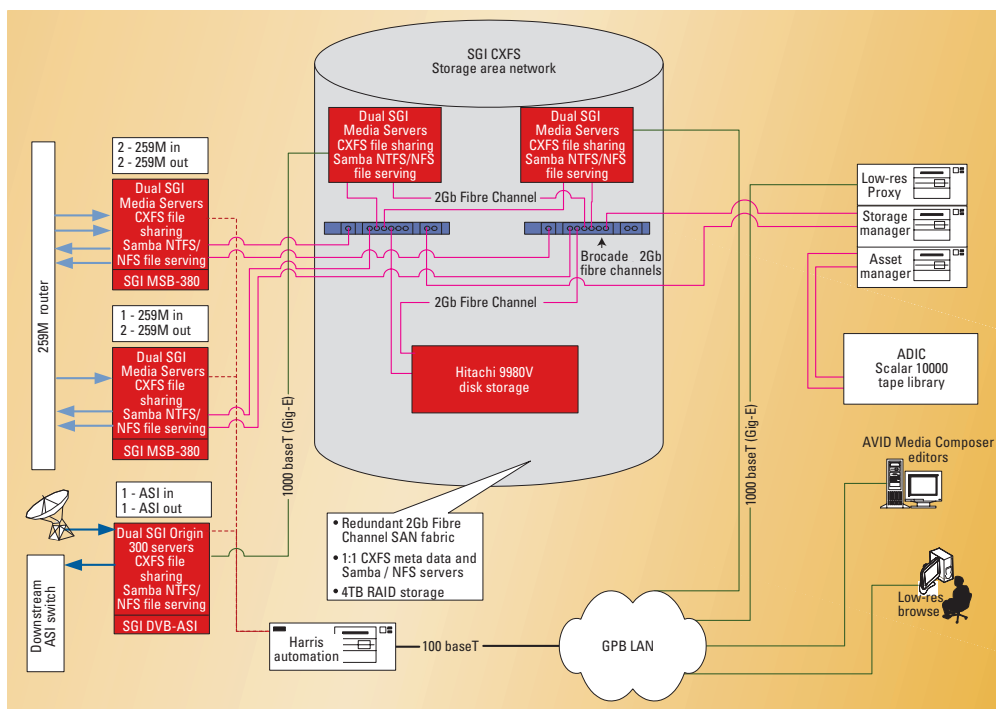


Figure 1. For GPB to eliminate as much videotape as possible, several channels of the SGI Media Server for Broadcast have been allocated for ingesting content into the centralized storage.

solution may be to implement one of several interfaces SGI has developed for the Avid environment that allow easy data exchange between its storage infrastructure and Avid nonlinear editors (NLE). However, the facility's current NLEs use Avid's older 2:1 video compression format, which requires conversion to MPEG-2 for on-air playback. Today these conversion, or "transcode," operations can take anywhere from four to 10 times real-time. This may be acceptable for cutting 30-second spots, but is impractical for long-form programming. In the interim, the NLEs will ingest and playout using SMPTE 259M through one of the SGI Media Server for broadcast systems.

The next phase also will include the integration of the Virage media asset management system for broadcast operations and educational media projects. SDI-based contribution material is passed via a Virage logger under Masstech control to provide keyframes for media management and subsequent low-resolution browsing and editing over LAN. The resulting media is stored on SGI CXFS SAN, allowing complete integration with an NLE system based on Avid Unity, the streaming of multi-resolution copies, and the inclusion of data sources. Edited pro-

Design Team

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Technology at work

SGI Media Server for broadcast systems
 SGI Origin 300 servers
 SGI CXFS shared file system
 Miranda Kaleido display system
 Hitachi Data Systems 9980V storage
 Masstech Group MassStore storage
 Masstech Group Mass Proxy transcoder
 ADIC Scalar robotic tape library with LTO-2 tape media
 Virage media asset management system
 Avid Media Composers
 Avid Xpress editing suites
 Avid Unity storage
 Harris automation
 Brocade 2Gb Fibre Channel switches

gram material is stored on the SAN until it is forwarded to the redundant on-air servers under Masstech and Harris control.

Virage integration is especially important for the current educational media organization's multiyear project detailing the history and restoration of the Fox Theatre in Atlanta. GPB is very excited about this portion of the project, as the Fox Theatre was one of the great movie palaces constructed during the 1920s. The station is collecting archive video, film and still images, as well as shooting new footage showing the progress of the theater's restoration. It has already started the process of indexing and cataloging all the video, stills and other media assets using the Virage cataloging/indexing product and media asset management system. SGI will integrate the Virage system with the central infrastructure, which will allow all programmatic information to be available in the central storage environment. Media assets will include "proxy content" – searchable,

retrievable and viewable on any desk-top throughout the facility – as well as high-resolution, or master, digital elements that will be stored for eventual post production of the documentary. The station will also use the Virage system for cataloging and indexing their existing educational programs and providing search capability to teachers in the field.

The next step: HD

In addition to building a new digital television workflow at the station, SGI also is assisting with the next evolutionary step, beyond standard definition into high definition. SGI – using its Media Server for broadcast system – developed a customized server that will allow for the capture of both SD and HD feeds (via a DVB/ASI stream) from national PBS transmissions. Provision is made to encode SMPTE 292M (HD), conforming finished programs from HD sources, encoding HD to DVB/ASI for storage, and subsequent back-to-back HD replay via the new HDTV feed they anticipate bringing on line in 2004.

In this next step, Harris automation will control an SGI Origin 300 video server for HDTV service and redundant MPEG-2 video servers to provide the additional SD channels and embedded data services.

In conclusion

The MCSi and SGI solution was chosen for the project because it was the only solution that presented a completely open digital infrastructure. GPB will begin broadcasting with the new dataflow in mid-2003. **BE**

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The SGI Origin 300 video server is controlled by Harris automation. Harris also controls the SGI Media Server for broadcast MPEG-2 video servers.

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