Automation and Live Television News:
Enhanced Support for a Complex Workflow

By Fred Schultz

The historical role of automation in television broadcast has been to provide the componentry needed for fitting available media systems to the workflow needs of the customer. When the automation products built for transmission/production/master control applications were applied to all-digital newsrooms, they were found to be overly complex, overly expensive, and fell short of adequately addressing many important workflow needs. This paper will review workflow in digital newsrooms, examine the purpose of the other components that will be used there, consider the influences of cost on customer decision-making, then discuss the design needed by a newsroom automation system to completely satisfy the needs of this space.

Arrival of the first practical video servers in 1994 generated a need for computer-based automation systems with a range of functionality and price points. The first application was commercial insertion, an ideal task because of its tightly prescribed requirements. Success there raised confidence in this fledgling technology.

As the cost of disk storage fell, server use expanded to include production and long-form programming. Hand-in-hand, manufacturers of servers and automation worked proactively to fine-tune their products and explore new applications. It was only when the industry began examining broadcast news that developmental momentum stalled at the barrier of workflow complexity.

Workflow of Early Transmission Applications

In the beginning, two alternative approaches to the use of video servers for commercial insertion were taken. One used the server to completely replace all playout VTRs, storing all active spots on its hard drives. The second continued to use VTRs but, in an effort to save wear to tape and decks, primarily cart machines, included a server with a smaller amount of storage for caching the most active spots. Despite a substantial installed base of cart machines to benefit from caching, ultimately the reliability and economy of a pure server solution came to dominate commercial insertion.

This early use of servers for commercial insertion had a simple and straightforward workflow (Fig. 1). The material arrived on tape, one commercial spot per tape, and an operator digitized each onto the server, using an interface modeled after tape-to-tape dubbing. The traffic system then generated a log of the spots to be played in each break. An internal server application or a simple

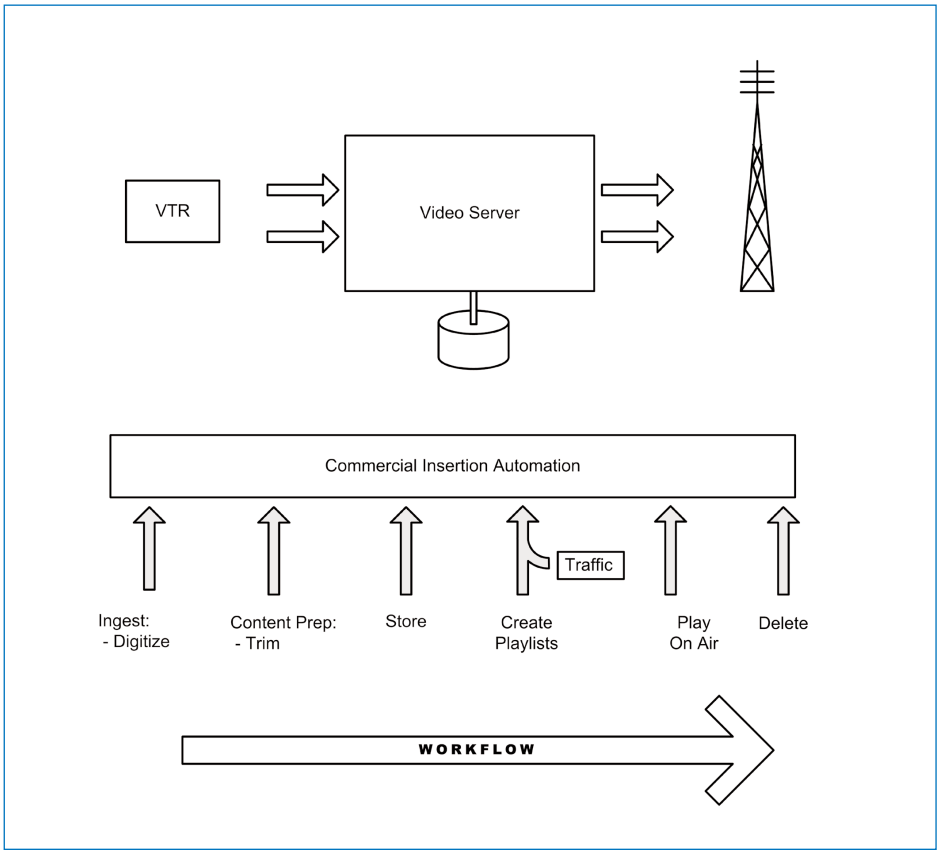

Figure 1. Early commercial insertion workflow.

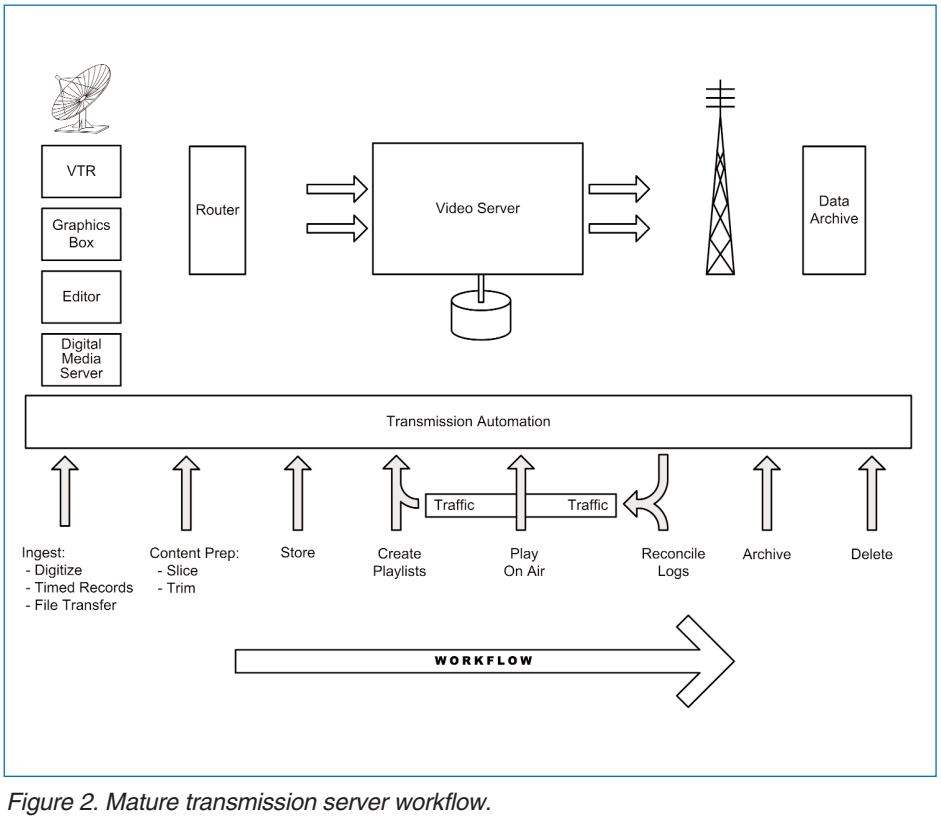

Figure 2. Mature transmission server workflow.

automation system generated a playlist sequence from the traffic log, and cued the first spot in the server. At the appropriate point in programming, a master control operator would begin playout of the break sequence, switch from programming to the server, switch back to programming at the end of the break, and note the spots played on the log. Finally, an operator would delete unneeded spots from the server using tools provided by the server or automation manufacturer.

Workflow of Mature Transmission Applications

The resounding success of video servers performing commercial insertion led to their use in other transmission and production applications. One such early use was for playing moving backgrounds, either as an input to the on-air switcher or as a feed to an on-camera video wall. Then, as the price of disk storage fell, servers began replacing tape for recording and replaying longform content such as syndicated programming. While the number of transmission applications grew, additional content sources also came into use (Fig. 2). Satellite downlinks became the source for both longform feeds as well as non-local commercials. Tools that previously had been adequate for trimming tops and tails of single spots needed additional capabilities to locate and slice out multiple spots and segments from a single downlinked recording.

With an increase in the amount of material recorded into the server daily, automation companies found it important to support timed recordings along with router control, satellite dish, and receiver control. New sources for server content came to include a station's nonlinear editors along with their graphic boxes. Initially, these devices, such as VTRs and satellite line feeds, transferred their content by realtime digitization of baseband video and audio.

Within the last few years there has been substantial growth in the use of non-baseband file transfer technology. At first these digital media servers operated as standalone boxes that received their content as files but played it out as realtime baseband. Now most can provide direct file transfers into the servers, if the server is compatible and the integration interface can manage the process.

Traffic systems have matured as well. The norm is now unmanned creation of spot playlists by a networked connection between the traffic system and the automation system. Furthermore, most contemporary traffic systems make use of the automatic as-run log created by the server or automation system and conform that log with no intervention required from the operator.

Archiving needs in the early years had been simplified by the simple expedient of storing or copying the original distribution tape. Any spot that was deleted could be redigitized if needed again, but as content began coming from non-tape sources, broadcasters sought other solutions to archiving. For some this meant true digital data archiving using DVD-RAMs or digital data tape as the storage media; others found that archiving onto baseband videotape was sufficiently cost-effective and technically adequate, especially in light of the low generational loss in the serial digital domain. Both of these archiving models raised the requirements placed on the automation system, and with the advent of separate pools of content on the server and in the archive, automation manufacturers expanded the variety of tools offered for media management chores.

Characteristics of Transmission Workflow

At this point it should be noted that while video servers advanced from commercial insertion to full transmission operations, the basic workflow remained largely unchanged for the following reasons: Transmission workflow is deterministic in that all the content and the processes for acquiring it are known without ambiguity. It has long lead times for content acquisition—the prerecorded content for playout is acquired hours if not days ahead of air time. It also has long lead times for scheduling—the schedule for playout is established hours if not days ahead of air time. Transmission workflow involves few overlapping content streams; aside from bugs, CGs, crawls, effects transitions, and squeezebacks, the content stream delivered during transmission operations originates from a single device stream.

The Challenge of Tape-Based News

Today almost all newsrooms are tape-based. They consist of a newsroom computer system and an array of standalone devices including VTRs, editors, house routing, and graphic boxes. The tape portion is expensive and prone to mechanical failures; tapes are fragile, require too long to shuttle, and can only be used by one person at a time. When serious comparison is made with digital server-based newsrooms, tape-based news is clearly burdened by human and hardware inefficiencies, excess costs, and compromised reliability. That said, the workflow of tape is ingrained across the industry and, as such, is a source of comfort to those who manage it.

Components of the Digital News Environment

An integrated digital news operation comprises three basic systems: the newsroom computer system (NRCS); the media devices; and an automation/integration layer (Fig. 3).

The newsroom computer system provides networked terminals across the news operation for managing wires, writing stories, creating rundowns, archiving and retrieval of text material, and messaging. A NRCS is already in place in most newsrooms.

The media devices include the video server, integrated editor, and optional browse editor; the CG; and the still store. In new graphic products, an expansion of functionality is blurring the boundaries that had separated the CG, still store, and the newer clip store, but in the field the distinctions still remain clear.

The automation or integration layer assumes linkage and completion roles when forging a unified system from this mix of devices and systems. It assures

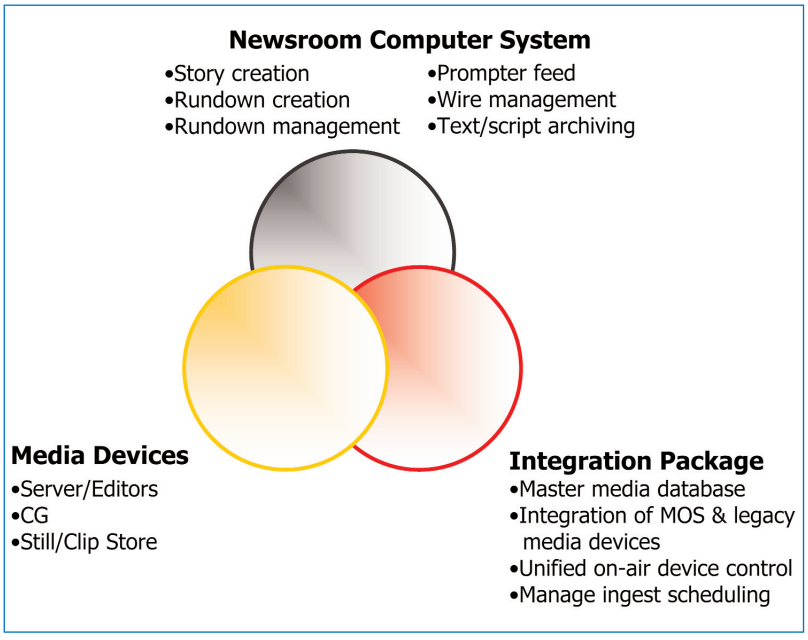

Figure 3. Components of the integrated digital newsroom.

satisfactory integration of all the devices with one another, provides a master database, and offers traditional automation functions like feeds and content management. A well-designed system should also reduce the interface complexity for performing these tasks.

Workflow of Digital News Production

A newscast aims to be a seamless fabric woven from a wide variety of content from an even wider variety of sources. As a result, only a few steps of the many possible in the digital workflow are always constant (Fig. 4). All other steps depend on production needs, hardware capability, and, frequently, on expediency (Table 1).

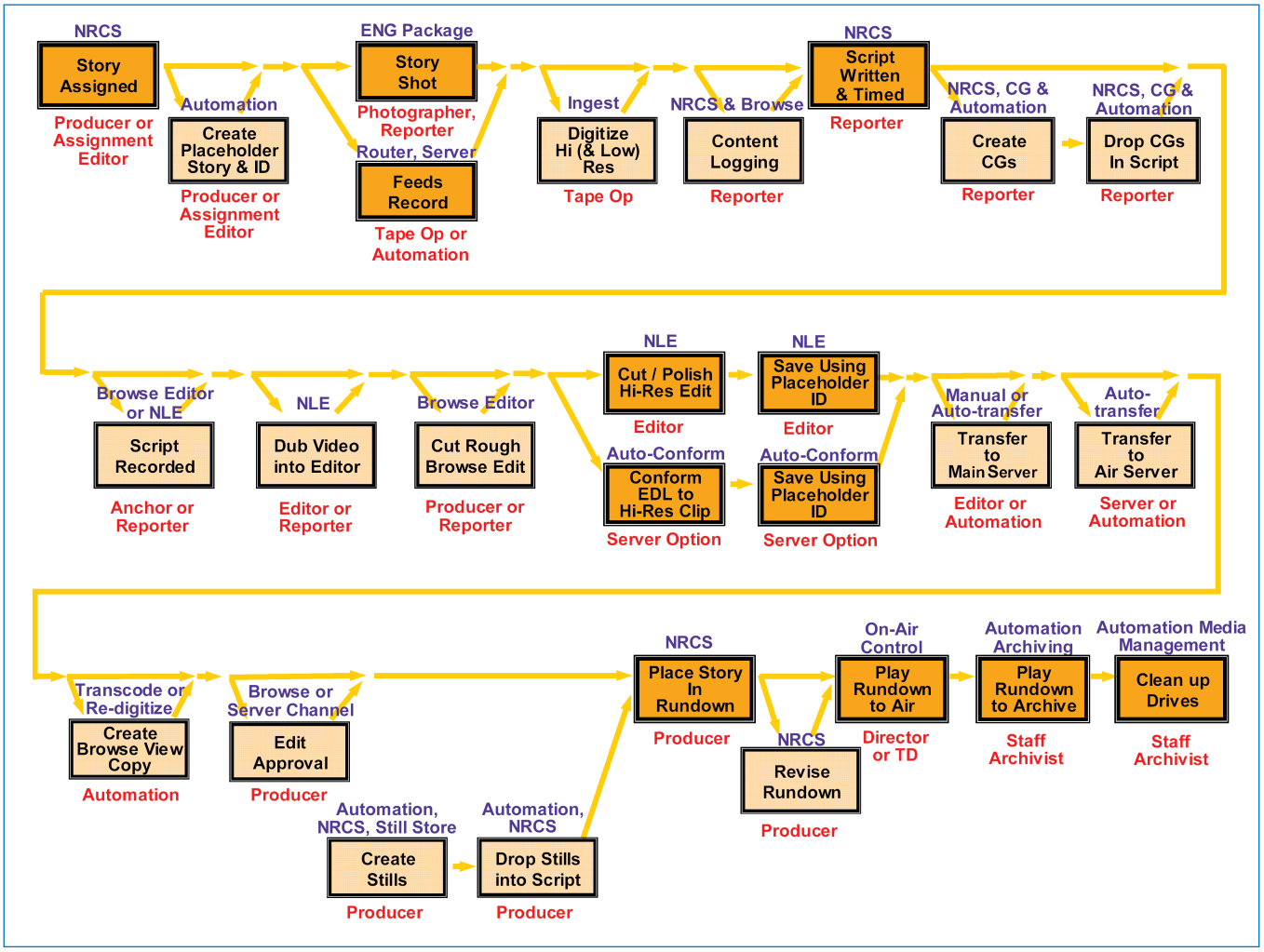

Figure 4. Workflow in the digital newsroom.

Table 1—Digital News Production Workflow

1. The news process begins when the story is assigned, usually by a producer or, perhaps, an assignment editor.

2. [Option] An appropriate tool in the NRCS enables a single entry to populate all the devices of the system with the correct data and metadata. This creates an empty story in the rundown and should build placeholder media IDs to receive the edited video.

3. The content for the story is acquired by shooting it in the field, ingesting fed content, or both.

4. [Option] Bulk digitization is handled by a tape operator. Digitization for browse view and browse editing could be done at this point. Alternatively this step could be skipped when editing systems and workflow needs allow editors to cut individual shots straight from the field tape onto the digital editor.

5. [Option] The content can be logged by the reporter at this point. This would ideally be done using a browse window on the NRCS.

6. The script will be written, timed, and saved for its specific show.

7. [Option] If the story requires CGs the reporter will create them, then drop them into the script at the places they need to hit. Well-crafted automation puts this capability in the NRCS window, and goes on to manage on-air playout, irrespective of whether the CG is a new or legacy device.

8. [Option] Any recording of the script would be done at this time by the anchor or reporter.

9. [Option] For any editing system that uses local storage, the editor or reporter would copy that content from the server.

10. [Option] A browse rough cut may be made by the reporter or producer.

11. Two alternate pathways lead to creating the high resolution edited story: (a). The editor may cut the finished story with or without using an EDL from a rough cut. At this time the editor must save the edited piece, ideally using the correct placeholder ID as supplied by the automation system. (b). The browse edit may be creatively adequate for airing, in which case a server which supports autoconformance into high resolution could create the high res copy on the server. This, too, would use the placeholder ID.

12. [Option] The high res edit may need to be transferred from the editor to the main server.

13. [Option] The high res edit may need to be transferred from the main server to an air server.

14. [Option] A browse view copy may be made from the high res edited piece.

15. [Option] Approval for airing the edited piece might be required.

16. [Option] In order for the producer to create and attach stills to the rundown there must be complete integration of the NRCS, the still store, and the automation system. Well-crafted automation puts these capabilities in the NRCS window and integrates them to on-air playout using new or legacy still stores.

17. The story with its attached CGs, stills, and edited video is placed in the rundown.

18. [Option] The rundown may be revised and resequenced by the producer.

19. The stories in the rundown are aired in an ever-changing sequence determined by the producer. A well-designed automation system will dynamically feed the server, CG, and still store instantaneously so that all changes are transparent to the director. This refreshes all devices in lockstep with the producer's changes, and should do so with legacy graphic devices as well as contemporary MOS-compliant ones. A well-designed automation system will display status of all media devices to the director on a single integrated interface optimized for workflow efficiency. This will reduce the mechanical workload otherwise required for manipulating separate media controls, and the distraction required for monitoring and mentally integrating information from separate media interfaces.

20. After a news show has aired, an archive will be made of the edited content. Original news stories are their exclusive property of a broadcaster and represent an exceedingly valuable asset. Archive systems are available in a wide range of features and prices, and no integrated newsroom is complete without one. Even the least costly of the well-designed automation systems will enable a station employee to create a clean shelf copy without intervention from the technical staff.

21. Before a news day can be considered finished, it is important to clean up space on the video server. At this point the system is ready for the next day's work.

Structural Differences between Transmission and News Operations

Top-Down Needs Analysis

The key differences presented by news operations arise from their non-deterministic scheduling with last-moment changes, the routine use of parallel interdependent stream sources, and the great amount of interlinking among systems.

The management of commercial broadcast news operations have only two fundamental reasons for investing in newsroom technology—saving money and increasing competitiveness. Through this prism, much of what is needed for an integrated digital newsroom snaps into focus.

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The Newsroom Computer System

A competitive NRCS today must support the Media Object Server (MOS) protocol. MOS-compliant systems are available from the two dominant vendors, along with a few other parties. A fair proportion of the installed base, particularly in the smaller markets, are legacy systems that will not support MOS. Replacing these NRCS is required for digital integration.

The Media Devices

Among the media devices, servers and editors receive most of the attention because of the improved economy, efficiency, and reliability they may provide. Savings are expected from VTR replacement, maintenance, and tape costs, along with a reduction in the number of tape operators. They further promise to increase competitiveness by reducing the time to get a story on-air, sharing simultaneous access to content among users, and making repurposing of cut content easier, faster, and more attractive.

Less attention has been given to integrating the graphic media devices. New models offer an abundance of features including MOS compliance, but all at a price. And despite the enhanced power of these new products, owners of the installed base of legacy boxes express substantial satisfaction with the performance of their existing units, preferring not to repurchase that functionality in order to install a newsroom server.

The Automation/Integration Layer

The automation layer has been the principal key to success or failure of those integrated digital newsrooms that have been built to date. From the outset it was clear that without an automation layer, even rudimentary news workflow could not be supported. Development of the MOS protocol was undertaken as part of the first major integration project to make communication possible among clip-based newsroom devices.

However, even having MOS-compliancy in all the devices is still not enough. While the MOS protocol is a powerful tool enabling compliant devices to communicate content information and ship sequence lists, it altogether omits support for realtime device control. To actually make a server channel or CG play the items that MOS pipes over from the rundown requires control from an automation layer. Under certain circumstances, this can be adequately provided by a simple machine control unit, such as the proprietary devices developed by server manufacturers. These are minimalist units that use MOS to extract ID sequences from the NRCS, turn them into RS-422 commands for the server channels, and provide a graphical user interface (GUI) on which the operator manually triggers each channel to play. As an inexpensive trigger for server channels, they do not address graphic devices, ingest management, master databasing, or enhance staff efficiency.

Since the need for context-aware device control is so critical, and because most digital newsrooms constructed to this point have been flagship installations or pilot projects rather than driven by profitability, large automation manufacturers have been brought in to provide device control. Use of such transmission-bred automation in flagship newsrooms kept their costs high, and in some cases, contributed to workflow gaps that undermined competitiveness. The absence of an

economical and comprehensive media control system even spurred release of a turnkey hardware/software newsroom designed for a single operator. It achieves a technically flawless show by locking and rehearsing the rundown before air time, a process that creates vulnerability to more flexible competitors. So the analysis comes down to specifying what functionality is needed from the automation layer to fully complete the building of a digital newsroom that will produce savings and competitiveness.

Functionality Needed from Automation Layer

To fully satisfy the automation role in building a digital newsroom that is both competitive and economical, the following functionality must be supplied:

A user interface providing unified control and status display of all the media devices. The display must be designed with human factors in mind, optimizing the operator's efficiency at monitoring what needs to be known about the media devices. This display must perform with equal effectiveness for news, weather, and sports, and the device control it provides should unburden the director/TD from the mechanics of separately managing half a dozen or more individual media channels. It should operate by tracking activity on the switcher and not require further actions of its own.

Control should integrate the server channels with all the graphic devices (whether MOS-compliant or not), so rundown changes made by the producer result in an automatic update to all the devices that is transparent to the director/TD. This block move capability unburdens the director/TD from manually orchestrating the separate sequencing of each individual device and channel throughout the show.

Ingest control, management, and scheduling for ad-hoc digitization, file transfers, and unattended feed recordings. Integral with this must be tools for traditional breakdown and trimming, along with processes that minimize manual entry of data and metadata.

Securing clean copies of aired original news material onto archive media. At a minimum this process should automate archiving onto baseband videotape for shelf storage and be done without requiring engineering or technical personnel. Segments should be separated by black. A printed log should be created and a running library log updated with content, time code, and media identifier. Above and beyond basic baseband shelf archiving, optional integration of true digital media archiving with automated nearline content retrieval should be available.

A server content management tool for keeping open space available. The basic tool should present an operator with a list of edited content that is already safely archived, has gone a specified period of time without being accessed, and has not been previously marked for saving. If any segments are seen as worth retaining longer on the server, they can be pulled from the list, afterwhich the rest of the list can be block-erased.

The master database of all content in all the media devices and shelved archives must be maintained. It must be linked with the text archiving of the NRCS, be open for external searching, and offer protection by redundancy against hardware failure.

Summary

All three systems needed for conversion of tape-based broadcast news operations to servers are now available, with MOS-compliant newsroom computer systems serving as an essential foundation. A variety of manufacturers offer server/editor combinations with MOS compliancy, giving broadcasters a choice of architecture, storage technology, and costs. Automation systems designed explicitly for live news operations have recently become available.

These true newsroom automation systems are tight, functional packages that provide full integration between the NRCS and all media devices, highly efficient on-air status and device control, and all applications necessary to efficiently sustain the daily workflow of fully-digital news.

THE AUTHOR

Fred Schultz is vice-president of news automation for Sundance Digital, Inc., Dallas, TX. Prior to joining Sundance in 2001, he served in various capacities: first with ASC; then with Leitch Technology: and, most recently, as manager of air and newsroom systems. Schultz is the author of a series of white papers on server technology and received a prime-time Emmy award for his work in television. He has a Ph.D. degree from Vanderbilt University.