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TABLE OF CONTENTS

VOLUME 53 | NUMBER 8 | AUGUST 2011

Broadcast Engineering®

FEATURES

46 Automation
When automating your facility means reducing staff, these guidelines will help you through this difficult process.

50 Understanding blocking capacitor effects
Here's an examination of high-frequency pathological signal transmission issues in today's high-bandwidth equipment.

BEYOND THE HEADLINES

DOWNLOAD

12 Dynamic storage tiering
A system mixing SSDs and HDDs can improve workflow efficiency.

FCC UPDATE

18 TV spectrum auctions
A Senate repurposing bill is gaining momentum.

DIGITAL HANDBOOK

TRANSITION TO DIGITAL

20 MPEG-4 AVC systems
A recent extension directly supports 3-D presentation.

COMPUTERS & NETWORKS

24 Programming routers
Get the most out of your routing infrastructure.

PRODUCTION ROOM

26 Mic design
Find out how classic mics and modern technology are influencing today's mic designs.

continued on page 6

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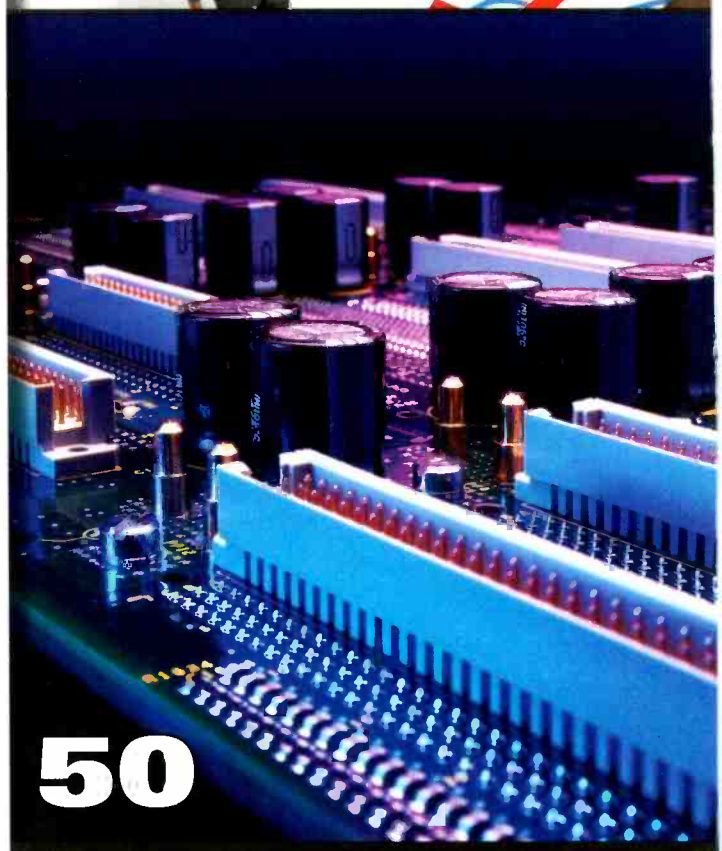

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TABLE OF CONTENTS (CONTINUED)

VOLUME 53 | NUMBER 8 | AUGUST 2011

SYSTEMS INTEGRATION

NEW MEDIA NETWORKS

32 IP for signal management
Hybrid routers offer a bridge between IP and deterministic routing.

SHOWCASE

38 Retooling
After losing Oprah, Chicago station WLS-TV creates a show to fill the void.

NEW PRODUCTS & REVIEWS

APPLIED TECHNOLOGIES

56 Dolby's PRM-4200

58 National Semiconductor's LMH0387

62 RTW's TouchMonitor

FIELD REPORTS

60 Spectra Logic's T950

64 Omneon Media Application Server

TECHNOLOGY IN TRANSITION

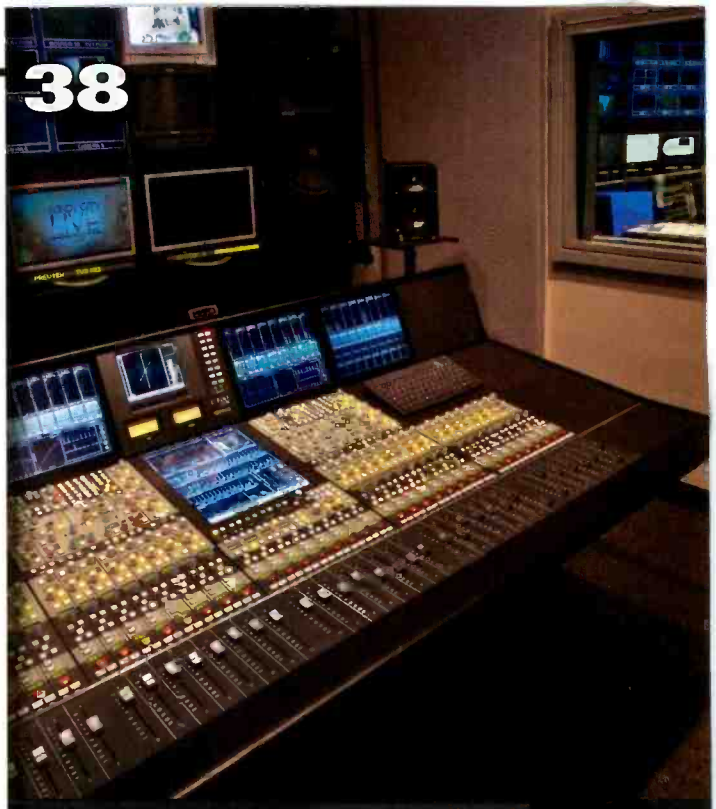
66 Video compression
The handwriting is on the wall for video switching.

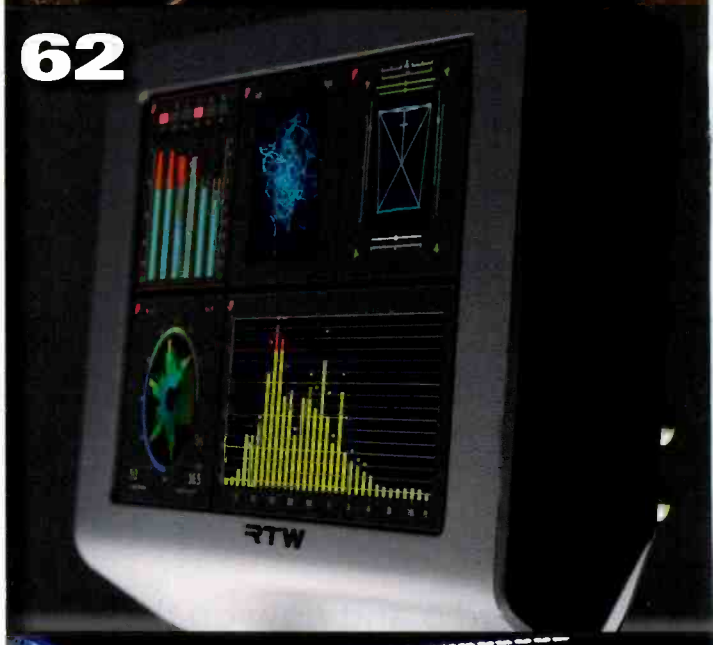
NEW PRODUCTS

68 Evertz's J2K encoder and decoder cards, and more ...

DEPARTMENTS

8 EDITORIAL
71 CLASSIFIEDS
73 ADVERTISERS INDEX
74 EOM





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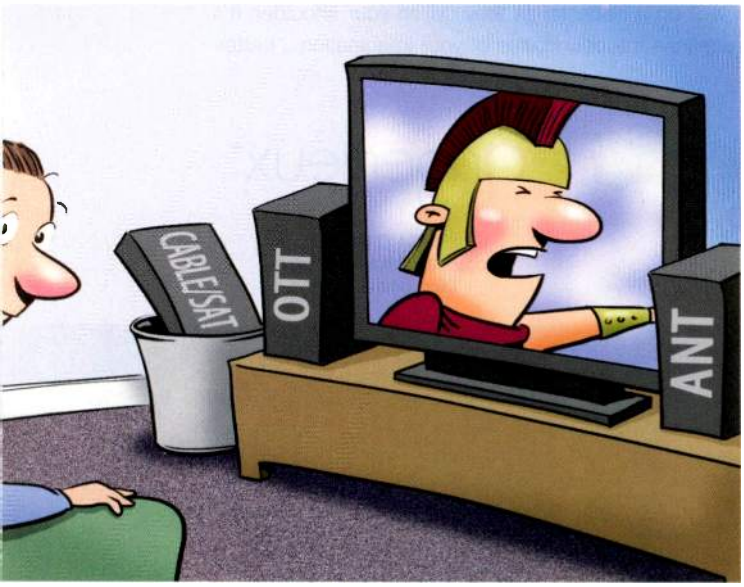
Connecting with viewers

The path from the TV station to a viewer's television set used to be simple and direct: transmit antenna to receive antenna. Today, there are a variety of ways to reach that HDTV.

In late July, over only one week's period, I reviewed more than a dozen press releases concerning ways viewers can access content. What I learned was there may be as many paths for entertainment to reach into the home as grubs in a summer lawn.

The large players — Hulu, Netflix, Amazon and even Wal-Mart — were all mentioned, but also there were stories about smaller companies. Hulu was ranked by



comScore as the ninth most popular video viewing site with almost 27 million unique viewers. Lest you think Hulu is merely another OTT player streaming YouTube videos, the subscription service also delivered almost 1 billion ads, or about 19 percent of the total 5.3 billion ads viewed in June. That is a lot of commercials.

In addition to the above familiar names, several new players are getting into the video delivery business. RIM, the BlackBerry maker, is rumored to be building an Apple TV-like STB. Codenamed Cyclone, the media hub connects to TV sets via HDMI, and it is Wi-Fi enabled. The box connects with Netflix, YouTube and in-home media sources.

For those former (or just angry) Netflix subscribers, Amazon Prime Instant Video will soon carry CBS network programming. The Amazon/CBS deal will include all episodes of "Star Trek." The Amazon service says it will provide access to 6000 movies and TV shows.

Streaming player Roku has released the Roku 2. The device provides access to 300 channels, including iTunes, Netflix, YouTube, Hulu Plus, Crackle and Amazon. Sports fans can access subscription-based feeds of MLB, NBA, NHL and UFC. And if that's not sufficient, the Roku player has an "enhanced remote" allowing viewers to wave the remote at the TV to play games like Angry Birds.

For those who prefer the stability of big-box stores, retailer Wal-Mart intends to challenge the dominance of Netflix through its recent acquisition of streaming service Vudu. Viewers will be able to stream movies and television shows through more than 300 devices, including HDTV sets, Blu-ray players and the Sony PlayStation 3.

All these new paths to viewers' eyeballs should make broadcasters tremble in their control rooms, right? Maybe not.

New consumer research from Leichtman Research Group shows that while 70 percent of households subscribe to both broadband and multichannel (cable/satellite) video services, only 8 percent of U.S. households have broadband but no cable or satellite.

Viewers using only broadband express a variety of reasons for not subscribing to multichannel providers. Of this group, 5 percent say they won't buy an MVPD service because they get all they want from the Internet.

Other reasons for not subscribing to a multichannel service are cost (28 percent), don't watch much TV (26 percent) or have no need for a service (18 percent).

Interestingly, viewing patterns of those using broadband but no MVPD are actually similar to those with both broadband and MVPD. Nineteen percent of the Internet-only group watch online video daily and 55 percent weekly. For those with both Internet and an MVPD service, 17 percent watch videos daily, and 48 percent watch weekly.

The research firm's conclusion: "These decisions [purchasing broadband and no MVPD] tend to be based more on economics than about alternatives to traditional video services."

I'm not worried about broadcasters going out of business. But those grubs ... that's something else.

Brad Dick

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Dynamic storage tiering

A system mixing SSDs and HDDs can improve workflow efficiency.

BY RON BIANCHINI

Data-intense broadcast projects can require petabytes of data with several hundred terabytes often actively in production at any given time. The need for storing content that is "in the can" on lower-cost archive systems with frequently accessed mission-critical data on more costly performance-hungry media can be a precarious balancing act for even the most seasoned IT administrator.

Employing an integrated tiered storage architecture that enables information to be dynamically stored on lower-cost SATA drives when not actively in use while leveraging the performance of SSD drives to handle digital workloads is a better way to gain the performance, simplicity and high availability that is required in a production environment with a dramatic reduction in acquisition, deployment and operating costs. Because of the orders of magnitude difference in storage media costs and performance, data storage systems that feature SSD tiering within a broadcast environment offer a viable alternative to traditional NAS environments.

Storage performance is reaching its limits in traditional NAS architectures as hard disk drive technology approaches limits imposed by the nature of a spinning disk. Even though the capacity of HDDs continues to increase, NAS servers have struggled to keep up with the amount of read/write requests sent to ever-denser disk drives. While capacity has increased, disk I/O rates have remained relatively constant, resulting in a decrease in the actual number of operations per stored byte. To improve performance, IT managers have turned to overprovisioning Fibre Channel drives, which results in the underutilization of a significant percentage of their raw capacity, inefficient use of limited data center space and wasted power consumption. Even high-end NAS servers cannot overcome the fundamental limitations of increased access times on denser SATA drives while attempting to deliver high-bandwidth file access to clients.

SSDs are a better option in overcoming the performance limits of HDDs, but they too have limitations of their own. Volatility can be an issue with DRAM, and flash memory can only be written to so many times. And introducing new media into a data center can be a hardship for storage administrators, who would have to learn the characteristics of SSDs and how they are best utilized by both broadcast and corporate applications.

Storage performance is reaching its limits in traditional NAS architectures as hard disk drive technology approaches limits imposed by the nature of a spinning disk.

To gain the performance benefits of SSDs within broadcast environments while minimizing the limiting factors of introducing new storage media into the infrastructure, a new approach using an appliance-based automated tiering system may be the answer. By automatically placing data on the storage medium that is best suited for its current access patterns, active files can be stored on fast-access media while files that have not been accessed recently reside on a mass storage server. Because the data is automatically moved to the most appropriate tier, the amount and specialization of management involved is negligible.

FRAME GRAB *A look at the issues driving today's technology*

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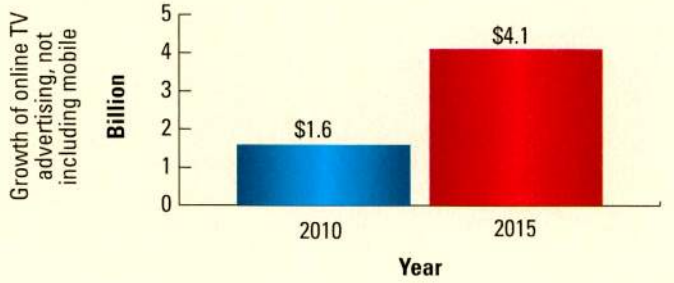

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The appliance, which features multiple tiers of fast-access storage and operating system software, is deployed between a currently installed mass storage NAS server and the client and application servers. (See Figure 1.) This allows an organization to use its existing infrastructure without disrupting data access. Inside the appliance are different types of storage media, including solid-state storage and serial-attached SCSI (SAS) HDDs. The OS software analyzes how files are being accessed and places the files internally on the most appropriate storage medium for the fastest possible access. This approach benefits write loads as well as read-only data. For optimal performance, changes made to data by client and application servers are stored locally within high-speed storage tiers on the tiering server, which writes all changed data back to the mass storage server at an interval specified by the administrator.

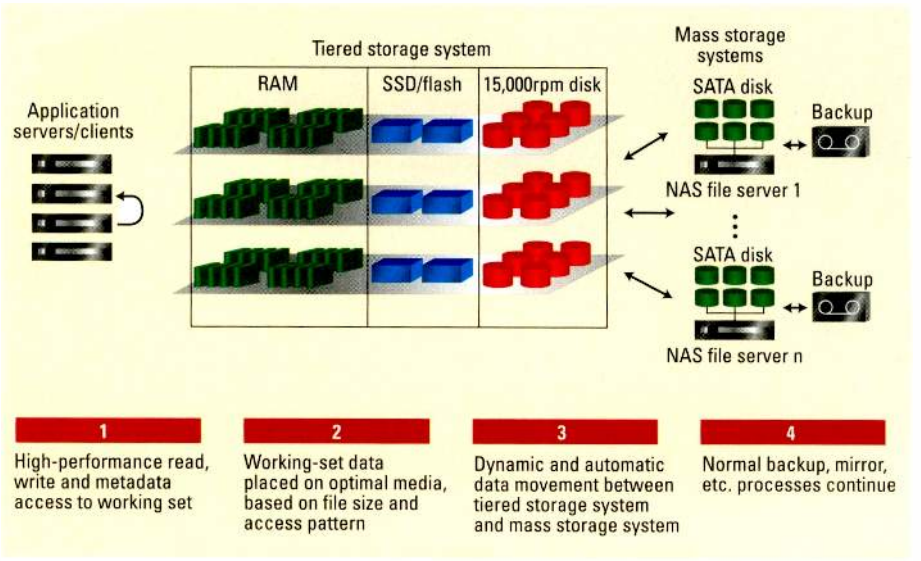

Figure 1. Shown here is an example of a tiered storage system.

In much the same way that additional media can be added to a mass storage server to increase capacity, new nodes can be added to the tiered storage system to form a scalable cluster of combined resources that increases overall performance. By separating the processing of file requests in the NAS infrastructure from data retention on the mass storage server, organizations will realize high-performance data delivery while freeing processor cycles on the storage server for tasks such as data mirroring, de-duplication and backup operations.

- Implementing a tiered storage approach to broadcast engineering provides several key benefits, including:
- Optimization of current NAS servers to enable performance increases for the most demanding active applications;
- Preserving current investment in existing NAS infrastructure by dramatically improving its performance and extending its useful lifespan;
- Enabling the use of less-expensive NAS servers and lower-cost, higher-capacity SATA drives as primary storage to expand the capacity of a NAS infrastructure without sacrificing performance;
- Saving on operational expenses by decreasing the number of expensive NAS servers and disk shelves within the data center:
  - Cost per terabyte,
  - Power,
  - Cooling,
  - Rack space;
- Avoiding the expenses of overprovisioning by allowing companies to pay only for the performance they need, with the option of scaling performance in the future by adding more automated tiering nodes to the cluster.

In much the same way that additional media can be added to a mass storage server to increase capacity, new nodes can be added to the tiered storage system.

In the broadcast environment

Tiered NAS appliances are used in broadcast environments to separate data delivery tasks from data retention and deliver both more efficiently. The data that a tiered file system stores on the cluster is called the working set. As clients and application servers request new files, such as images, audio, video and documents, the cluster retrieves them from the mass storage server and adds them to the working set. Active data remains available on the internal SSD and HDD media within a cluster of high-performance tiered appliances. As files become less active, the file system moves them to slower storage tiers and eventually removes them from the working set, at which point they are located only on the mass storage server.

Rather than design a system around supporting the most active data, a tiered system can be constructed to dynamically move that data to various tiers as the need for access changes. For example, if the system receives only a few random read-only requests for a file, it places it in DRAM and eventually writes it to disk storage. However, if the cluster then sees multiple random reads for the file, from many clients, it moves some blocks from DRAM to flash SSD, retaining

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the hottest data in the highest-performance storage medium. If the file is modified with write operations, the cluster also writes the changes back to the mass storage server within the time period specified by the maximum write-back delay setting.

In all cases, the contents of the file are distributed across the pooled resources of all of the nodes in the cluster, preventing data from becoming bottlenecked on a single node. The file system serves the file's data as blocks and permits different clients to access and update different parts of the file. This is particularly useful for very large files that are accessed by multiple clients or threads simultaneously; for example, client A can write one part of a file while client B simultaneously writes a different part of the same file. Additionally, if the access patterns indicate the need, the file system can place read-only copies of the file on multiple nodes in the cluster.

With the OS set to constantly monitor data access patterns and self-adjust to increase performance, tiered storage systems are optimized to distribute workload in the cluster and minimize accesses to the mass storage system as needed. Rather than adding HDDs to increase application performance, having multiple storage tiers to move data in and out of based on its frequency of usage and access provides better overall performance at a lower cost. The total equipment deployment cost of a tiered storage appliance can be as much as one-third that of traditional NAS, in addition to providing dramatic savings in operational costs.

Conclusion

A dynamically tiered NAS infrastructure meets the need of broadcast engineering in a way that allows high production values to seamlessly meet with cutting-edge technology to efficiently deliver digital content while minimizing the costs of management, equipment, power, cooling and rack space. By combining multiple storage tiers in a single appliance with integrated software to automatically organize data for maximum performance, broadcast organizations are better positioned to ensure their most mission-critical information is readily available while proactively dealing with the realities of economics in today's challenging business environment. Implementing a tiered storage architecture that leverages high-performance SSDs with lower-cost, higher-capacity SATA HDDs is an ideal way for broadcasters to ensure they always remain on-air without any interruptions. BE

Ron Bianchini is president and CEO of Avere Systems.

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TV spectrum auctions

A Senate repurposing bill is gaining momentum.

BY HARRY C. MARTIN

In June, the Senate Commerce Committee approved S.911, a bipartisan bill that represents the most detailed effort yet to make TV band spectrum auctions a reality. The bill now goes to the full Senate. Due to other legislative priorities, the Senate may not take final action this year. Also, any auction plan would depend on action on corresponding bills in the House, which is not as far along as the Senate. But repurposing legislation could pass as early as this summer if it is attached to pending budget legislation.

TV spectrum repurposing enters the picture as a potential source of funding for the new public safety service.

The focus of S.911 is the creation of a public safety wireless network, which would be controlled by a new government-created corporation — the Public Safety Broadband Corporation (PSBC). TV spectrum repurposing enters the picture as a potential source of funding for the new public safety service, mainly through the sale of the reclaimed spectrum to big wireless providers. Pertinent to TV broadcasters are the following provisions:

- No full-power TV licensee would be forced to give up spectrum in order to make it available for an incentive auction. But, if a licensee opts to relinquish its spectrum, the commission would be authorized to share some part of the resulting auction proceeds with the licensee.
- The FCC's methodology for sharing auction proceeds must "consider the value of the spectrum voluntarily relinquished in its current use and the timeliness with which the licensee cleared its use of such spectrum." This vague standard would be subject to FCC interpretation through the rulemaking process.
- Licensees choosing to retain their spectrum would likely be subject to spectrum "repacking," which could require them to change to one of the frequencies that remain available for over-the-air TV. Such repacking may require frequency sharing or bandwidth reductions in markets where there is sufficient remaining spectrum to accommodate all migrating stations.
- In imposing such an involuntary move, the commission would only have to make "reasonable efforts" to assure that the repurposed licensee gets "an identical amount of contiguous spectrum" in the same band (i.e., UHF or VHF); in the same geographic market; and with the same area/population coverage and interference protection. Such protections would apply only if "technically feasible" and where their application would be "in the public interest."
- The FCC would not be permitted to force stations to share a channel, although licensees who voluntarily elect to channel share would be guaranteed the same MVPD carriage rights they currently enjoy.
- No less than 5 percent of auction proceeds — but no more than $1 billion — would be set aside in a new Incentive Auction Relocation Fund (IARF). The IARF would be available to the NTIA, which would, in consultation with the commission, dole out funds to licensees and MVPDs to reimburse them for the "reasonable costs" incurred in repacking.

While S.911 includes considerably more detail than past spectrum repurposing bills, it is too early to draw reliable conclusions about what the repurposing process will eventually look like. Among the unknowns are:

- the extent to which repurposing will be resisted by broadcasters;
- if it is implemented, how much money will be paid out under an auction or repacking plan; and
- whether such funds would adequately compensate for lost spectrum or transition costs under a repacking plan.

Moreover, it is hard to know what will be left of over-the-air TV, particularly in smaller and midsized markets, if the Senate's bill becomes law.

There is also the practical reality that no bill will be enacted. Unless it is attached to budget legislation, as noted above, the legislation may not make it to the floor this year. And, controversial nonbroadcast proposals in the bill, e.g., creation of a new corporation that would hold the nationwide license for a public safety network, could bring down the legislation. BE

Harry C. Martin is a member of Fletcher, Heald and Hildreth, PLC.

? Send questions and comments to: harry.martin@penton.com

Dateline

- Noncommercial TV stations in Iowa and Missouri must file their biennial ownership reports by Oct. 1.
- By Oct. 1, TV and Class A TV stations in the following locations must place their 2011 EEO reports in their public files and post them on their websites: Alaska, Florida, Hawaii, Iowa, Missouri, Oregon, the Pacific Islands, Puerto Rico, the Virgin Islands and Washington.

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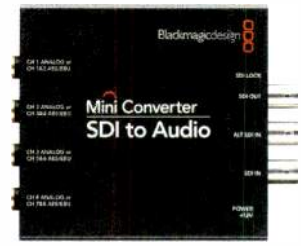

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MPEG-4 AVC systems

A recent extension directly supports 3-D presentation.

BY ALDO CUGNINI

MPEG-4 AVC offers many tools for coding video and higher coding efficiency than MPEG-2. The growing number of AVC applications is facilitated by a broad set of profiles, which group together different feature sets. A recent extension to AVC is Multiview Video Coding (MVC), which offers content producers the ability to code different views of the same production, directly supporting 3-D presentation. First, let's look at some of the various profiles.

Profiles

MPEG profiles are defined so that a higher profile is a superset of a lower one. (See Table 1.) Within these profiles, levels are defined that describe a set of constraints on decoder performance (processing power and the memory size), essentially limiting the maximum pixel rate. A decoder that supports a particular profile and level is only required to support the corresponding subset of the full syntax and a set of parameter constraints.

It is important to realize that MPEG coding was developed to enable a wide range of applications, supporting both real-time (streaming) and non-real-time (storage) applications. The use of the different profiles essentially concentrated on videoconferencing, storage and broadcast. The Constrained Baseline Profile and Baseline Profile were developed for low-cost applications; videoconferencing and mobile uses gravitated towards the former, being cheaper to implement and not needing the additional error resilience tools of the latter. Both profiles specify that every coded picture of the coded video sequence is a coded frame containing only frame macroblocks, i.e., coded pictures of the coded video sequence may not be coded as fields.

The Main Profile adds support for B-frames (bidirectionally predictive), which were left out of the simpler profiles to lower both memory requirements and computational complexity. The Extended Profile adds some

AVC	SVC	Intra
Constrained baseline profile		
Baseline profile	Scalable baseline profile	
Main profile		
Extended profile		
High profile	Scalable high profile	Scalable high Intra profile
High 10 profile		High 10 Intra profile
High 4:2:2 profile		High 4:2:2 Intra profile
High 4:4:4 predictive profile		High 4:4:4 Intra profile CAVLC 4:4:4 Intra profile
Stereo high profile		
Multiview high profile		

Table 1. Various MPEG profiles

FRAME GRAB

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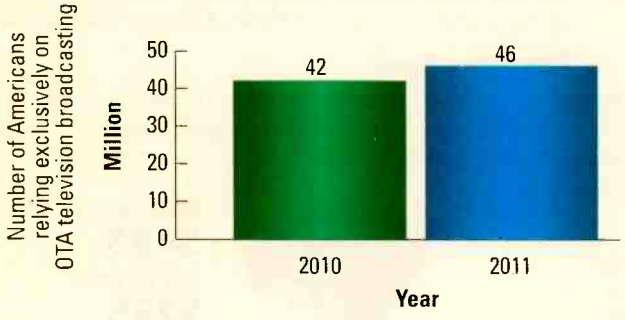

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Existing MPEG codecs can handle certain 3-D formats, but not necessarily in a backwards-compatible way.

coding tools, including support for up to eight slice groups per picture. (Pixels are arranged in groups called blocks, and these are further arranged into macroblocks.) Macroblocks of a picture can be mapped into slice groups, which are further partitioned into slices, adding compression efficiency.

The High Profile improves compression quality (up to 12 percent for progressive HD video and film sources) while adding almost no computational complexity (but a slight memory increase) over Main Profile. The profile adds switchable transform and scaling matrices to achieve the improvement. Devices such as the Sony PlayStation and all current Blu-ray disc players support the High Profile.

The "derivative" High Profiles add additional tools: High 10 adds 10 bits/channel coding, High 4:2:2 adds 4:2:2 chroma sampling, and High 4:4:4 Predictive adds 4:4:4 chroma at 12 bits/channel. An earlier High 4:4:4 Profile was later removed.

3-D

Stereoscopic video is receiving growing interest by consumers, CE manufacturers and broadcasters, and existing MPEG codecs can handle certain 3-D formats, but not necessarily in a backwards-compatible way. Frame-compatible 3-D can be transmitted over either MPEG-2 or AVC, because the left and right views are vertically decimated by a factor of two and arranged into formats such as side-by-side or top-and-bottom. Because these frame-compatible formats fit into a conventional 30Hz frame period, no additional baseband bandwidth is needed, and conventional baseband video equipment can handle the signals. Frame-compatible video can thus be encoded using a conventional MPEG-2 or AVC codec, but cannot be displayed on a 2-D display, which cannot separate or properly integrate the left and right views.

MVC

Newer specifications, however, can deal with these issues and provide bandwidth savings, as well. Multiview Video Coding (MVC) was developed by MPEG to support multiple simultaneous views of a subject, and in 2008, an MVC extension to AVC was released. In general, an MVC encoder receives *n* temporally synchronized video streams and generates one output bit stream. The decoder receives the bit stream, and decodes and outputs the *n* video signals.

MVC works by exploiting the similarities between multiple-camera video captures of a scene. By eliminating redundant information across camera views, MVC achieves a reduction in bit rate of about 20 to 25 percent on average when compared to encoding each view separately. This is accomplished by encoding a full-resolution 2-D view and the difference information between the left and the right views. This difference is coded in the video stream in a format that updated decoders and 3-D displays can play back in any 3-D format at the highest quality possible, while legacy 2-D televisions and decoders play the stream in 2-D. The 2-D view can be decoded from the base-layer AVC stream by using a High Profile decoder, which could then be output on a conventional 2-D display.

An MVC decoder would generate the stereo views from the base layer and enhancement layers, and deliver them to a stereoscopic display. In this way, MVC is fully backward-compatible and display-independent. Of course, encoding 3-D in a fashion that is intended to yield a compatible 2-D representation will not always be the production intent; the left or right view is not always intended to be viewed alone.

The Multiview High Profile, using the same coding tools as supported by the High Profile, has been specified so that fixed decoder resources of single-view AVC decoders, such as memory, can be repurposed for decoding stereo and multiview video bit streams. The Stereo High Profile was developed to support coding left- and right-eye stereo views as the multiple views of MVC. Also added to AVC was Frame Packing Arrangement Supplemental Enhancement Information (SEI) messaging, which signals the decoder that the left- and right-eye stereo views are packed into a single high-resolution video frame either in a top-and-bottom, side-by-side, checkerboard or other arrangement.

The Blu-ray 3-D specification calls for encoding 3-D video using the MVC codec. (AVC is currently supported by all Blu-ray Disc players.) The Multiview High Profile as defined in the MPEG-MVC Amendment uses the same coding tools as supported by the earlier High Profile of the MPEG-4 AVC standard.

Intra

As an aid to editing and content retrieval, several of the advanced profiles include intra versions, in which there are no predictive frames, i.e., every frame is intra coded. Although this carries a bandwidth premium, it generates streams (and files) where each frame is an intact element that does not depend on any other frame for its reconstruction. The CAVLC 4:4:4 Intra and High 4:4:4 Intra Profile provide the highest capability in the production environment, with the latter supporting both CABAC and CAVLC stream coding. CABAC compresses data more efficiently than CAVLC but requires considerably more processing power to encode and decode. BE

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Programming routers

Get the most out of your routing infrastructure.

BY BRAD GILMER

This month's article will introduce network router programming. If you have not worked with IT infrastructure, you may be surprised at the number of options and possible configurations available to advanced programmers. The majority of this article will focus on Cisco routers and their operating system called IOS. There are several reasons for this. First, I am familiar with IOS. Second, I have seen a lot of Cisco equipment in media facilities, so it is likely you will come across this at some point. Third, there is a huge surplus market for Cisco routers; you can likely pick up a device to experiment with for much less than $100. Also, while this article uses the term "router," be aware that sometimes the distinction between a router, a switch and a firewall can get blurry. In the Cisco world, all three of these devices can be programmed.

Why program?

Why you would ever want to learn about how to configure a router? The most straightforward answer is that by learning how to program a router, you can make it do what you want. But here are some specific reasons you might want to know how to program a router:

- You can get predictable performance from the network when you set specific quality of service (QoS) parameters.
- Knowing how to program a router allows you to set up virtual private networks (VPNs), which can provide high-performance, secure remote connections.
- You can also set up virtual LANs (VLANS) to segment traffic, increasing the performance and predictability of the network, simplifying network traffic management.
- Programming allows full access to a variety of network security measures and provides a way to change network security parameters on the fly.

How to program a router

Almost every router, even the ones bought in an office supply store, have a Web interface. The router creates this Web interface by running an embedded HTTP server, which provides access to the router's configuration. Typically, this Web page allows you to configure basic parameters. Many consumer routers are combined with wireless access points, so this Web interface also allows you to configure wireless parameters as well.

Knowing how to program a router allows you to set up virtual private networks, which can provide high-performance, secure remote connections.

This configuration method has a number of advantages. It is straightforward and ubiquitous. The configuration parameters offered are usually easily understood. It is an efficient way to become acquainted with the capabilities of a router, and configuration capabilities can be quickly explained to other network engineers and even end users. The most obvious problem with this configuration method is that it is necessarily simplistic.

A second way to program the router is through uploadable configuration files. This method is not supported on consumer routers, but it is quite common in commercial routers. Configuration files can be created using a text editor, or they can be obtained from the manufacturer. Configuration files can also be prebuilt on the Internet.

A word of caution: Be sure to understand *every single line* of a configuration file, especially if you have not created it yourself. In the best case, a file may crash the router. Worst case, the file can open security holes, which can be exploited.

A third way, and perhaps the most common way to program a commercial-grade router, is through a command line interface (CLI). For those of you who have been working with *NIX or who are old enough to remember using DOS, working with a CLI will be a familiar experience. When using a CLI, type simple commands, and the router provides a text-based response. While the CLI tends to be a little terse, it is an extremely powerful interface, and once learned, it can be much quicker to make changes using a CLI than using a Web interface.

Default configurations

Before you start programming using a Web interface or a CLI, it would be good to have a general idea of how the router behaves in its default configuration. Consumer routers are configured to plug and play. The manufacturer makes a host of assumptions about how you will use the router so that, when plugged in, it is pretty much ready to go.

Commercial routers are completely different. In fact, in the default configuration, Cisco routers must be programmed from the ground up. This can be quite a shock for a technician who is just beginning to work with this type of equipment.

Cisco IOS

This article will conclude with a

high level overview of Cisco IOS. IOS contains a command interpreter that interprets commands you type and creates a stored configuration in the router based on your input. Viewed from where a network engineer sits, IOS is almost like learning a computer programming language.

```
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User Access Verification

Username: YourUsername
Password:

Router1>_
```

Figure 1. The Cisco IOS command line interface (CLI) is terse but extremely powerful. Users working with the CLI for the first time will see a screen similar to the one above.

Once logged into the IOS, your screen may look similar to Figure 1. Entering a question mark ("?") at the prompt will generate a list of possible commands. Many commands such as "show" take additional arguments, so entering "show ?" at the prompt will generate a list of allowable words to follow the word "show."

IOS has hundreds of commands, but many of them are intuitive. For example, if you were to type "ip name-server 192.168.2.1," and then typed "show run" (short for "show running-config"), you would see a configuration line that tells the router to use 192.168.2.1 as the name server for the router.

Once you learn IOS, it can be used to configure just about everything on the router. Beyond that, it can help troubleshoot network devices in real time, make backups of the configuration for archival and even copy a running configuration to a new router.

There are many different versions of IOS available. Depending upon what you are trying to do, you may need the most current version. However, an older version may work just fine. Generally speaking, newer versions of IOS require more memory, and newer versions of IOS may require newer hardware. Check hardware compatibility and memory requirements before upgrading the IOS on an existing router.

Conclusion

There are many resources available for learning about router programming. Cisco does a particularly good job of producing courses, books, online tutorials, FAQs, sample configuration files, and other Web resources for learning IOS and for working with their routers. Other manufacturers provide similar resources.

While you could work on a live router, or find a simulator to use as you begin learning about router programming, there is a large aftermarket for used router hardware. IOS versions build on each other, and IOS basics are similar across most Cisco router products. Therefore, buy an inexpensive small router, connect it up to a couple of computers and start experimenting. Also, take an introductory course. This may save you many hours as you begin working with IOS. BE

Brad Gilmer is president of Gilmer & Associates, executive director of the Advanced Media Workflow Association and executive director of the Video Services Forum.

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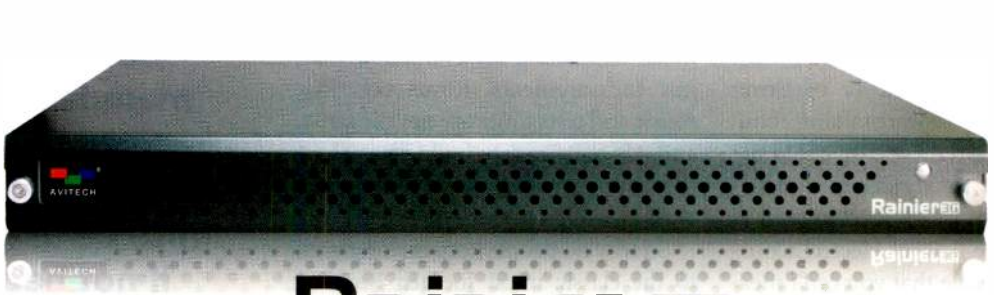

Mic design

Find out how classic mics and modern technology are influencing today's mic designs.

BY KEVIN K. RUPPERT, CPBE, CBNT

You see them in music videos. You see them on album art and in classic photos of famous musicians recording in their studios. If you're lucky, you might also have a chance to use one while performing or engineering a performance yourself. I'm talking about classic microphones. Usually more than just museum pieces, these examples of fine electro acoustic design are highly prized and sought after by the people who make recordings.

But are they really better than today's mics? What makes the design of classic mics, such as the RCA 77 and the Neumann U47, so enduring? And, even more importantly, how do classic mics compare to those being made today? With modern design and manufacturing techniques, shouldn't today's mics be as good, if not better, than those designed and made decades ago? We asked experts in the field of mic design to help us find out.

One of the first things the experts pointed out is that you must keep in mind that mic evaluation is subjective. Specifications don't tell you the whole story. David Royer of Royer Labs says that if we were talking about modems or hard drives, we could use the specs and totally depend on science. But mics involve art as well as science. In the field of electro acoustics, there is a rule that you can't measure what is not there. That makes it difficult to provide numbers for some of the subtle differences in sound between microphones.

Oliver Archut (writing in the Neumann web forums) points out that after nearly 100 years of electro acoustics, we still use crude standards to measure and evaluate performance. We still measure audio as a static function and do not include the dynamic character of a recording. Dynamic range and intermodulation distortion are trying to place values on dynamic functions, but these measurements are still done static. Most experts agree that there is more to making an evaluation than just measurements. Royer says that music and tests tones are not the same, and it is quite easy to build equipment that sounds mediocre and that has superb measured performance.

The designs of classic mics, such as the RCA 77, raised the bar for performance and provide a guideline for what to expect out of a microphone.

So why do people keep coming back to the classic mics? Juergen Breitlow of Sennheiser believes that these classic designs have a very special character regarding their sound. They were used over the last decades in a lot of recordings with famous artists and have defined a special taste or preference in their sound. Why wouldn't you want to try to use the same tools that were used by these artists to reproduce the esthetics of these old recordings? Chris Currier, also of Sennheiser, says that there were some amazing things happening in the golden days of the Hollywood films and recording industry. Currier thinks that it is more than just a nostalgic memory; it is actual tangible history.

Royer admits that mic selection is partly nostalgia but that knowledge of mic performance still plays a large role. Performers know that, for instance, the U47 can generally be counted on to sound good on voices, and an RCA ribbon mic can be counted on to sound good on brass. If you are an experienced engineer, you are going to lean towards those mics for those situations because you know that they will work.

The old designs raised the bar for performance and were unique at the time, so they were easily recognized and remembered. Chad Wiggins, the category director of wired products for Shure, says that it makes sense that the tools and methods used to make legendary music are studied and emulated by today's performers and engineers. That's how art is advanced, after all. The next generation takes what is handed down from the previous one and expands on it.

With modern design and manufacturing techniques, shouldn't today's mics be as good, if not better, than those from decades ago?

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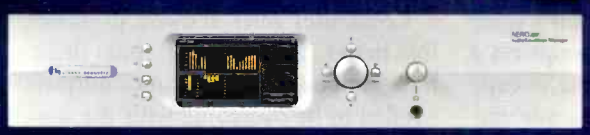

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Because early mic designers were basically starting from scratch, their products were made on the best technical level and materials (such as matching transformers) of that time. There were no marketing departments demanding that the company produce products that show the customer something new or better, so what you probably got was solid performance without some of the hype and gimmicks that you might be getting in today's microphone market.

Duplicating success

What can we do if we want to make new mics that perform as well as the classics? The task for present day designers is to use new technologies to make products that are equal to or better than the old ones, and that are more compact, versatile and reliable. Some things can't be improved on, though, which explains why most of the designers that responded to this article admit that many mic designs are basically copies of the old favorites, such as the U47 and SM58.

Thomas Stubics of AKG Harman states that modern production methods allow much lower production tolerances, higher quality and lower costs. You can set your goals on making a really good mic and keep the cost down because, for one thing, everything does not have to be assembled by hand as it did in the early days of microphones.

Changing mic design

Today's performers certainly have different demands of the product than earlier artists did. For instance, rock vocals as well as venues have changed since the 1950s, when mics such as the Shure 55 were initially designed.

There is no doubt that the state of the art in microphone design continues to advance. Wiggins states that audio performance has gotten better in terms of output level and self-noise. Of course, some mic designs are less rugged then others. A ribbon mic still needs to be treated with more care then a handheld dynamic. But advances in designs are making mics hold up better under stress and perform well under higher sound pressure levels than their predecessors.

Today's designers have several advantages over the people who took on this task years ago. Wiggins points out that the raw materials, manufacturing processes and measurement tools are "leaps ahead of what were available a few decades ago." This allows manufacturers to produce mics that perform much more consistently than their forbears from unit to unit and year to year.

Size matters

Because modern design has made mics more rugged and compact, the look and profile for certain applications have changed. Today's mics combine size, shape and structural elements that not only determine styling, but also have an effect on sound performance. Wiggins cautions microphone buyers about styling and reminds them that styling should not be used just to get a look. Microphones that look radical often have radical performance — and not in a good way.

Because modern design has made mics more rugged and compact, the look and profile for certain applications have changed.

Breitlow says he sees two trends in the design of the outside of mics. One is smaller mics that allow a voice talent to see a screen or script on a stand, and larger mics trying to copy the old designs to give you some vintage feeling. He explains that the first microphones were quite big because the electronics were so huge. Now, the electronics can be made much smaller, but we still want to keep them a certain size. Especially for singers, if the mic gets too small, the singer does not feel like he or she is being recognized as a true talent. Can you imagine a rapper in the studio singing into a small stick mic?

Of course, the outside dimensions of a microphone affect its acoustics. Breitlow points out that most design elements have an influence on the sound. There is an interaction of the mic parts with the sound field as soon as the dimensions are comparable to the wavelength of the sound being recorded.

Going tubular

One trend you will see in looking over mic catalogs is the prevalence of vacuum tubes in microphones. Artists claim that tube microphones produce a pleasing and desirable sound. The theory is that saturation in well designed tube mics produces harmonics that sound warm and musical. (This is despite the fact that the circuits employed tend to have more total harmonic distortion.) Some people, however, might ask why use a mic in a situation that saturated the preamplifier.

How did tubes find their way into mics? The most famous examples of tube mics have traced their ancestry to Germany. According to Robin Stephenson of the Internet site eHow, American broadcasters intentionally employed limited bandwidth in the early days of radio. The primitive carbon mics of the time seemed to work well enough for this purpose. In Germany, however, broadcasting was state-run. The impeccable Germans insisted on the highest quality sound that they could broadcast. Better mics needed to be developed.

Condenser mics showed promise for better performance, but their high impedance and low output needed to be overcome with the use of a tube preamp built into the mic. The line of mics that came from this period is still among the most prized for use in recording, including the

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U47. According to one expert in the field of studio mics, up to the 1970s, the tube was a technical standard in that it filled the technical function for amplification that was described above. Because of the evolution of solid-state devices and circuits, the use of vacuum tubes to make a quiet and sensitive mic was no longer required. Now, says the expert, the tube is one of the "instruments" (like a musical instrument) used to create a special sound.

This is not to say that it is not a valid artistic choice (somewhat like choosing a particular guitar amp to achieve a sound). There is a technical issue here which is of concern to engineers. It can occur when the user of the tube mic also decides that the sound he or she wants requires a tube amplifier after the mic. The point was made by one mic expert that you are now combining two parts of a very complex nonlinear transfer function. There is no way to know how this is going to sound. You have lost the confidence in your final product that you thought you were going to achieve by using a well respected product.

The future of mics

Modern technology is moving mic design in new directions. Part of it is actually a new market. Mic designers admit that a new, large part of their business is to the large unwashed masses of mic buyers — that is, people who do not have a large, expensive studio or a lot of money to spend on equipment. The PC has allowed people to record music or webcasts at home. The latest equipment catalogs show plenty of mics that don't even have an analog output in favor of a USB connection that the user can connect directly to the PC. Some of them even include software to help you edit and publish your session to a podcast. Several well-known mic designs are now available in a USB model.

LCD displays, LEDs and features from the mobile phone world are available on newer mics.

Udo Wagner of Microtech Gefell says that he expects to see more of the PC trend in mic designs of the future, along with smaller and smaller (micro, nano) designs that will probably include built-in DSP and computer aids to monitor audio levels, etc. He also contends that about half of the design efforts will be driven by the desire for "nostalgic old things" such as tubes. He admits that technological "toys" are finding their way into mic designs. LCD displays, LEDs and features from the mobile phone world are available on newer mics. This seems to make sense because, if you are marketing to the 30 something's, the best way to get their attention is to include something that looks like a cell phone.

In summary

Microphone design is an exciting combination of art and science. Future advancements will continue to bring us mics that serve the digital age, but the careful designs and work of an earlier time still give us a guideline for what to expect out of a microphone. BE

Kevin K. Ruppert, CPBE, CBNT, is the engineering maintenance supervisor for WISC-TV.

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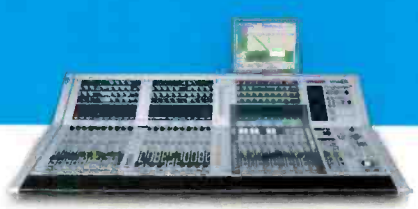

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BY NEIL SHARPE

With the wider adoption of IT-based infrastructures for playout facilities, it's natural to consider the scope for moving to IP-based signal management in production studios. This is typically a much more demanding environment than playout for real-time signal processing and routing, especially with respect to multichannel audio handling.

When it comes to moving video and audio signals efficiently around a television facility, there are endless challenges, especially as HDTV consumers have driven the demand for broadcasters to produce theater-quality sound. Establishing this capability in video production facilities involves more complex audio mixing equipment and production switchers, and often recording consoles. It also requires monitoring equipment to evaluate quality, as well as the ability to switch and control mono audio channels, discrete AES-3 signals, AES-3 signals with non-PCM payload and possibly even MADI signals for bulk audio transport. (See Figure 1.)

Moving to IP?

When considering a move to IP for signal management in studios, broadcasters have to consider both the IP model and the use of Ethernet as a common physical layer for audio and video. Let's assume that audio and video would be switched using the best available IP switch. Even with high-performance switches, a key issue is that HD video in studios is 1.5Gb/s and moving to 3Gb/s, and this exceeds the bandwidth of the affordable GigE IP physical layer. Video mezzanine compression can be used to reduce the channel bandwidth requirements, but this will add cost and introduce an additional, bothersome delay that must be managed.

There is also the problem of determinism inside the IP physical layer. One might contemplate an SDI video layer at full bandwidth and use an IP layer for audio. But here, the problem is once again determinism for the audio signal layer and the bridge between the IP physical layer and the SDI physical layer. An embedder or de-embedder is still required; it has just slightly changed its form.

Another possible solution would be to use IP for audio only. This puts all the de-embedding and possibly embedding into the final or output piece of equipment, which reduces the system cost of embedders and de-embedders, but it does not solve timing issues. It also introduces its own delay for IP buffer management, which could be problematic for identical A and B chain playout back-up.

These delay issues are important because any quality audio production requires that its source audio signals, or more specifically samples, must use signals exactly in phase. The use of multiple IP switches and devices connected to even the most carefully designed IP system can result in slipped sample alignment and significant audio program degradation. Furthermore, today's facilities tend to incorporate routers with matrices ranging from 200 x 400 up to 500 x 1000. Given these dimensions, and the deterministic timing requirements for synchronism and low latency, it seems

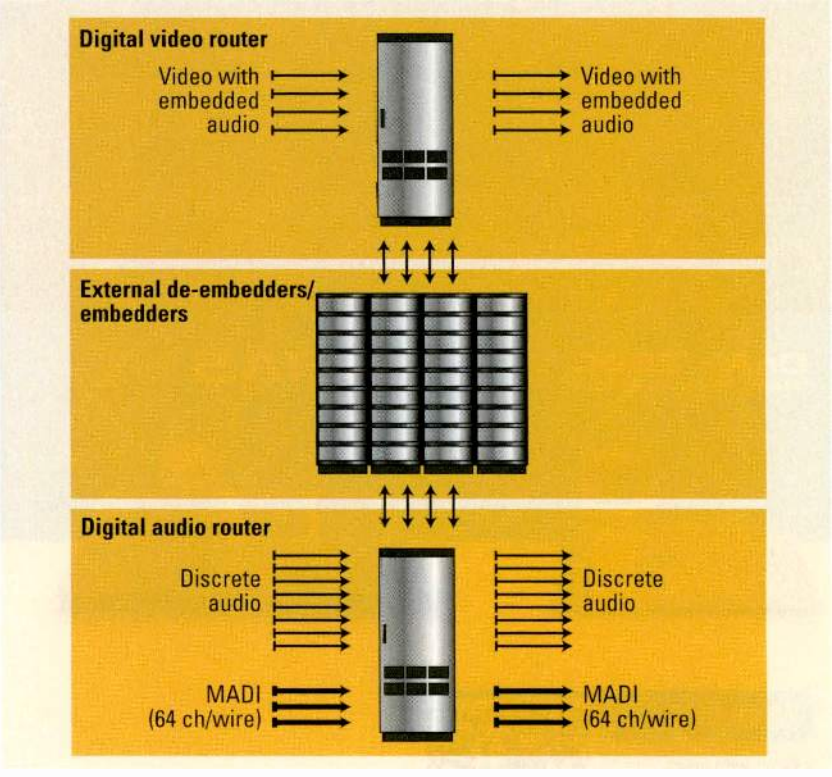

Figure 1. Shown here is a traditional production facility with independent audio and video routers, used with external terminal equipment.

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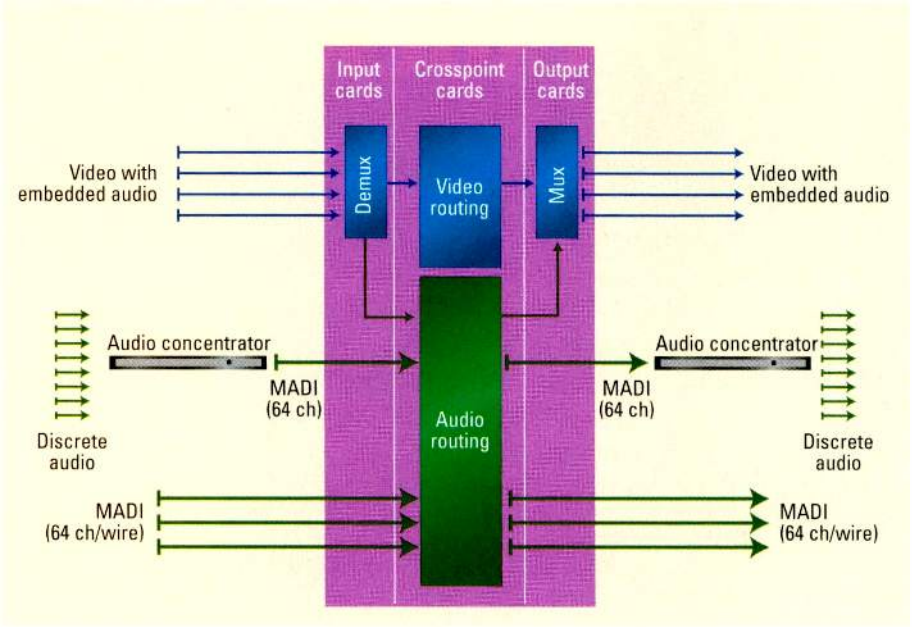

Figure 2. Shown here is a conceptual diagram of hybrid router signal flow.

that Ethernet infrastructures and IP are just not a plausible solution in the production environment.

The move to hybrid routing

The solution to improving signal management in production environments involves a switch fabric that is both synchronous and deterministic for audio and video. This requires a baseband "hybrid" router with 3Gb/s/HD/SD switching (using embedded audio) and integrated audio processing. These types of routers are now being adopted by studios, and they can handle multiple formats and functions within a single frame, including embedding and de-embedding audio, handling mismatched audio channels, audio shuffling and audio breakaways. (See Figure 2.)

Hybrid router frame architecture currently follows the same general approach as traditional baseband routers, although there are some important differences. For instance, in such a router, one crosspoint card switches both the video signals and the audio signals. The video signals are switched traditionally with a crossbar matrix chip, and the audio signals are switched in the time domain using a shared memory architecture. It is critical that audio delay is minimized during this switch process. The video signals and audio TDM streams are then fed to their corresponding output cards.

Critical timing parameters

It is imperative that the delay of video and audio through a production studio router is as short as possible. With careful design of the output embedder, the video delay of a hybrid router can be just a few pixels. This is accomplished by always leaving the video signal in the serial domain and embedding audio data "on-the-fly" in what is, effectively, a bit-by-bit mode of operation. Short video delays, ideally much less than half of a video line, ensure that plant system timing is simplified. This is especially true when using a hybrid router for preselection of inputs to a video production switcher.

The maximum audio delay with a hybrid router is constrained because every embedded signal fed to the router will have differing sample distributions. Therefore, differing buffer depths must be managed for each de-embedder and embedder in the router so that any mono audio signal de-embedded from any video signal may be embedded into a common video output. This can then result in a one-line minimum to two-line maximum delay. Add in uncertainty for +/- half video line input HD-SDI timing, and the audio delay becomes three lines maximum. This is more than satisfactory to ensure that even after multiple re-entries, lip sync will be preserved.

In production applications, the hybrid router provides a direct interface with embedded video signals, audio signals and MADI signals. Every audio input is made available as mono channel audio. MADI is connected directly to the router inputs and outputs providing a single-cable, low-cost connection for the audio production switcher or mixing console, and all embedded audio is de-embedded from video inputs. Because the system is synchronized, the switching between inputs and outputs is deterministic and sample-accurate.

Care must be taken to ensure full preservation of the multichannel phase coherence, or audio image. Embedder sample distribution will vary between video signals. Audio sample timing slips can be generated when switching audio from one embedded input into a different embedded output. Recall that one sample slip in time alignment is a significant phase error, which degrades the surround sound image of the program audio. With 16-channel audio embedders, it is possible to have image-accurate audio transport within a single video signal. If more than 16 channels of audio need to be exactly in phase, MADI is the better signal transport. Since Dolby E is a common signal for production, it also needs to be handled correctly within the router with switch points that comply with SMPTE RP-168 Dolby guard band specifications. This capability should be available simultaneously for HD and SD signals in the same frame.

Ingest and DHP

Another popular application for a hybrid router is ingest. In this case, the router affords complete flexibility to

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shuffle and route any single de-embedded mono input to any other embedded mono output. Hybrid routers may also offer dynamic hybrid pathfinding (DHP). This involves populating a portion of the router with hybrid inputs and outputs that are connected to the sources that need frequent channel reassignment. Another smaller router partition is populated with additional hybrid input and output modules that are fed by, and fed back into, the router. This is the same pooled resource topology used by discrete de-embedders and embedders in an external modular equipment frame. The balance of the router can be filled with standard video or MADI input and output cards.

When sized correctly, DHP may reduce a router's cost by approximately 20 percent, and it also reduces the overall hybrid card count for the core router. Hybrid cards used for pathfinding are often significantly less expensive than external terminal equipment. Importantly, the hybrid pooled resource provides full mono audio routing between the pool and the core of the router, something that is not even possible with external embedders and de-embedders.

When sized correctly, dynamic hybrid pathfinding (DHP) may reduce a router's cost by approximately 20 percent.

With DHP, an audio breakaway route can be made automatically between signals on standard input and output cards. The router control system will find an available output/input path, which re-enters the router hybrid cards described earlier and generates the additional takes for these cards. What would have been four takes becomes just one.

Conclusion

In summation, the most successful technology for high-quality real-time signal management in live production environments is hybrid routing. It avoids signal timing problems and offers the ability to save costs by dramatically reducing equipment needs. In essence, hybrid routing provides the highest possible performance for combined A/V signal switching in production and ingest operations, either on land or on wheels. **BE**

Neil Sharpe is vice president of marketing at Miranda Technologies.

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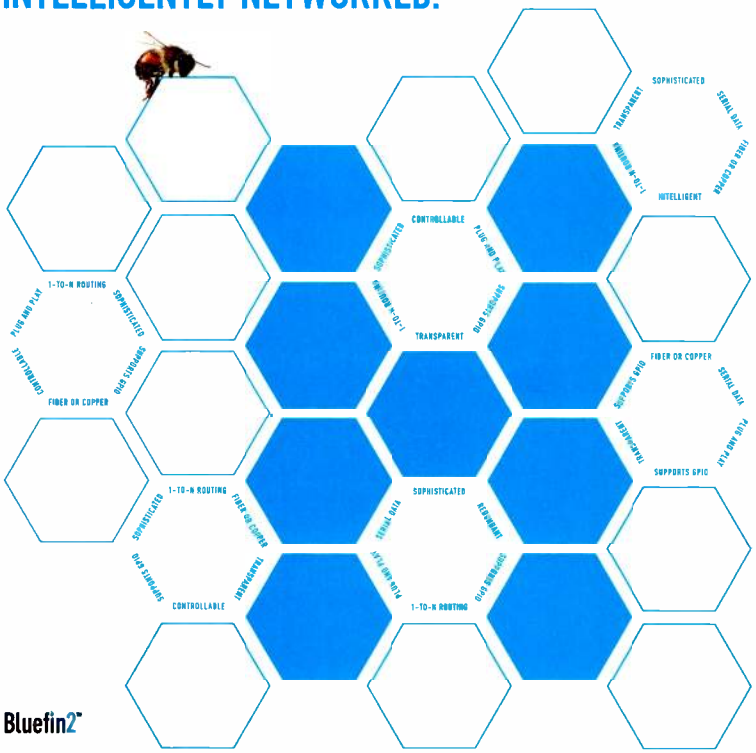

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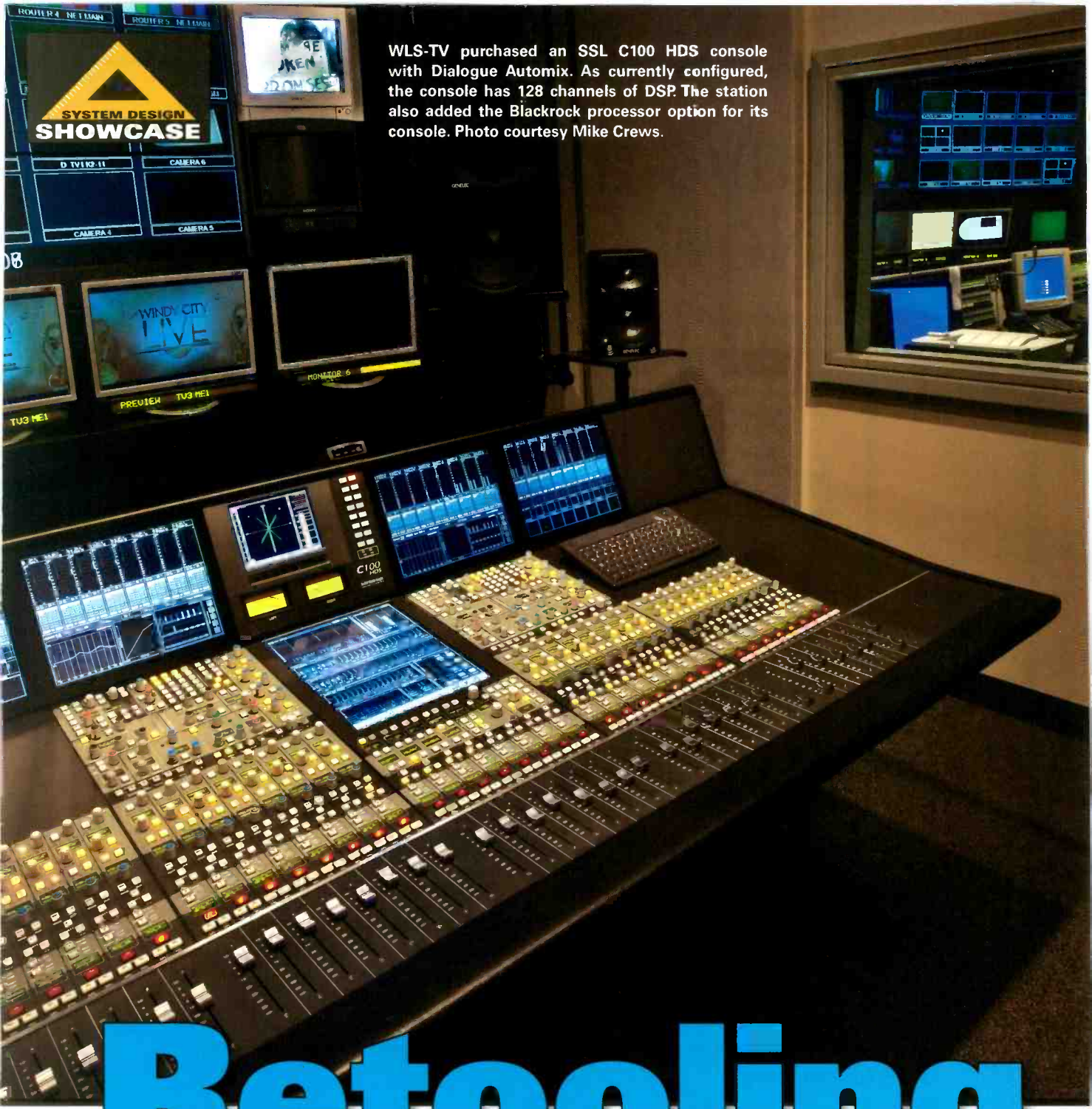

WLS-TV purchased an SSL C100 HDS console with Dialogue Automix. As currently configured, the console has 128 channels of DSP. The station also added the Blackrock processor option for its console. Photo courtesy Mike Crews.

Retooling

After losing Oprah, Chicago station WLS-TV creates a show to fill the void.

BY GARY ESKOW

She remains an icon, one of the most recognized celebrities on the planet, and her decision to pull the plug on her wildly popular television show sent millions of fans into a tizzy. Television stations that relied on Oprah's draw to anchor their daytime schedules had a more practical problem: How would they deal with the hole that her departure created?

For WLS-TV, an ABC-owned television station in Chicago, Oprah was more than a rock-solid presence in its line up; she was a local fixture. When

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the show's 25-year run ended, the station had a choice to make: purchase another show for syndication or develop a program internally to take its place. Under the direction of Emily Barr, president and general manager, the decision was made to hire a staff of producers to create a new production in-house.

Generally seen in the 4 p.m. slot, the station aired "The Oprah Winfrey Show" at 9 a.m., between "Good Morning America" and "The View." It was apparent that the new show, "Windy City LIVE" would have to maintain solid production values.

WLS-TV made substantial upgrades to its internal studios while "Windy City LIVE" was in development. HD capability was critical, and since "Windy City LIVE" airs live, the new equipment had to be flexible and portable.

TV 1, the station's main control room, designed around a Snell Kahuna 4ME production switcher, was already HD-capable. The station purchased an SSL Aysis Air Console in 1999, but support and maintenance issues forced the company to consider replacing it. After considering several options, the station purchased an SSL C100 HDS console with Dialogue Automix.

It may be hard to remember, but less than three decades ago a few pieces of outboard signal processors served quite well in an audio post environment.

Design team

WLS-TV:
Emily Barr, president and general manager
Kal Hassan, VP and director of engineering

ABC 7:
Thomas Hebel, VP creative services and programming
Lisa Clingan-Cruz, design director

Jeff Hall Design

OSA Onstage Audio

Chicago Scenic

New York City Lites:
Deke Hazirijian, lighting designer

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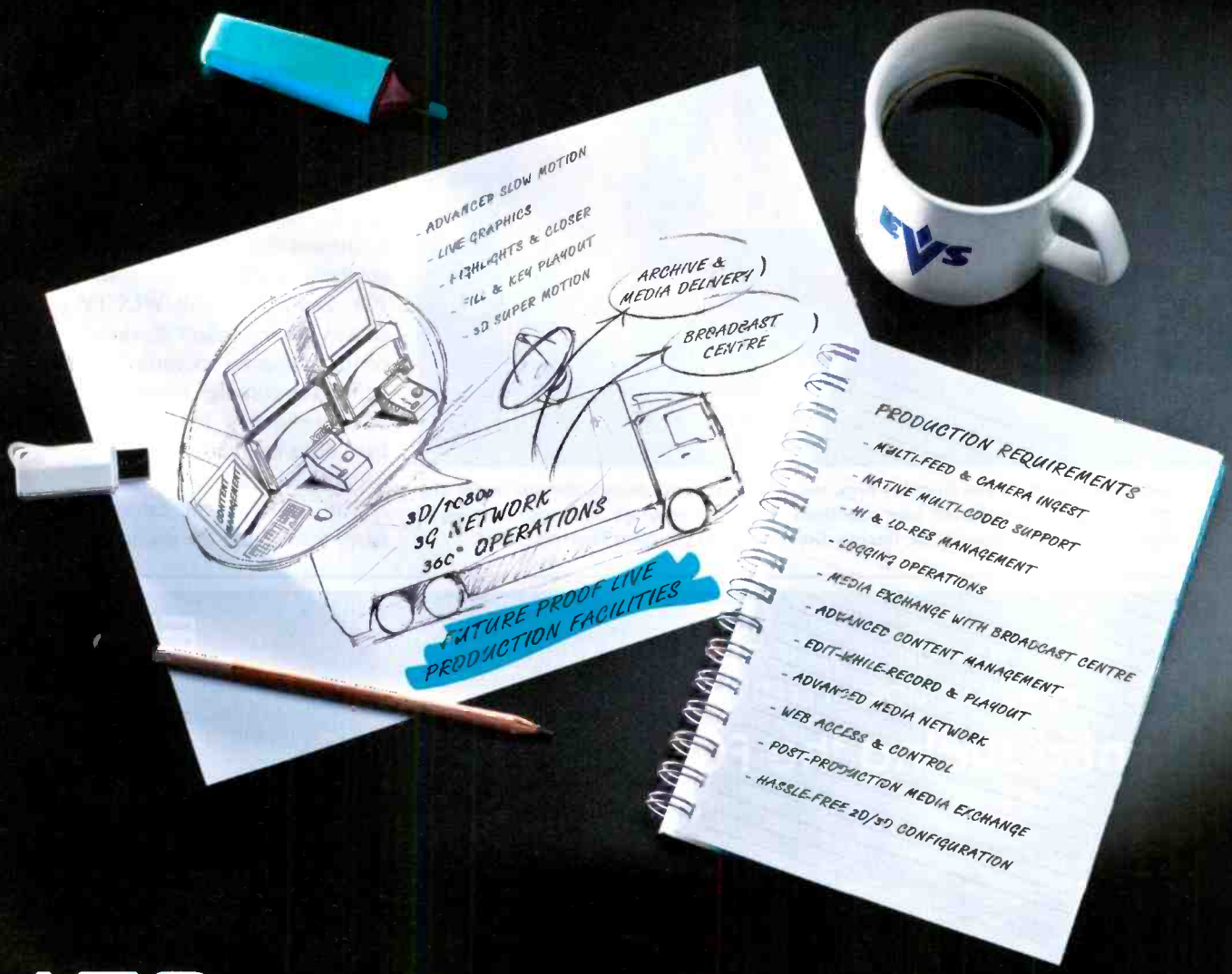

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Live Entertainment

Jeff Hall Design, a Los Angeles firm, was brought in to design the set under the direction of Thomas Hebel, vice president of creative services and programming at ABC 7, and Lisa Clingan-Cruz, design director. Photo courtesy Thomas Hebel.

It may be hard to remember, but less than three decades ago, a few pieces of outboard signal processors served quite well in an audio post environment. Hardware — a favorite reverb unit, perhaps, or a few compressors — lives on, but most processing is handled inside the console these days, and 5.1 eats up a lot of DSP. The station initially thought that the 96 DSP channels that the C100 HDS ships with would suffice, but Kal Hassan, vice president and director of engineering, realized that additional channels were required. As currently configured, the console has 128 channels of DSP. WLS-TV purchased the redundant Blackrock processor option for its console. Housed within the console's frame, Blackrock offers redundant PSUs and RAID 1 hard disks in addition to a robust signal processing engine.

The on-air talent camera moves freely throughout the studio, so a total

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TV 1, WLS-TV's main control room, was designed around a Snell Kahuna 4ME production switcher and was already HD-capable. A Genelec 5.1 monitoring system continues to serve the control room. Photo courtesy Thomas Hebel.

Equipment list

Dejero ENG system
Genelec 5.1 audio monitors
HME wireless system
Jimmy Jib
RTS Adam intercom
Shure wireless microphones
Snell Kahuna 4ME production switcher
Sony HDC1400 HD cameras
HDC-P1 HD box cameras
Soundcraft GB840 audio console
SSL C100 HDS audio console
Blackrock audio processor
Vinten 105 robotic head

of eight Shure wireless mics were purchased, and another four are on the way. The station uses an HME wireless system, and an RTS Adam is the base intercom system. An existing Genelec 5.1 monitoring system continues to serve the control room.

"Windy City LIVE" was expected by some to simply be a local talk show, but it's more than that. It's information and entertainment and everything Chicago. It features celebrities, local bands, cooking segments with top local chefs, fashion, politics and lively chat about what's on people's minds along with segments pulled in from remote locations around the Chicago area. One of the main challenges the technical staff faced centered around the mandate to include social media. Skype had to be

One of the main challenges the technical staff faced centered around the mandate to include social media. Integrating Skype was another.

integrated, and the crew needed to move quickly to program live feeds back to the control room. WLS-TV purchased an ENG system from Dejero, a Canadian company, instead of a remote truck. This system accepts air cards from four different vendors and aggregates them to maximize bandwidth.

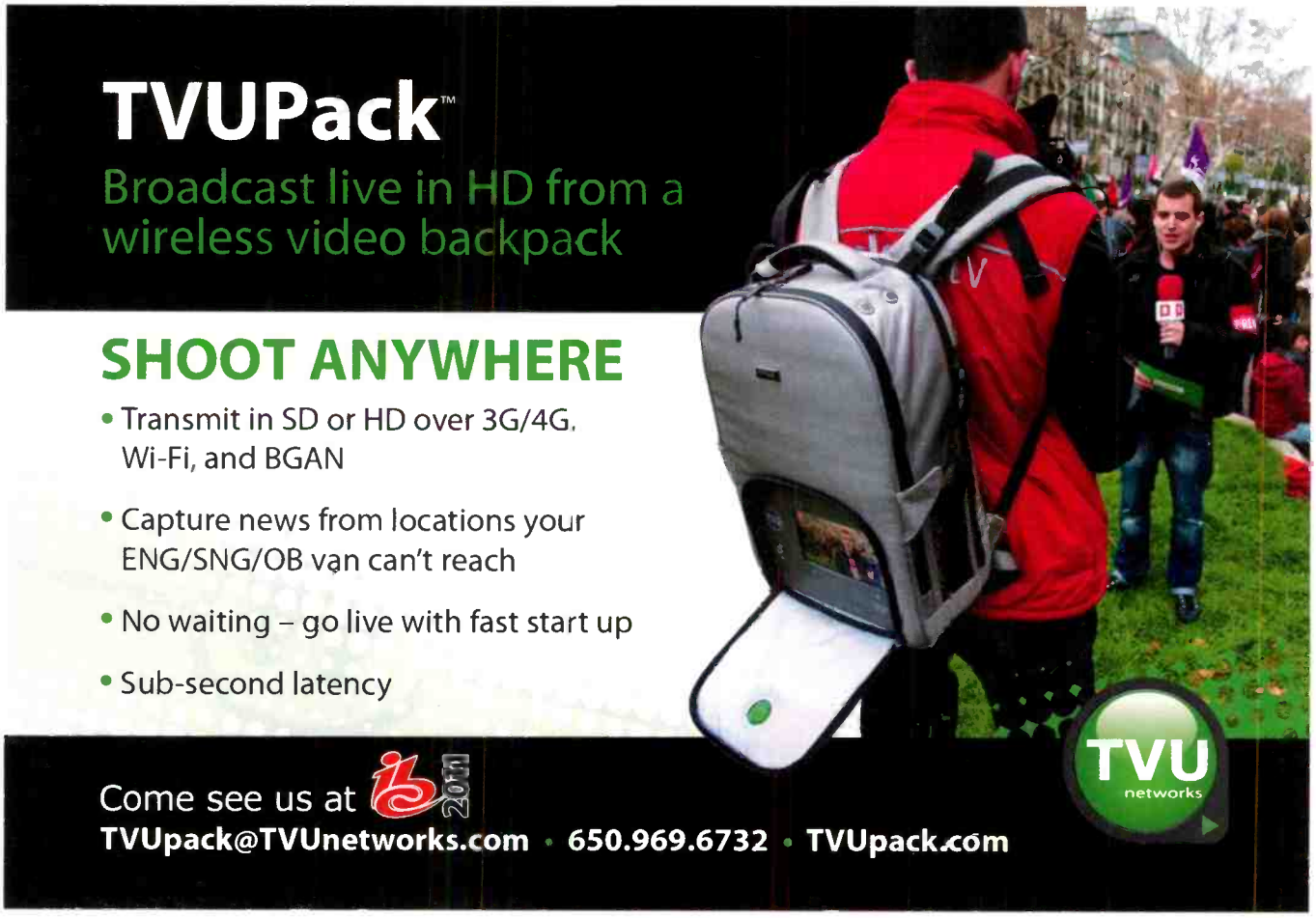
The station purchased an ENG system from Dejero instead of a remote truck. The system aggregates air cards from four different vendors to maximize bandwidth.

The station purchased three Sony HDC1400 series HD cameras and three HDC-P1 HD box cameras. One of these cameras is used as a hand held, whereas build up kits are incorporated into the other two. One of the HDC-P1s is installed on a Jimmy Jib, and the other two are installed on Vinten 105 robotic heads placed in the lighting grid.

Jeff Hall Design, a Los Angeles firm, was brought in to design the set under the direction of Thomas Hebel, vice president of creative services and programming at ABC 7, and Lisa Clingan-Cruz, design director. Chicago Scenic built and installed the set, and Deke Hazirijian, lighting designer with New York City Lites, provided the lighting. OSA Onstage Audio, a Chicago firm, provided the reinforcement speakers that are strategically laid out across the performance areas, as well as cabling, break out boxes, Lexicon reverbs, DBX equalizers, audience speakers and a variety of microphones. A Soundcraft GB840 console is permanently installed in the studio to support the performance area.

"Windy City LIVE" has had a distinct impact on WLS-TV, according to Hassan. "As the No. 1 station in the market, 'Windy City LIVE' is another feather in our cap," he said. "The addition of an hour-long, local production with a live studio audience brings vitality and energy. We love the energy!" **BE**

Gary Eskow is a composer and journalist who reports on the audio post industry.



Automation

When automating your facililty means reducing staff, here are some guidelines to help you through this difficult process.

BY SID GUEL

Broadcasting and the production of content are complex enough. With 24/7 operations and 100-percent uptime requirements, any changes to a broadcast operation must be planned and carefully implemented. The affects of change go even higher when people must embrace new work flows.

Automating the production and distribution of content, by definition, has a direct effect on people. While it's important that a broadcaster remain up-to-date with modern technology, there is often an elephant in the room that no one likes to talk about — how staff and personnel will react to automation, especially when that often results in staff reductions. Fortunately, with careful planning and implementation, staff expectations can be managed while the facility reaches the goals set by management.

The ultimate goal

When upper management and the ownership of a broadcast facility decide to modernize their operations, there are hundreds of issues to consider and resolve. How much will this new technology cost? How long will it take to get a return on the investment? Will operating costs be lower? If so, by how much? Who will be affected by the new workflow?

All of these are legitimate concerns and issues that must be addressed. The often complex path to success begins with setting a goal. Ask: Where do you want to be at the end of this process?

Planning is king

Once you've established the goal, the next logical step is the planning. Thoughtful and methodical planning is just plain smart. Like any technology project, planning must include a time line with a start time, end time, and multiple benchmarks and milestones along the way.

When a project affects people, a whole new dimension of complexity is created. Leaving out the effect that change may have on staff is a sure-fire way to create trouble.

Mangement must be on-board

When managing factors involving personnel, management must be on-board with the plan and how it affects their employees. Voicing concerns and advocating for or against employee concerns are acceptable debate topics and a helpful part of this process.

While some may not be happy with the decisions made, the result should be what is best for the business.

At the end of the debate, however, all members of the management team must be in-line and on-board with the final decisions made. While some may not be happy with the decisions made, the result should be what is best for the business.

Manage personnel changes early

After planning and team buy-in, personnel issues should be the first item considered. Ask: Which current positions will be affected? It's important to identify which staff members are capable or not capable of operating a complex automation system.

Resolving personnel changes prior to a physical automation implementation will clearly promote the seriousness of the situation. Resolving personnel changes early in the transition process may also deter unwanted retribution. Give staff, union leadership and employee representatives an early heads up when personnel changes are to be made.

Stick to your plan

Once management agrees on a plan, it's important to stick with it and not vary from the original goals. There will always be unexpected twists and turns, but the result should always be the original goal. Personnel issues are the most sensitive, so humility and respectfulness are important during this process. But, stick to the plan and always have the goal at the forefront of your thinking and when you speak with personnel.

Obtain legal protection

A professional labor attorney is a must for any personnel reductions. Management must ensure a legal due process is followed, one that prevents causing a liability for the company. Labor and employment law firms have the knowledge and experience to minimize risk and ensure a legal process for the protection of all parties involved. The last thing a broadcaster, or a personnel member for that matter, wants is to end up in a costly and drawn-out legal skirmish.

Having a knowledgeable firm involved from day one will help with the dotting of all the i's and the crossing of all the t's. Legal counsel can guide the process and make clear what the boundaries are and advise on the legal process. For example, a broadcaster may consider eliminating a position versus a general lay-off. Changing the terminology can sometimes avoid legal issues. Terms like "evaluation" and "position elimination" may be less likely to result in conflicts than if the changes are called termination. The result may be the same, but words often carry important weight.

Staff members clearly want to keep their jobs. Conversely, management is looking to reduce operating costs.

Hire a third-party consultant

Hiring an outside broadcast automation consultant may be beneficial. This may be especially so if personnel and management relations are frayed and suspicions run high. In most cases, broadcasters are sensitive to personnel changes and want a fair and unbiased process for both management and personnel. A knowledgeable and independent broadcast automation consultant can provide a fair assessment without burdening the broadcaster or the automation manufacturer with this sensitive task or liability.

A professional consultant can create a program for properly evaluating a team of broadcast engineers and/or operators to determine competency and capability in operating a complex automation system. The consultant should have the ability to identify those who are able to be trained in a reasonable and efficient manner. A competent broadcast automation consultant will work with management to establish a variety of evaluation criteria parameters and also a scoring mechanism. Having this professional working together, and in parallel, with a broadcaster's legal counsel can ensure a fair, proper and legal process is followed.

When selecting a broadcast automation consultant, seek a consultant with extensive knowledge and expertise with broadcast automation systems. Look for consultants who have experience with installing systems,

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l and sensitive

s clearly want to keep versely, management reduce operating costs. s of a staff member's person- nce you peel back a few layers, ll find a real human being whose ife is about to change. Stick to your goals and plans. but be mindful of how changes may affect your people.

The more options you make available for affected employees, the less conflict that will develop — and the easier this process becomes.

Provide multiple options

For station management, having multiple options for staff and personnel make this process a little easier. A serious tone and multiple options can help employees understand the gravity of the situation and the career options that are offered. Such choices may include for example, early retirement, job buyouts or simply moving an employee to another position within the same facility or company. The more options you make available for affected employees, the less conflict that will develop — and the easier this difficult process becomes.

At the end of the day

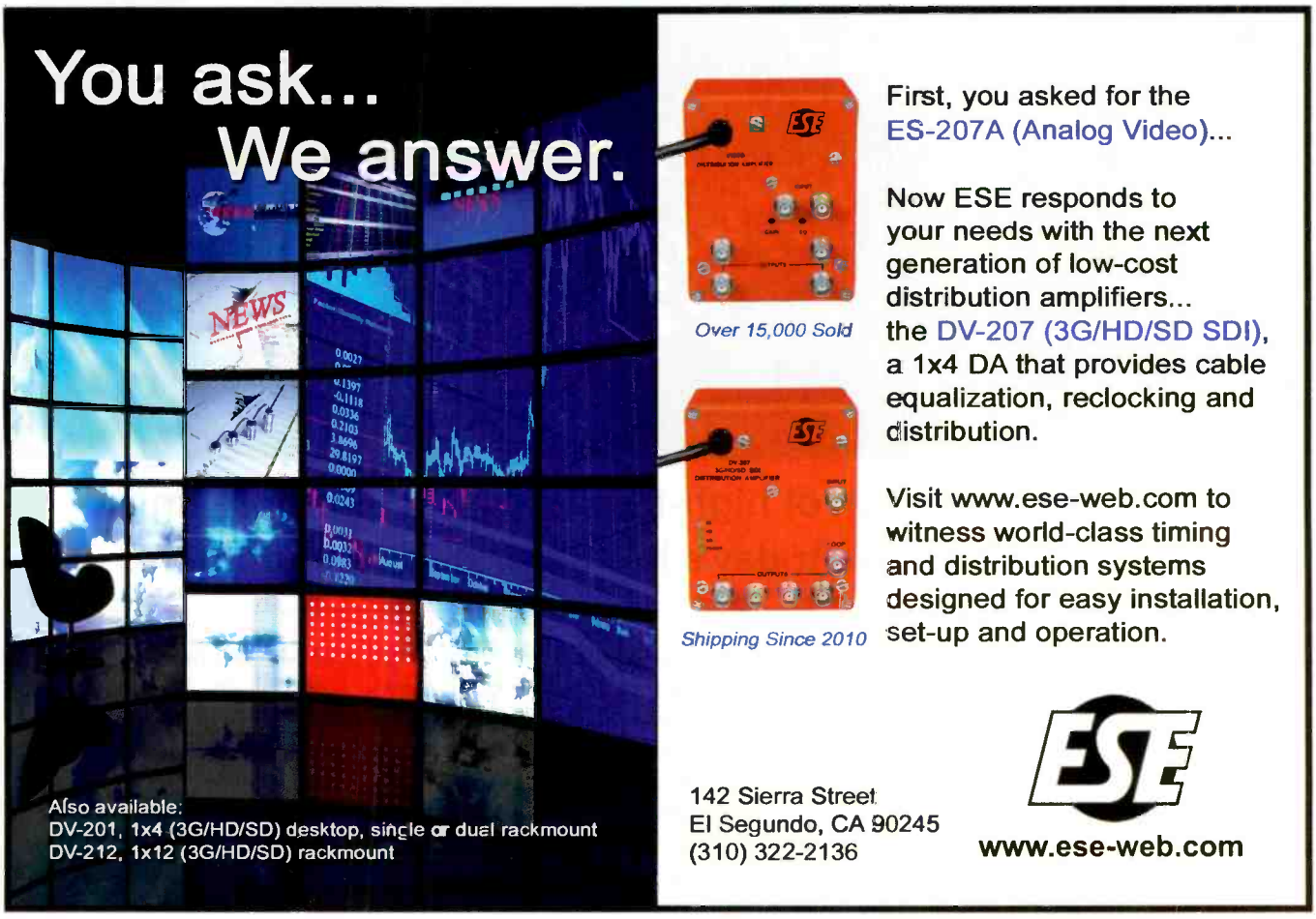
Planning a legal and fair process and procedure early on is a must. All needed parties must be together at the table as part of the planning process. Constant communication is critical. All plans should have time lines set with notable milestones.

Affected personnel should be notified as soon as possible. Keeping staff informed will prove to be successful in the end. Expect unexpected twists and turns. Be firm, however, and stay focused on the goal.

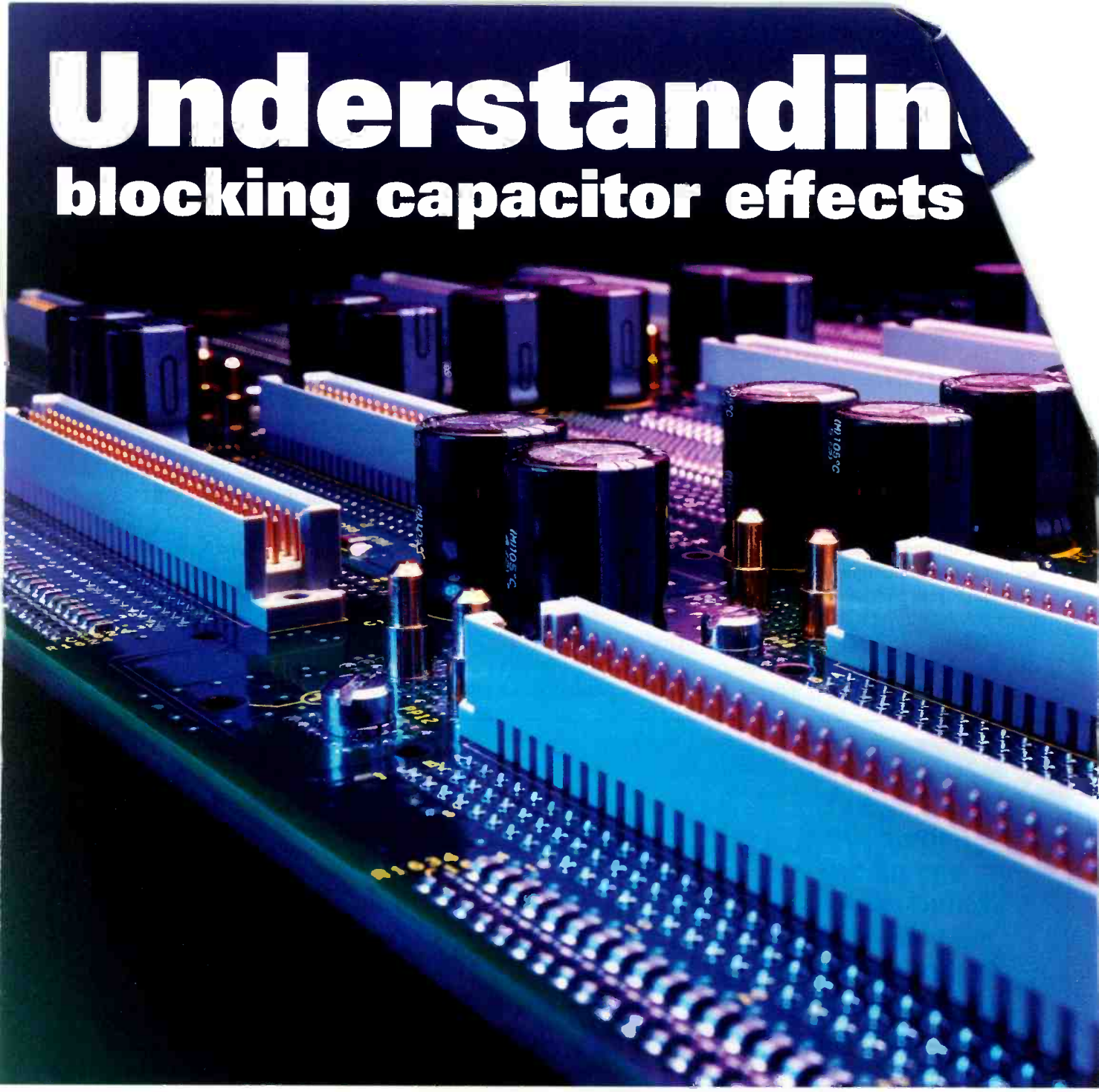
Not everyone is going to be 100-percent happy. For affected personnel, due process is important.

At the end of the day, it's all about doing what it takes to keep the business profitable. At the same time, finding respectable solutions for affected staff is equally as important. BE

Sid Guel is the president and founder of Broadcast Automation Consulting.



Understandin
blocking capacitor effects



Here's an examination of high-frequency pathological signal transmission issues in today's high-bandwidth equipment.

BY RENAUD LAVOIE

Why should we do AC-coupling on SDI and, how does AC-coupling degrade our SDI signal? In past experiences, many engineers asked me this simple question, and because we are familiar with AC-coupled signals, we usually forget about the theory behind our design choice and we apply the rule of thumb. I think that we behave this way a lot of the time. Maybe it is because we don't always have enough time to think about the theory!

Like me, you maybe discovered this signal degradation in the lab. I had worked for many years in a telecommunications business, and when I joined a well-known broadcast business in Montreal, one of my first assignments was to work on an optical-to-electrical converter. At that time, small form-factor pluggable (SFP) was a new concept in telecommunications. So why don't we use it for broadcast? I ordered a few parts to play with.

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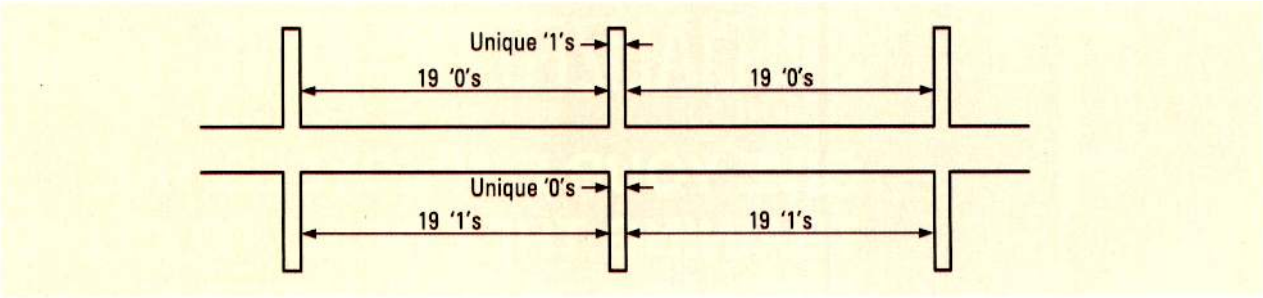

Figure 1. Pathological signal

My first conclusion was that everything worked perfectly except with the pathological signal. (The AC-coupling wasn't the only problem; laser control loop and other problem were present in the SFP.) Then, I contacted the SFP manufacturer to correct the automatic power control loop; it sent me a new SFP with a slow control loop. I investigated the circuit in detail since the behaviour of the SFP was not improving. The AC-coupling capacitor value was 0.1µF because the module was used for 8b/10b encoding a well-balanced signal. I did find the remaining problems of the pathological signals in my SFP, but I faced a bigger problem: The manufacturer didn't want to change the layout with bigger capacitors.

I hope you will enjoy this quick explanation of the AC-coupling capacitors versus the beautiful pathological signal. As a designer, you can find articles on how the equalizer should handle the pathological signals, but the information about how blocking capacitors react versus pathological is not accessible on the Internet. This article explains the behavior of the blocking capacitor and shows why the pathological signal is affected.

Pathological signal generation

The pathological signal is a result of the coding scheme of the SMPTE standards. Two functions are used in SDI to encode the signal. The reason for these two polynomials is simple: to encode the signal without significantly increasing the bandwidth. In many cases, the 8b/10b is used to encode the signal and to balance the number of 1's and 0's (called DC-balance or zero DC-component). Those encoding schemes increase drastically the bandwidth, 25 percent for the 8b/10b. Today, the data communications and telecommunications companies are looking to 64b/66b to reduce this increase to a reasonable 3.125 percent.

The scrambling and non-return-to-zero-inverted (NRZI) are used to increase the transition density in the serial data stream, but some sequences create the undesired pathological signals. The NRZI also allows the receiver to decode an inverted stream; remember that the goal of the scrambler and the NRZI was the minimization of the overhead created by the encoding. Take as an example the 8b/10b encoding; from the 8 bits of data, the encoder creates 10 bits. With the 8b/10b encoding, the data stream has a 25 percent speed overhead due to the encoding, compared to 0 percent with the NRZI. However, the 8b/10b encoding creates a DC-balance data stream. The SDI encoding is accomplished after the concatenation of two functions:

$$G_1(X) = X^9 + X^4 + 1 \quad \text{Scrambler}$$
$$G_2(X) = X + 1 \quad \text{NRZI}$$

As a consequence of this encoding scheme, runs of 0's and 1's can appear in the data stream. Applying 300_{hex} followed by 198_{hex} during the video active line produces 19 high (or low) data followed by a unique 1 low (or high) data. This run isn't a problem if this occurs once, compared to 66b/64b that can produce 66 consecutive identical data (CID). The problem with the SDI encoding is the repetitive sequence of 300_{hex} followed by 198_{hex}; it produces the pathological signal, a specific shade of magenta, which occurs in the active portion of the line. (See Figure 1.)

Blocking capacitor effect

A blocking capacitor with a termination resistor forms a high-pass filter. This filter should have a low cutoff frequency to minimize the distortion on the signal. (See Figure 2.)

When long runs of consecutive identical bits are presented to this high-pass filter, a voltage drop occurs, resulting in low-frequency jitter.

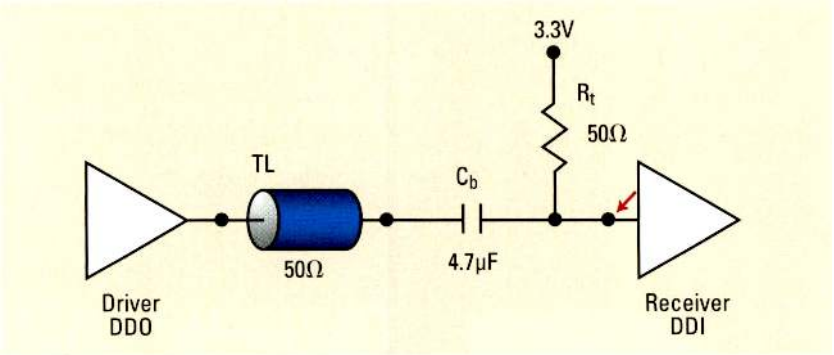

Figure 2. A simple model of a typical AC-coupling capacitor. Note that the blocking capacitor affects the differential signal as well.

This jitter is pattern-dependant. It is called pattern-dependant jitter (PDJ) or data-dependant jitter (DDJ). (See Figure 3 on page 54.)

To minimize the PDJ, the 3dB cut-off frequency should be set correctly. This frequency is directly related to the capacitor (C_b) and the resistor (R_t). If you use new components with internal termination, you have lesser values of R_t. The goal is to use a smaller capacitor size with the desired capacitance to minimize reflections. The following equations solve the capacitor's value:

$$C_b = \frac{-T * N_{CID}}{2 * R_t * \ln\left(1 - \frac{1.2PDJ}{t_r}\right)}$$

Where:

$$PDJ = \frac{\Delta V}{slope}$$

$$\Delta V = 0.5V_{pp}\left(1 - e^{-t/\tau}\right)$$

t is the discharge time: N_{CID} * bit period.

τ is the RC constant (C_b and R_t), twice R_t considering the driver impedance.

$$slope = V_{pp} * \frac{0.6}{t_r}$$

V_{PP} is the voltage swing.

t_r is the rise time of the signal (20 percent to 80 percent).

Note for designers: If you ever simulate AC-coupled high-speed traces, you will always see an option like "skip x symbols at the beginning." Remember that the AC-coupling capacitor is discharged at the beginning of the simulation, so you will have the same behavior; your signal will not be DC-balanced, even with 8b/10b. The simulator will skip the first eye diagram to ensure that your simulation is relevant.

If the pattern was only limited to one occurence, the blocking capacitor for SDI encoding should be really small. In the SMPTE-259 (270Mb/s) and SMPTE-292 specifications, the pattern can be repetitive up to 720 or 1920 times respectively. The difference between the number of 0's and 1's over a long time can be called the

If the pattern was only limited to one occurence, the blocking capacitor for SDI encoding should be really small.

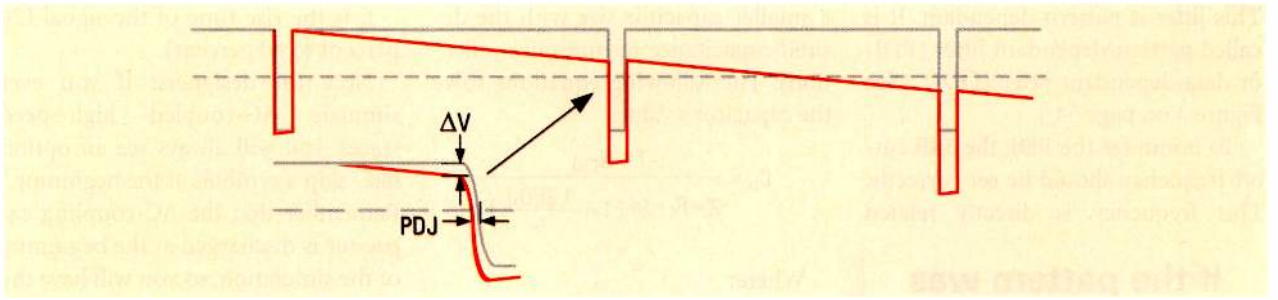

Figure 3. The high-pass filter introduces voltage drop and low-frequency jitter.

cumulative bit difference (CBD); over a line the CBD is large.

Eye diagram after the blocking capacitor

With the previous explanation, we can clearly understand why the pathological problem is not the CID but the DC unbalance over the line period (CBD). In other words, the capacitor charge will not stay at the midpoint for the entire line. This effect moves the unique 1 or 0 over the time far from the decision point, creating errors. Figures 4 and 5 show the eye diagram at the end of the line for the 270Mb/s pathological signal (half line).

Another way to represent the blocking capacitor effect is in frequency domain. Compare the frequency spectrum of the pathological signal versus a random stream applied to the blocking capacitor circuit. (See Figure 6 on page 55.) Note the power close to DC for the pathological signal (red). All the energy below the cutoff frequency will be attenuated, reducing the SNR and thus degrading the bit error rate (338Hz for the 4.7µF and 265 kHz for the 6nF).

Possible changes on C_b and R_t

The previous waveform demonstrates the pathological frequency spectrum versus a perfect random signal with 1 and 0 balance. To preserve the maximum SNR, the cutoff frequency of 338Hz appears to be a good choice. Changing the internal termination from 50Ω to 75Ω and keeping the same cutoff frequency, now the value of C_b is 3.3µF. (See Figure 7 on page 55.) This 3.3µF capacitor can be smaller in size and can be more stable in temperature.

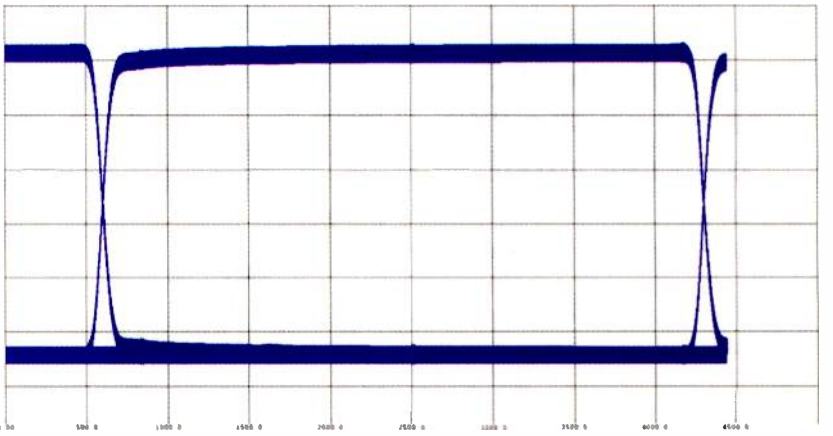

Figure 4. Eye diagram 270Mb/s, C_b = 4.7µF

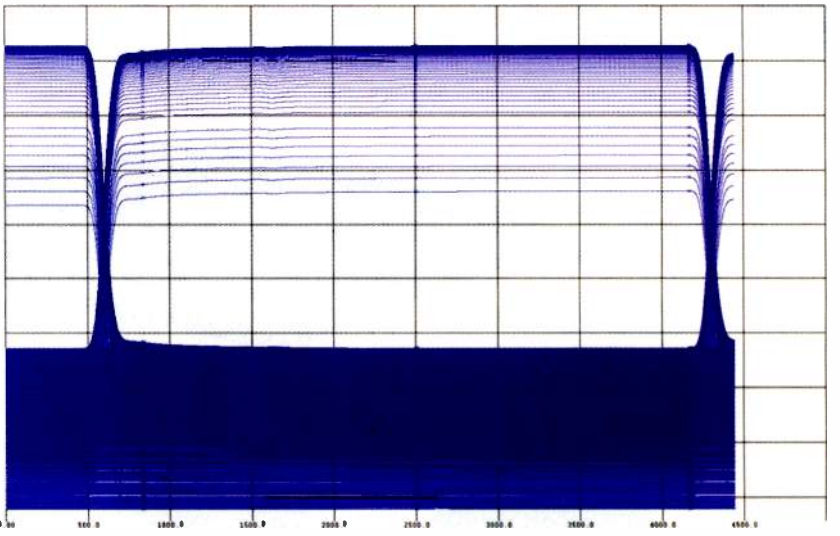

Figure 5. Eye diagram 270Mb/s, C_b = 6nF. Note: This model has been created with the generic CML IBIS model.

DC-coupled versus AC-coupled

So why don't we do DC-coupled circuits instead of AC-coupled? The DC-coupled could be a great solution, but you should be aware of a few key characteristic of your drivers and receivers. First is the common mode voltage of your driver; every high-speed driver is swinging around a DC

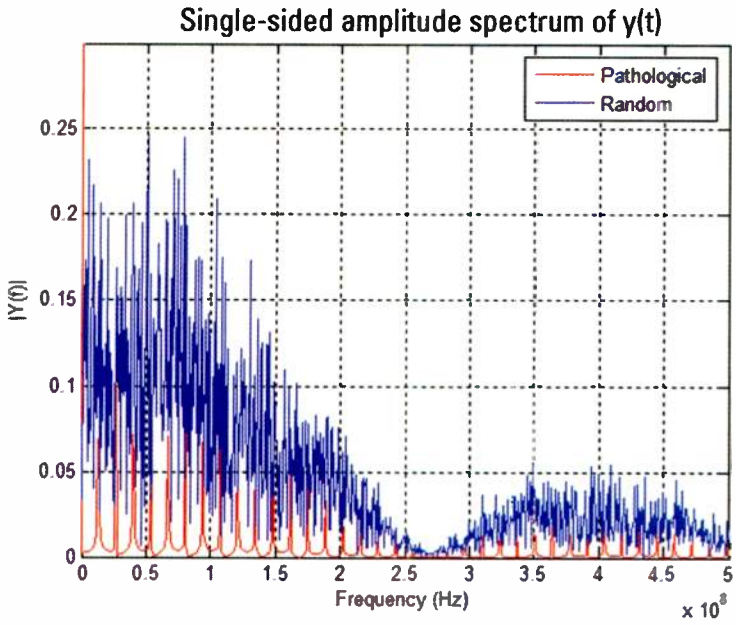

Figure 6. Frequency spectrum 270Mb/s: Random signal (blue), pathological (red)

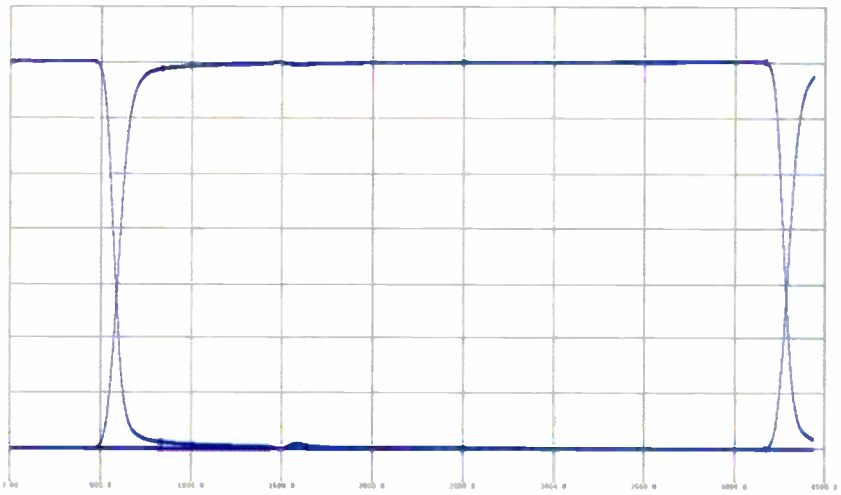

Figure 7. Eye diagram 270Mb/s, C_b = 3.3µF, Rt = 75Ω

voltage on each wire. As example, the output of your equalizer could swing from 3.3V to 2.9V. (See the datasheet of the part you use for more precise information.) If you use a new FPGA to deserialize the signal, you might have a voltage common mode of 1.2V with an allowed swing of +/-400mV. You can clearly see that your equalizer outputs will not work with your FPGA inputs. In this specific case, AC-coupling is one of the easiest solutions.

Here are the key points to consider before deciding to go DC-coupled:

- Known driver: no DC offset possible, ie on the same board or in the same system;
- Common mode voltage (V_{cm}) of the driver is included in the receiver input common mode voltage;
- All combinations of V_{cm} positive and negative swings of the signal are included in the receiver tolerance.

Conclusion

This article shows the blocking capacitor's effect on the pathological signal. This effect can be controlled by designing the system to have a low 3dB cutoff frequency and by ensuring an equal number of 1's and 0's over time. With SDI encoding, the second option isn't possible; the designer should set the cutoff frequency very low to keep the SNR as high as possible or use DC-coupling when the technology and design permit it. BE

Renaud Lavoie is president and CEO of Embrionix.

Dolby's PRM-4200

The monitor provides black-level performance that would satisfy the most discriminating eye.

BY BOB FRYE

While the death of the CRT is welcome news for the environment, professionals who have relied on the CRT for critical work like color correction are less enthusiastic about losing their trusted monitors. One reason is the inability of most flat-panel replacements to render true blacks and dark detail. For the Dolby PRM-4200 Professional Reference Monitor, we wanted black-level performance that would satisfy even the most discriminating eye. Achieving this goal required taking a fresh approach to the problem.

The PRM-4200 Professional Reference Monitor supports not only today's 10-bit video formats, but also emerging 12-bit formats without dithering or down-scaling of the color gamut.

The primary cause for the lifted "milky" blacks that have made LCD displays infamous among color-critical users is the cold cathode fluorescent lamp (CCFL), which also limits the available color gamut. Static LED backlight units, meanwhile, offer improved color, but they do little to solve the lack of pure, deep blacks.

A viable CRT replacement

Our solution: dual modulation. The PRM-4200 features a unique backlight unit comprised of some 1500 RGB LED triads that directly illuminate the LCD panel. The output of each R, G and B element within each LED is dynamically modulated on a frame-by-frame basis to match the image content for each frame. When the image requires that a portion of the screen be dark, the corresponding LEDs dim. This means no light will pass through the LCD to the viewer. The result is absolute black levels — true blacks and superior dark details. In fact, the black-level performance of the Dolby monitor has been measured to surpass the black-level performance of any other display device on the market.

Once the full-color backlight image for a particular content frame is generated, this information is then used to create the LCD image. The modulation of the LCD panel occurs in real time and is based on a complex algorithm composed of a variety of matrix and 2D filtering operations.

The pairing of a modulated LCD with a dynamically modulated backlight unit has implications for overall image quality as well as black levels. Our dual-modulation process enables precise color accuracy at all luminance levels and exceptionally wide dynamic ranges. While other monitors claim color accuracy at a particular point in brightness, the color accuracy of the Dolby monitor is linear across the entire grey scale. Likewise, a very wide "dynamic envelope" and a very wide "gamut envelope" enable the monitor to emulate any monitor whose performance "fits" within gamuts up to DCI-P3 and luminance envelopes up to 600cd/m^2.

The LCD/LED display technology built into the monitor also has economic benefits. It eliminates the costly re-tubing that CRT reference monitors need every 18 to 24 months. Similarly, the LCD/LED combination is less susceptible to burn in and other issues that shorten the lifespan of today's plasma technology and necessitate the frequent replacement of plasma monitors.

Indeed, we built the monitor with longevity in mind. Consider the increasing popularity of cameras such as the ARRI Alexa, RED Epic and Sony F35. Most monitors can display only a small portion of the high-resolution images produced by these cameras. Our monitor already supports native viewing of both 10- and 12-bit formats, and will be capable of displaying the advanced high-dynamic-range output of cameras, color grading systems, and other production and post-production devices moving forward.

By supporting 12-bit video input, the monitor is also future-proofed for higher bit-rate work flows like the new architecture for digital cinema mastering being developed by the Academy of Motion Pictures Arts & Sciences. It is the only Grade 1 monitor on the market that already supports the proposed infrastructure, which promises to become a standard for digital cinema mastering into the future.

With its patented dual-modulation design and a host of other innovative features, the PRM-4200 improves on the capabilities of the CRT and offers durability, versatility and compliance with emerging formats. BE

Bob Frye is product manager for the Dolby PRM-4200 Professional Reference Monitor.

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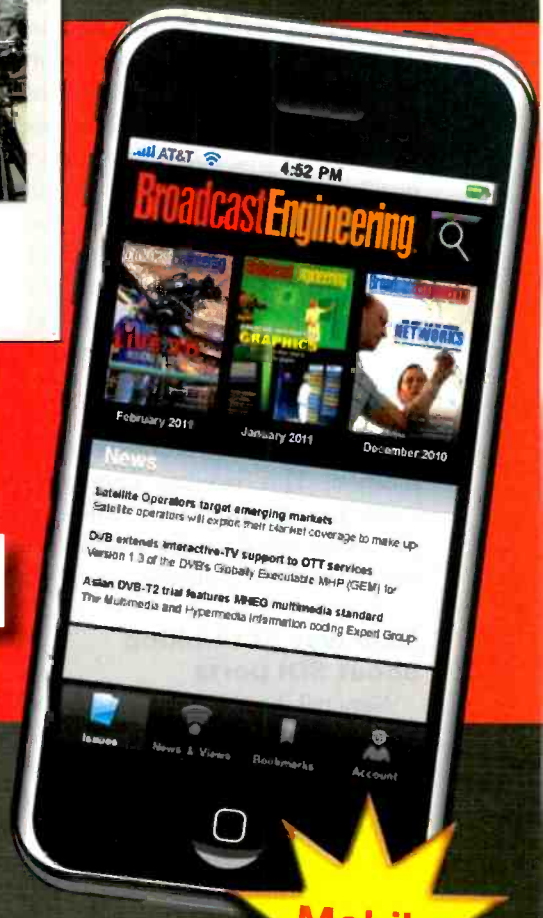

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The LMH0387

National Semiconductor's bidirectional SDI I/O device simplifies hardware headaches.

BY GARY MELCHIOR

Traditionally, SDI ports on video equipment have been fixed as either inputs or outputs. This has led to hardware designers choosing architectures with a limited number of input and output ports based on the number of BNC connectors they can fit into a given form factor. The fixed nature of these SDI ports necessitates many unique board configurations in order to support a variety of applications. For example, one board may require one input and seven outputs, while another requires four in and four out. This leads to higher design costs, as well as higher inventory costs for stocking each unique configuration.

Furthermore, the SDI ports on each of these unique boards must meet stringent design requirements, such as the SMPTE 424M return loss specification. This requires fine-tuning many passive components for each particular board design, a time-consuming and costly process.

New way of thinking about SDI ports

National Semiconductor has developed a single-chip bidirectional SDI I/O — the LMH0387. This configurable I/O device provides the flexibility for SDI ports to be set as either inputs or outputs via software or a switch, allowing one physical board design to be used in multiple configurations. The device includes an integrated return loss network to assure compliance with the SMPTE return loss specification. This saves time by avoiding the need for the often iterative process of fine-tuning passive components to achieve specification compliance, while conserving board area and reducing bill of materials costs.

The LMH0387 configurable I/O is a single-chip solution that integrates the full functionality of an SDI adaptive cable equalizer, SDI cable driver and integrated return loss network in a tiny 7mm x 7mm package. It provides a single pin for both the input and output functions. This pin connects to the BNC connector via a single AC-coupling capacitor. No additional components are required in the SDI signal path.

The bidirectional I/O provides a switch to configure the single pin as either input or output. In the input mode, the equalizer is enabled, and the cable driver is disabled to prevent interference on the shared pin. In the output mode, the cable driver is enabled, and the equalizer is typically disabled for power savings but may optionally be left enabled to provide a loopback path of the signal being driven on the cable.

The bidirectional I/O optimizes BNC usage, which is especially important when the number of available BNCs is physically limited by board size. Suppose you are designing video equipment with five SDI ports, and you would like to provide various options for the number of inputs and outputs. These ports could be configured as four in, one out (4 x 1); 3 x 2; 2 x 3; or 1 x 4. With dedicated equalizers and cable drivers, this would require four unique designs. Using the configurable I/O, this identical functionality can be realized with a single physical design, programmable as four different options. (See Figure 1.) Only one board needs to be designed, optimized, maintained and stocked for a given number of SDI ports. The board's I/O configurations can be preconfigured before delivery, programmed during installation or even changed live post-installation if desired.

By integrating the return loss network, the LMH0387 delivers plug-and-play compliance to rigorous SMPTE return loss specifications and simplifies board design. The SMPTE return loss requirement specifies how

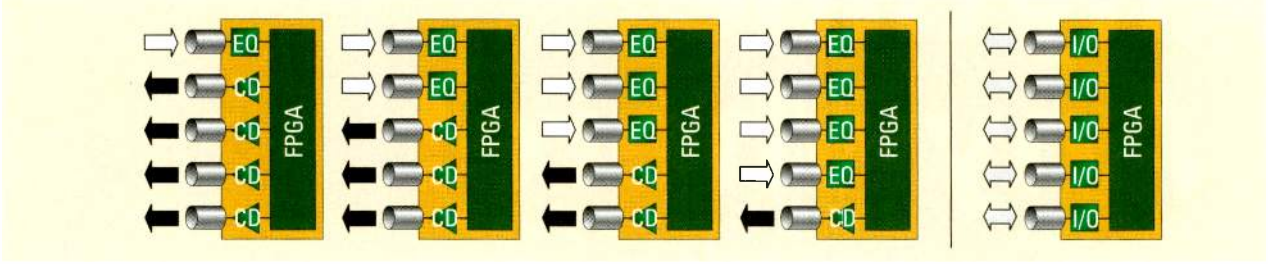


Figure 1. Designing video equipment with five SDI ports and various options for the number of inputs and outputs would require four unique designs (left). With the LMH0387, this functionality can be achieved with a single physical design, programmable as four different options (right).

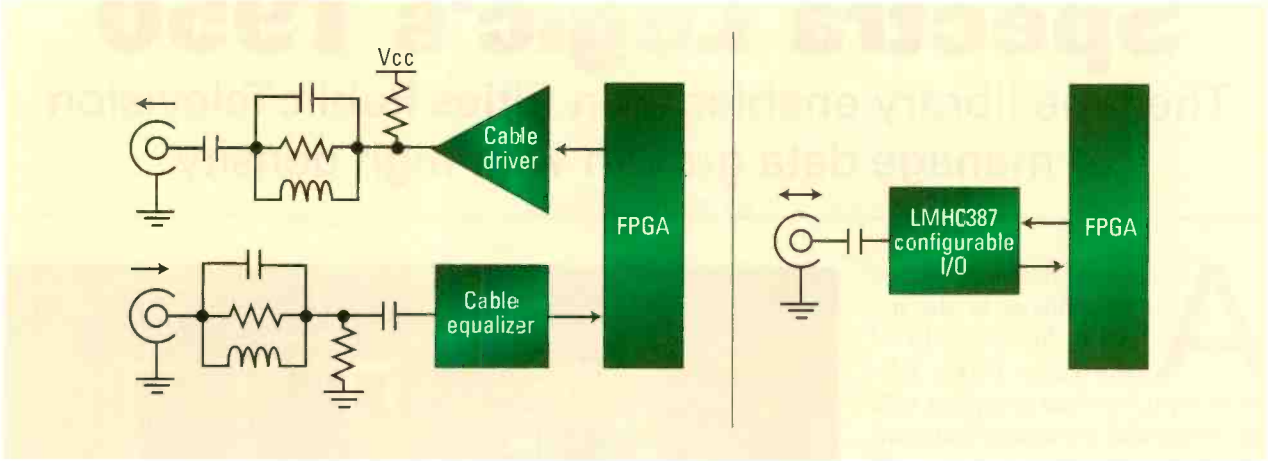


Figure 2. The traditional solution (left) consists of two BNCs, two ICs and return loss networks. The LMH0387 solution (right) consists of one BNC and one IC.

close in impedance a network must be to 75Ω across a specified frequency range. This requirement is intended to prevent reflections and increase the power transfer at the BNC. A return loss network, consisting of inductors, resistors and sometimes capacitors, is required to compensate for the input or output capacitance of the receiver or driver circuit. (See Figure 2.) Good return loss is best achieved by placing this network as close as possible to the equalizer or cable driver chips and using physically small components in order to minimize impedance discontinuities. By integrating this network inside the package, the return loss is optimized, and the LMH0387 is able to achieve greater than 5dB of margin above the SMPTE specification.

Summary

The LMH0387 configurable I/O enables a new way of thinking about SDI ports. They are no longer fixed and inflexible, but instead, become adaptable to your particular application. One board using the bidirectional I/O supplants the need for many unique designs. The I/O device can replace an SDI equalizer or cable driver, or do the job of both depending on the need, in addition to simplifying layout and saving board space. BE

Gary Melchior is an applications engineer with National Semiconductor.

Spectra Logic's T950

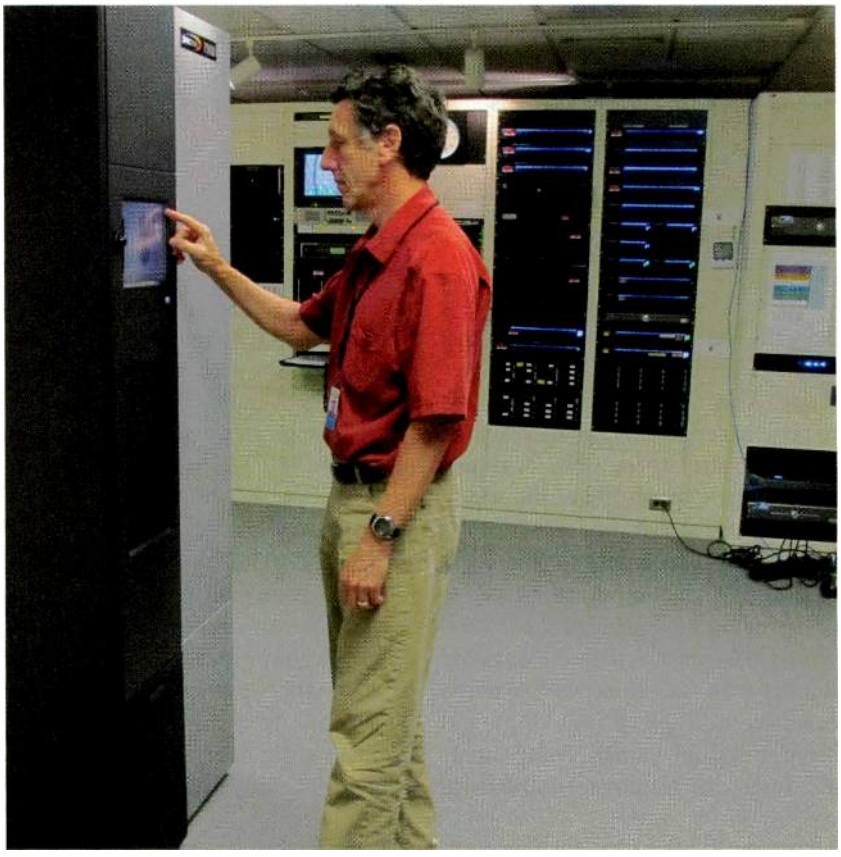
The tape library enables Twin Cities Public Television to manage data growth with high density.

BY BRUCE JACOBS

As one of the most watched PBS affiliates in the nation, at Minnesota-based Twin Cities Public Television (tpt), we were grappling with the storage and retrieval of burgeoning digital video data volumes. We produce our own television programs and broadcast thousands of hours each year from PBS and other distributors.

With a large, wide variety of content, our data set increases rapidly and must be retained anywhere from one week to perpetuity due to various industry program rights. The challenge of managing this rapid sizable data growth prompted us to search for a large, efficient storage system to accommodate our 180TB of data today — and to plan for future growth.

Our previous robotic tape library was pushing its capacity thresholds at a 60TB limit and was configured with older, antiquated SAIT drives. We needed a higher-density storage solution. As part of a thorough technology review, the station considered both tape and hard disk systems. The hard disk systems we evaluated didn't offer the low cost, high capacity and reliability we needed, so we turned our attention to an updated Spectra Logic tape library that offered reliability, high performance and smooth integration with our Masstech software.



Bruce Jacobs, CTO of Twin Cities Public TV, uses Spectra's BlueScale 11 operating system to check the status of the Spectra T950 tape library.

Tape libraries have an excellent reputation and have been well-tested thanks to their widespread use in the media and entertainment industry.

DAM: Why tape?

Tape libraries have an excellent reputation and have been well-tested thanks to their widespread use in the media and entertainment industry. While robotic tape library operation is easy, ensuring middleware interface integration with the tape library, server and automation requires a high degree of expertise for a broadcast environment. In fact, the middleware software integration was one of the biggest challenges we faced.

My advice to peers is to address this issue early in the process of a major data center equipment refresh. Once you've determined your hardware components, focus on your middleware software package. Do you need a new one? Must you upgrade your current software to ensure that all of the components in the network will work well together?

Like many broadcasters, tpt is legally required to delete programs if we don't have legal long-term retention rights, hence the need for a strong middleware platform. In fact, some of our distributors and affiliates require an affidavit confirming that

The Spectra T950 can scale up to as many as eight frames and 10,050 slots.

video clip use has been discontinued once rights expire. Despite the terabytes we reclaimed when we defragmented existing tapes once our rights expired, we were still running out of space and desperately needed more storage capacity.

Based on the results of the technology review and our past positive experience with the vendor, we upgraded to a high-density Spectra T950 tape library with LTO-4 tapes and BlueScale 11 management software. The tape library offers high availability, capacity and density; proactive drive and media heath checks; detailed reporting features; proactive notification and tracking; data integrity verification; and ease of use. The unit arrived well packed and easy to unload, install and commission. The only hiccup was that we neglected to order enough fibre channel cables to support the new unit, as one cable is required for each LTO-4 drive, but the minor setback was quickly remedied by an overnight cable shipment.

The tape library is being used for the nearline storage of all of our broadcast television programs. Data resides on the library and is transferred to the archive daily. Then it is retrieved as historical programs are needed. The station is taking advantage of the tape library's exclusive Global Spare option, which enables a spare failover tape drive to be configured on-site, and ensures that all necessary drives are always available to the MassStor software to retrieve and store content in required time frames.

The results

The Spectra T950 offers triple the capacity of our previous SAIT-based library. While it's difficult to believe, before implementing robotic tape libraries, we used a video tape storage system that consumed 3600sq ft of data center floor space. We've experienced a dramatic 99.7 percent reclamation of space over the years, as our current library consumes just 9.2sq ft. Since installation, we've improved time management and streamlined staffing efficiencies, thus saving money as well.

We've experienced a dramatic 99.7 percent reclamation of space over the years, as our current library consumes just 9.2sq ft.

The space efficiency and high capacity of the tape library with LTO-4 drives combined with the reliability of BlueScale 11 software meets all of our requirements. It's ideal for anyone managing large data sets — either within or outside of the media and entertainment industry. BE

Bruce Jacobs is CTO of Twin Cities Public TV.

RTW's TouchMonitor

The audio meter features a touch screen and a flexible configuration.

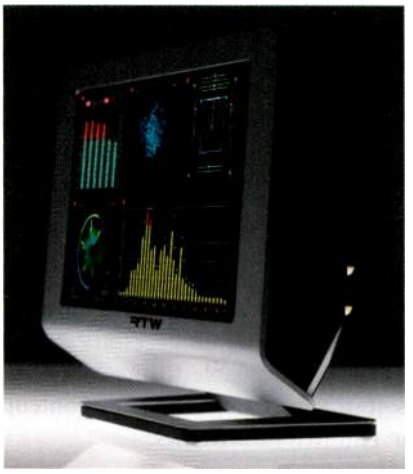
BY MIKE KAHSNITZ

The entire pro audio industry, particularly those working in broadcast, is currently undergoing a fast paradigm shift from traditional peak metering of audio programs towards integrated loudness management. This is mainly a result of some of today's current standards and recommendations, such as EBU R128, ITU 1770/1771, ATSC A/85, the CALM Act and ARIB. This change will soon affect the daily tasks of many audio teams, from content generation to the distribution of the final product over a number of channels. Today, older metering instruments hardly meet current requirements due to insufficient computing power.

Here in the U.S., the CALM Act that Congress passed last year requires the FCC to adopt the ATSC A/85 guidelines. Originally approved by the ATSC in 2009, an updated version of these guidelines was published in May, which has left the pro audio industry with the task of finding and implementing the best systems for adhering to these regulations.

As a member of the P/Loud group of the European Broadcasting Union (EBU), I work on loudness recommendations mainly for the EU. It became obvious, however, that the modern loudness measurement equipment required for putting these new regulations into practice should meet not only local, but any relevant international regulations as well. On top of this, as regulations on new topics tend to develop quite fast, it should be easy for the user to update his or her equipment to adapt to any upcoming version of such recommendations and regulations.

Finding solutions to meet these new regulations has been challenging, especially as we inch closer to the deadline for implementation of these new standards. From its years of research, expertise and involvement in groups such as the EBU, RTW has developed a new metering product: the TouchMonitor range. This family of products combines the technological benefits of dedicated hardware with the flexibility of software and an ergonomic touch-sensitive display. The first two models of the new range — the TM7 with a 7in display and the TM9 featuring a 9in display — integrate the entire signal processing functionality, the display unit and all interface ports into a hardware unit with an overall depth of 46mm.



The RTW TouchMonitor simultaneously visualizes up to 16 signal sources using flexible, advanced instruments.

A TouchMonitor simultaneously visualizes up to 16 signal sources using many flexible and advanced instruments. The 3G-SDI interface for the TM9 model is capable of processing and visualizing up to 32 input signals at the same time. In addition, the unit handles and displays many independent audio groups simultaneously within the same preset. Each group can be displayed on different instruments. In addition, while the screen layout of traditional RTW meters was largely static, the new audio meter allows for freely arranging, scaling and, where appropriate, rotating all instruments that are part of a preset on the screen. Thus, the user can quickly access a large number of signal paths, each configured with the appropriate instruments using presets.

The system comes with no mechanical controls; the user controls the units using just the 16:9 touch-sensitive display screen. Alternatively, if the environment does not allow for touchscreen operation, the GUI can also be controlled using a mouse. Initially, the majority of instruments known from previous RTW metering products were made available on the system. These include a large number of peak-meter models, a vectorscope, an RTA and the Surround Sound Analyzer used for visualizing multichannel audio.

Meanwhile, the unit also supports various new developments, including several instruments for visualizing channel or sum loudness on a graphical or numerical basis that comply with the current EBU, ITU, ATSC and ARIB recommendations. Originally designed by TC Electronic, the loudness radar meter with its characteristic circular view was licensed for use on the system.

From the range of functions, the user can select exactly those instruments needed for his or her specific application thanks to the concept of software modules, which can be added at any time in the future with appropriate software licenses. Thus, the audio meter's universal hardware platform allows for configurations as simple as stereo peak meters to

full-fledged multifunctional multichannel-enabled metering systems.

The menu system developed for the system guides the user through the process of making relevant settings, including the analog or digital domain, channel counts, and the loudness standard to be applied or the instrument selection. This allows for creating new presets quickly and in a target-oriented manner.

For each single-channel or multichannel audio signal to be displayed on the system, the user sets up a separate audio group defining the desired input channels, the channel configuration and other details. Each audio group can be populated with instruments suitable for the selected domain and channel mode if the appropriate licenses have been unlocked. After creating the groups for all sources to be visualized within a preset, the user can freely place instruments from those groups on the available screen area using the graphical view editor. This allows for displaying a number of entirely independent sources with their relevant instruments on the screen at the same time.

Without a doubt, loudness is one of the major reasons for the increased interest in audio metering today. When designing this new audio meter, RTW opted for a loudness implementation that fully complies with all current standards and recommendations but also allows for customizing all critical parameters such as integration times or gating. On the other hand, if you select an established setting such as the EBU mode that is specified by the EBU R128 standard, the standardized parameters cannot be altered. This way, the user always knows whether a measurement is standards-compliant or based on custom settings. BE

Mike Kahsnitz is technical director at RTW.

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from Vegas

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Omneon Media Application Server

CNN standardizes across all of its platforms.

BY BOB HESSKAMP AND MICHAEL KOETTER

As CNN brings content to air on CNN, CNN International, CNN en Espanol and HLN, and to the Internet on CNN.com, our goal is to leverage our substantial volume of unique news content as fully as possible in telling compelling and meaningful stories. Last year, we replaced aging feeds-ingest, edit and playout infrastructure at our Atlanta facilities with a new HD infrastructure. With this upgrade, we took on the challenge of building an integrated production environment that would enable journalists to find and access the best of the media gathered by our global news organization.

The Broadcast Engineering & System Technology (BEST) and Image and Sound teams here worked with Omneon (now part of Harmonic) Broadcast Solutions Group, Adobe, Apple, Avid, Cisco, IPV, Sony, Telestream and Vizrt to design, install and bring online the systems comprising our new production environment.

We decided not to settle for an existing system but instead to leverage our partnerships and our own staff to define and develop an open HD infrastructure and media asset management system that could supply video to all of our platforms, integrate well with our archive and make it easy for journalists to get the video they need to do their jobs. In doing so, we achieved a number of firsts.

We were the first to use the combination of the Omneon Media Application Server (MAS) and the Omneon MediaGrid active storage system as a production system. We also achieved significant industry firsts in our use of MXF in Apple Final Cut Pro with the addition of Sony's Cinemon plug-in, and in our integration of Adobe After Effects and Adobe Premiere Pro functionality into our internal MAM system. These variables meant that we had to be dynamic in anticipating and handling the rollout, and we managed it successfully, implementing a system that will help drive our business forward.

When CNN decided to revamp its ingest, edit and playout infrastructure, it chose the Omneon Media Application Server and MediaGrid. The network will implement this framework at all of its bureaus worldwide. Photo courtesy John Nowak/CNN.

Development

From day one of the project, our stakeholders were represented. We adopted a new Agile development process (Scrum), going through iterative development cycles right next to internal clients, whose ability to see our work early on was key to the project's success. The MAS environment simplified development by providing an intelligent middleware layer between stored media content and the applications used to access or process content. During our testing phase, collaboration among our development team, the engineering team and operations helped us to ensure that we tested almost every single scenario we might face in production. It was a careful yet fast process, as we were able to test and adjust quickly with new builds and fixes. During actual rollout, this earlier work helped us to maintain the performance required by the 24-hour news cycle.

Ingest

Within the new HD production infrastructure now online, we use MXF Op1a-wrapped HD XDCAM 35 as our house format, from pulling content off cameras to editing, archiving and fulfillment. This approach has allowed us to eliminate transcoding or reingest of 35Mb/s content and thereby maintain image quality while keeping file sizes small enough for fast, efficient movement around our facility and from bureau to bureau.

The MAS presents a single virtualized view of content across all Harmonic managed systems, including Omneon MediaDeck ingest server systems, two 126TB MediaGrid systems and Spectrum playout servers. The server also allows our internally developed media management system, MediaSource-2, to access media metadata easily, thus providing robust search functionality to journalists, and to trigger system functions such as file movement and transcoding. Our media management system also provides workflow integration with our Vizrt Viz Dart front-end ingest system, Final Cut Pro editors and other systems across the CNN enterprise.

Editing

The Sony Cinemon plug-in supports the direct import and editing of XDCAM MXF files in Final Cut Pro and facilitates the edit-during-ingest approach that allows our journalists to edit growing files on the MediaGrid and to move stories to air quickly. Cinemon preserves the quality of edited media by performing a GOP-splice render that cleans up long-GOP content so that there is an I-frame on the in and outpoint of a mid-GOP edit. This technique preserves the native encoding from the MediaDeck system or XDCAM camera and maintains image quality.

The new proxy edit system we devised in collaboration with Adobe and IPV provides a journalist-friendly user interface to Premiere Pro and a facility-friendly backend render environment, both of which are fully integrated with MediaSource-2. Seconds after an ingest begins, journalists can use the simplified Adobe Premier Pro user interface to edit low-resolution proxy video generated by our IPV system. Completed timelines can be conformed to our house format automatically by the MediaSource render management service attached to the MediaGrid system. While the autoconform process can support any effects employed by Adobe Premiere Pro, we continue to rely on our Final Cut Pro systems and editors for craft editing. This powerful and cost-effective new model makes true location-independent production a reality by eliminating the need to move high-resolution files around our facilities.

With this new production infrastructure, we tied all of our production operations together in a way never before achieved. The vastly improved workflow we've put in place at CNN Atlanta allows produced content to be taken to air or Web in a matter of minutes. Any media cut by any network (or for any network) is available for playback on any other CNN network, as well as to our more than 1000 affiliates worldwide via our Newsource services. We're now going ahead with plans to roll out this architecture at other bureaus around the world.

The future

We're seeing more and more companies take this kind of open IT approach, with MXF as a production format gaining a lot of steam. Widespread vendor support for MXF and MPEG as a meaningful production format indicates that this type of agile integrated production system will only become easier to build. Moving forward, our engineering team is contributing to this trend through its involvement in the development of an application specification, through AMWA, for simple MXF acquisition and production. The specification, AS10, will be based on SMPTE RDD9 and provide a significantly simpler and faster means of validating that files will work within a given MXF production ecosystem. There are already a significant number of camera, edit, transcode and playout vendors on the team, and we have great hopes for the value this will bring to the industry. BE

Bob Hesskamp is SVP CNN Broadcast Engineering and Systems Technology (BEST), Turner Broadcasting/CNN, and Michael Koetter is VP News Technology Planning and Development, CNN BEST.

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Video compression

The handwriting is on the wall for video switching.

BY JOHN LUFF

Reality in our industry is all in the presentation of approximations of reality. The essence of video and audio compression is the selective discarding of information that the consumer of the content will not miss. We do our job best not when we send the most pristine and perfect images and sound, but rather when it's been transmitted through the narrowest funnel we can manage without making it obvious to the consumer's untrained eyes.

A ballot for the most essential invention in the media industry in our lifetimes would have to at least include compression.

Changes in video compression technology

This began decades ago as an area of research called bit-rate reduction, now, of course, called video compression. In the 1970s, it was generally thought that 525/625 video needed well in excess of 25Mb/s for adequate digital representation. In fact, the EBU published a paper once purporting to mathematically "prove" that the job could not be done in less than 34Mb/s. Jumping forward a couple of decades, it is quite obvious that the calculation was not able to take into account research done much later. At that time, there were plenty of questions about how one might even approach perceptual coding of images (and sound). There were also many papers about run length encoding, the Nyquist limit and other topics worthy of serious reading.

Part of what changed is the development of effective pixel motion estimation, which, in fairness to the scientists of the 1970s, was largely not possible in real time on affordable hardware. Today, we think nothing about using the hardware codecs in cell phones to transmit news stories in 720p at effective rates below 2Mb/s, and SD content is delivered over DTV transmission at sub-1Mb/s rates. The compression ratios are mind boggling. If the entire DTV bit stream is used to deliver one 1080i29.27, the compression ratio is most descriptively given as just over 0.3 bits per pixel of the display. But audio and PSIP eat into the available bandwidth, making the number seem even more absurd.

In the more modern era — the period when cost-effective, real-time systems began wide deployment — MPEG-2 compression has clearly dominated the market. Over the last few years, H.264 (MPEG-4 Part 10, or AVC compression) has begun to replace MPEG-2 for many uses. Its more efficient algorithms allow equivalent quality at lower bit rates, or higher quality at the same economic cost in bandwidth. Though we tend to dwell on the technical aspects, it is the economic benefit that drives technological change today. Would anyone doubt that we would have no reason to deploy AVC without the cost savings in transmission bandwidth or storage cost? I suspect the answer to such a rhetorical question is completely academic, for the cost of developing new compression tools would hardly be supportable unless there is a demonstrable benefit to companies investing in new hardware.

Frankly, we are lucky that compression has become a key component of technological advances we rely on, both as consumers of content and creators of content. DTV, Internet distribution of content, video chat, 3G/4G newsgathering, digital archives, wireless home networking of content, personal music and video players, DVD and Blu-ray players, and digital still and movie cameras are but a few innovations that would not be possible without compression. A ballot for the most essential invention in the media industry in our lifetimes would have to at least include compression.

But there is no free lunch. To use compression as more than a point source solution, that is to say at two ends of a loop in a closed system, we need effective standards, which of necessity stifle innovation in the process of technology self regulation. We might have much more effective compression by now if the marketplace was able to innovate without the need to interoperate. And part of the innovation continuum seems to

be the increase in complexity that often comes along.

An example is the death of video switching. I do not mean to imply it is already dead. But I see the handwriting on the wall. There is a lot of "baseband" switching all over the fabric of our industry, but increasingly we see "switching" of compressed content streams. That process is more accurately described as a splice that joins to time-independent streams of content into one stream with perfect continuity in syntax. Baseband switching is far less complex, but as we inexorably move toward a mostly IT infrastructure carrying mostly compressed content, I see an increase in system complexity. The reasons are simple enough to understand.

To switch between two video signals, one needs to only break the electrical connection to one source and establish the connection to the second source. In an ideal world, you need to assure the signals are synchronized, though with the exception of a short glitch, cutting between to unsynchronized sources is often acceptable.

But with compressed signals, one must do much more. In any case, assuming the available bandwidth would support either source flexibly, you still need to align the syntax in the signals so that the decoder will not lose its place in the bit stream. In addition, it is critical to establish the group of pictures (GOP) cadence on both sides of the switch, better termed a splice. This is not terribly hard to do, but requires buffering to allow for matching up two inherently asynchronous signals.

Many years ago, SMPTE and others began work on standards to establish how such switching might be signaled to downstream devices, making it possible for a device listening in on the transmitted sequence to know when an appropriate splice point would be arriving. This work created a SMPTE standard, which is the basis of the SCTE splicing standards used for commercial insertion worldwide. Networks like FOX and others have adopted splicing as a critical technology for the distribution of content to affiliates, with a Technical Emmy given to FOX in 2008-2009.

A great reference for questions about splicing in considerable detail was written by Norm Hurst and Katie Cornog and can be found at *www.mpeg.org/MPEG/splicing-FAQ.html*. BE

John Luff is a broadcast technology consultant.

Send questions and comments to: john.luff@penton.com

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Continuous Innovation

Evertz — J2K

Encoder and decoder cards offer JPEG2000 SD and HD compression; use variable JPEG2000 compression rate on ASI or IP; designed to offer better quality, higher rate and lower latency than previous generations; 7880DEC-J2K-IPASI decoder supports pass through of up to two AES groups (eight channels) of audio embedded; 7880ENC-J2K-IPASI also supports pass through of up to four AES groups (16 channels) of embedded audio; these functions of the card are easily controlled through the Evertz VistaLINK interface.

www.evertz.com

SGL — FlashNet 6.4

A key new feature of the scalable content storage management system is the Amalgamation Service, a workflow enhancement tool that allows small files to be archived more efficiently while significantly increasing access time; another new feature is the ability to store index information on the Cartridge Memory Chip on LTO tape, providing significantly improved access speed; traditionally index information is written on a partition on the tape and in order to access that information, the tape has to loaded and spooled; by writing to the Cartidge Memory Chip, indexes are more quickly accessed by the drive, resulting in rapid tape positioning and data access.

www.sglbroadcast.com

LYNX Technik — CHD 1812

HDMI-to-SDI converter features two electrical SDI outputs, as well as an optional fiber-optic output; incorporates an integrated frame symchronizer with full cross lock capability to any sync reference standard, making it ideal for ingesting HDMI signals into a broadcast facility from an external asynchronous HDMI source; audio in the HDMI signal is embedded into the SDI output, and the two external analog audio inputs can be embedded into any AES channel.

www.lynx-technik.com

Snell — Morpheus ICE 2.2

Channel-in-a-box introduces additional branding tools for visually enhancing HD and/or SD channels; operators can generate vertical and horizontal crawls via automated URL or RSS feed, or from manually created source information, and multiple DVE per mixer effects allow them to squeeze different on-air content while inserting graphics and audio effects; meets any head-end requirement with its ability to set specific VANC packets (such as SCTE-104) in the outgoing video path for each on-air channel.

www.snellgroup.com

Polecam — Wide

Motorized camera head accommodates DSLR cameras or camcorders of up 200mm width, 280mm height and 3.6kg weight; fully compatible with Polecam rigs of up to 6m span; features a high-resolution pulse-width-modulated electronic drive, replacing the bipolar direct-current feed used on Polecam's previous joystick control system; optical pulse encoders fitted to the pan and tilt motors provide feedback to the motor controller, ensuring smooth and stable operation; motor braking is activated whenever the joystick is stationary; integral 12-pin connector delivers up to 12V at 1A to power a camera.

www.polecam.com

Panasonic — HDTV Producer

Main components of the video production studio include two AG-HMC80 AVCCAM HD/SD professional camcorders for video capture, an AG-HMX100 HD/SD AV mixer with MultiViewer for video and audio mixing with digital effects, an AG-HMR10 compact AVCCAM recorder for recording of up to four hours of content, a 42in TH-42LF20 LCD monitor with 1080p resolution, as well as SDHC cards and all the audio/video accessories and cabling necessary to begin producing HD content immediately; includes accessories such as a Shure SM48LC microphone and boom stand, an intercom/tally system with four headsets/belt packs, two tripod systems with dollies, and two zoom/focus rear lens control systems.

www.panasonic-broadcast.com

AJA Video — Ki Pro Mini

Compact field recorder supports all four types of Apple ProRes 422 (including HQ, LT and Proxy); designed to simplify the link between production and post by unobtrusively fitting in small spaces and acquiring on the best codec for use with Apple Final Cut Studio, from any SDI or HDMI camera, regardless of format; records edit-ready SD/HD files from any camera to Compact Flash cards; offers skip log and capture with instant mounting of native OSX media, as well as professional connectivity through SD/HD-SDI and HDMI I/O.

www.aja.com

Jampro — JAT-U

Broadband batwing IV/V 470MHz to 860MHz antenna; radome-enclosed unit can be either top- or side-mounted on a tower; minimum windloading while providing broadband response makes it ideal for applications where either one channel is defined or multiple channels are combined.

www.jampro.com

Autoscript CuePlus

Tally accessory provides both a selectable color range and multiple color states; the ability to select from a range of colors addresses the needs of talent with color vision impairments, such as color blindness; can be mounted on and powered directly from Autoscript's LED line of prompters.

www.autoscript.tv

EVS Sports360°

Sports content management system aims to help sports content owners, broadcasters and facility companies to address multiple markets; features include enhanced live production with high-end replays, on-the-fly editing, new ultra motion control capabilities, overlay graphic analysis or 3-D replay and super-motion operations, sports highlights and immediate media access and exchange with post production, logging and statistics integration, second screen applications, and sports archive management; also includes mobile, Web streaming and multichannel delivery.

www.evs.tv

Cobalt Digital 9257

Card-based MADI audio distribution amplifier system, developed for openGear, is designed to provide a quick and easy way to transport audio between vehicles without the need for fiber and without degradation; allows multiple signal copies to be reclocked, preserving signal integrity and enabling a longer cable run; up to 20 input channels of the scalable DA can be installed in one frame, making it ideal for the limited space available in trucks.

www.cobaltdigital.com

Guntermann & Drunck DVICenter

DVI matrix switch is designed to optimize studio workflow; offers a centralized configuration through a web interface or OSD; provides multiple users with access to a series of computers using different platforms simultaneously; provides a high resolution of 1920 x 1200 at 60Hz over distances of up to 280m by CAT cabling and up to 10km by fiber optics.

www.gdsys.de

Isilon Systems S200

Next-generation, ultra-high-performance 2U NAS platform built on Isilon's unified scale-out technology; accelerates business performance and time to market with ultra-fast primary storage for mission-critical, highly transactional and random access file-based applications; scales with the most demanding workflows and applications; uses enterprise SSDs to accelerate namespace-intensive metadata operations; enables placement of mission-critical, latency-sensitive data on SSDs in a SmartPools environment.

www.isilon.com

Sonnet Technologies Fusion F2-SSD

RAID storage system features two high-performance 2.5in, 256MB SSDs side-by-side in an aluminum enclosure about the size of two stacked CD cases; silent-running system is designed to offer editors uncompromising performance in the field and on location; with its two-port 6Gb/s eSATA controller card, the system delivers up to 385MB/s sustained read speeds and can be bus-powered via a FireWire power cable.

www.sonnettech.com

Thales Angenieux Optimo 45-120

PL-mount 45mm to 120mm T2.8 zoom lens has been designed for 35mm film cameras and new generations of digital cameras; available in meters or feet, its focus ring has a 320° focus rotation with more than 50 precise focus witness marks and minimal breathing; small and light enough for handheld cameras, steadicam or crane; long enough for close-ups.

www.angenieux.com

Haivision Viper MAX

Encoder/streaming device combines Haivision's H.264 encoding with an integrated Furnace operating environment; through a simple, user-friendly touch screen, operators can set up a multichannel session, initiate simultaneous streaming and recording, and automatically make content available for on-demand viewing; captures full-resolution, full-frame-rate, dual-channel content synchronously, assuring contextual review; during a session, remote viewers can watch multistream HD content live by clicking a Web link and launching Haivision's browser-independent InStream player.

www.haivision.com

FOR-A LTR-120HS

Video archiving recorder supports LTO-5 (Linear Tape Open); features 1.5TB of recording capacity and LTFS portable file system; can be used as material/program exchange media server; using high-quality AVC-Intra codec with HD-SDI input/output and MXF wrapper/un-wrapper, the MXF files on LTO-5 tape can be used easily by other NLE systems; enables "archive at ingest" systems.

www.for-a.com

Wohler AMP2-16V

Upgrades to the modular audio/video processing monitor include auto-detect for 3G/HD/SD and embedded Dolby, which enables customers to perform automatic monitoring in mixed signal format environments; additional enhancements include support for SMPTE 2020 metadata monitoring, a menu lockout function that prevents unauthorized changes to the unit's configuration, the ability to cycle through solo monitoring of defined clusters of audio channels at the press of a button, an optical TOSLINK input option for monitoring the consumer's STB experience, and improved display of metadata and stream status information.

www.wohler.com

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www.playbox.tv

Blackmagic Design — DaVinci Resolve 8

New features for the color correction tool include multilayer timeline support with editing, as well as XML import and export with Apple Final Cut Pro 7 and Adobe Premiere Pro; now includes OpenCL processing to allow use on Apple iMac and MacBook Pro computers; new advanced processing tools enable real-time noise reduction, curve grading, advanced multipoint stabilization and automatic stereoscopic 3-D image alignment.

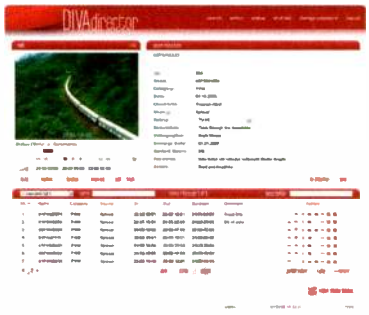
www.blackmagic-design.com

Videssence — ExceLED 225 – Nine Light

High-performance LED fixtures at low wattages; suitable for large production studios, theaters and other areas that require a long throw and high light levels; produces over 5200 lux at 9m; light has nine cubes with nine LED optical modules in each; the left and right row of cubes pivot outward to adjust or separate the beam spread; also offered in 25W, 50W and 100W versions.

www.videssence.tv

Front Porch Digital — DIVAdirector V4.2



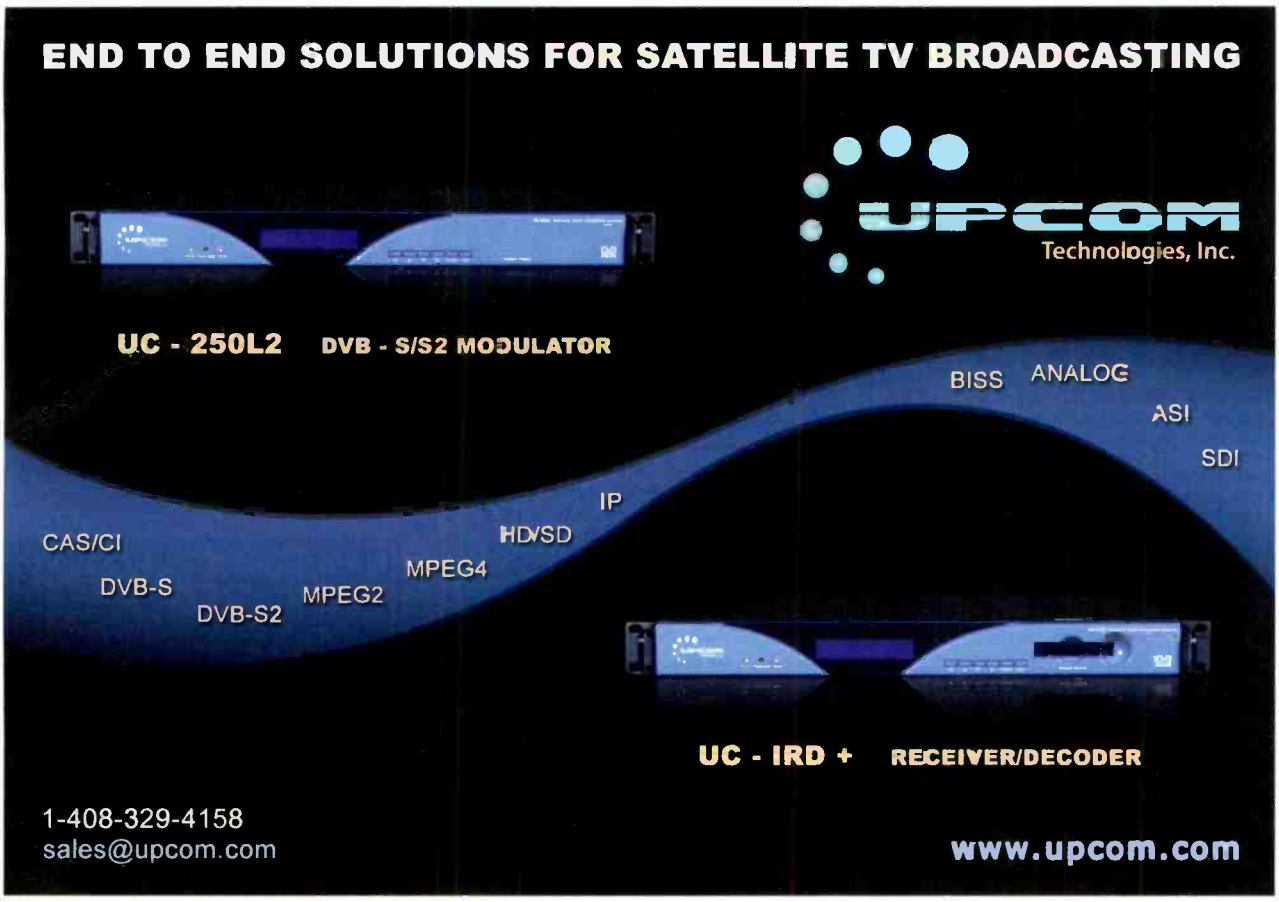
Media asset management system enables operators, using their Web browsers, to search, locate and retrieve stored media assets directly from their desktops; new version adds a revamped and simplified browser interface, support for identification and retrieval of clips with noncontiguous timecode, partial-restore format auto-detection to further simplify user interactions with the complex format/wrapper challenges handled by DIVArchive, and management of remote proxies without the need for their replication specifically for DIVAdirector; offers enhanced integration with SAMMA Solo system.

www.fpdigital.com

Telecast Fiber Systems — TR6442i (CommLink)

Fiber-optic transceiver system can carry two intercom channels over a single strand of fiber across distances of more than 40km; ideal for outside broadcasting; features autonulling hybrid technology, making it easy to interface with industry-standard party-line and matrix-style intercom systems; when in two-wire mode, CommLink will extend two channels of a Clear-Com party-line system or an RTS two-wire intercom system; when no intercom power supply is available, the transceiver will act as a power supply for up to five intercom belt packs.

www.telecast-fiber.com



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abc 24 MEMPHIS CW 30 WLMT

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The ideal candidate must have an Associates Degree in electronics, 3 years of broadcast television experience, strong troubleshooting skills with Thales Transmitters and systems, be well organized and have a successful history in broadcast news and studio maintenance computer experience is a plus.

Please send resume to:

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Virtual trade shows

Online technical conferences provide education with a convenience factor.

BY ANTHONY R. GARGANO

"An electrical problem has shut down Amtrak and closed the northeast corridor tracks into New York." Those were the words I heard one morning at 5 a.m. as I got into the shower and turned on both the hot water and my shower radio. An inveterate news junky, the shower radio is always set to the local all-news station and provides my first fix of the day. As I stepped under the hot spray, the newscaster's words elicited a "What? Oh, no!"

It was the opening day of SMPTE's 2nd Annual International Conference on Stereoscopic 3-D for Media and Entertainment, which was held at the Broadway Millenium Hotel in New York City — a convenient walk from Penn Station. Rather than fighting the morning drive traffic, my plan — a good one at the time or so I thought — was to opt for the more civilized commute of a relaxing train ride into Penn Station via the now unfortunately stilled northeast corridor rail tracks. Well, that obviously was not going to work, especially after an updated news report said that repairs would likely be completed later in the morning, but there would still be significant schedule delays throughout the day.

Time for Plan B: the unrelaxed and definitely uncivil drive into Manhattan. Better listen to the traffic report. Surprise! The rail shutdown has created significant delays at the bridges and tunnels going into Manhattan and all the arteries on the New Jersey side feeding them.

At that point, figuring the morning and possibly more was a certain loss, it was time to take a look at the agenda to assess what sessions I was going to miss. As I brought up the conference schedule on my iMac, I couldn't help but think how expedient it would have been to attend the sessions in virtual fashion from the comfort of my office chair. No train schedule hassles, no drive time frazzle, no need for anything other than jeans and sneaks.

Personally, attending a virtual trade show is an option that I really would only exercise in an emergency. The opportunity for face-to-face interaction and discussion with industry colleagues during breaks in between the technical sessions and at the organized social functions is almost as important as the sitting, listening and learning aspects of the sessions themselves. But there is an argument to be made that in the event of last-minute delays or for those with restricted travel budgets in today's tight economy, attending a virtual conference is better than no conference at all.

For those with restricted travel budgets, attending a virtual conference is better than no conference at all.

Clearly, not without complications for the organizers, providing a virtual attendance option to a live event requires discipline, particularly on the part of the presenters. Slides and presentation materials need to be submitted sufficiently in advance in order to enable day of the event availability to the online attendees. Having previously served in various roles as a session organizer, panel moderator and a presenter guilty of turning in late slides (mea culpa), I know how daunting of a task this can be.

Also, let's not overlook the practical considerations. A technical conference is designed not only to impart information to the attendees, but also it serves as a revenue generator for the conference hosting organization. And, that revenue is most important in that it allows the host to organize future sessions for attendee education and to provide forums for technology developers and venues for presenters. Thus, a reasonable stipend for online session attendance is something to be expected and accepted. Who knows? Paid online attendance might even offer an exciting new revenue opportunity for conference organizers who could then invest in even better conference events.

But back to the SMPTE 3-D conference. SMPTE recently announced its YouTube channel (nice to see our fundamental standards body actually using the media whose technology it oversees!), and you can find an excerpt or two from the conference there. It's a far cry from an online attendance option but perhaps a great first step. Opting to get there at all costs, I set out driving only to encounter a huge construction delay followed by a bumper-to-bumper crawl due to a traffic accident. Finally, concluding it was just not meant to be, I disappointedly turned back toward my home office with visions, unfortunately not to be realized, of sitting there comfortably in those jeans and sneaks attending the conference. My long-term colleague and dear friend SMPTE president Pete Ludé, are you listening? BE

Anthony R. Gargano is a consultant and former industry executive.

? Send questions and comments to: anthony.gargano@penton.com

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