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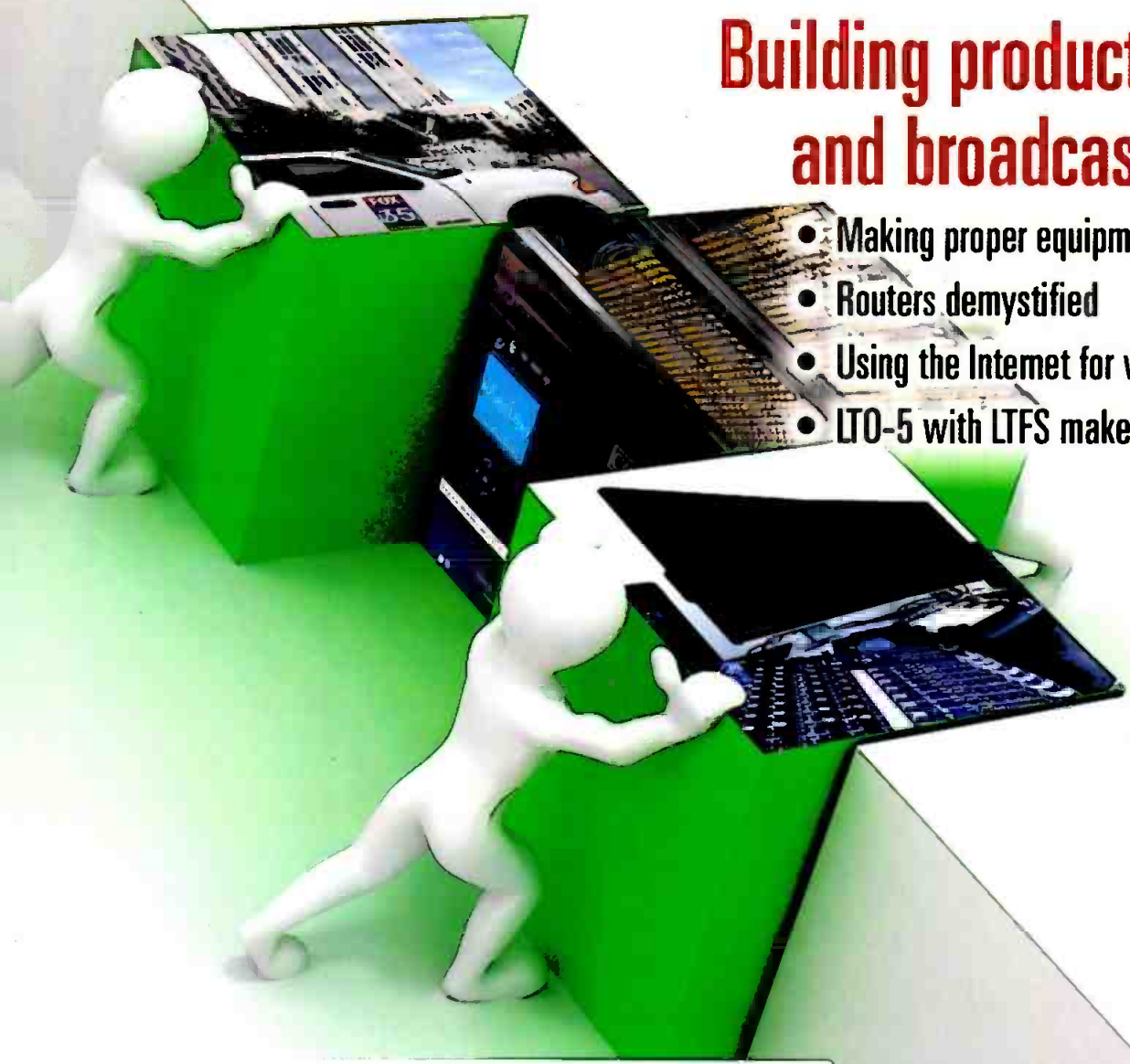

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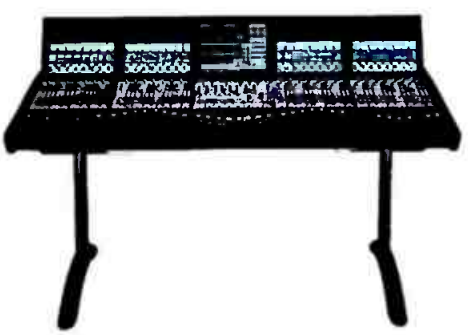

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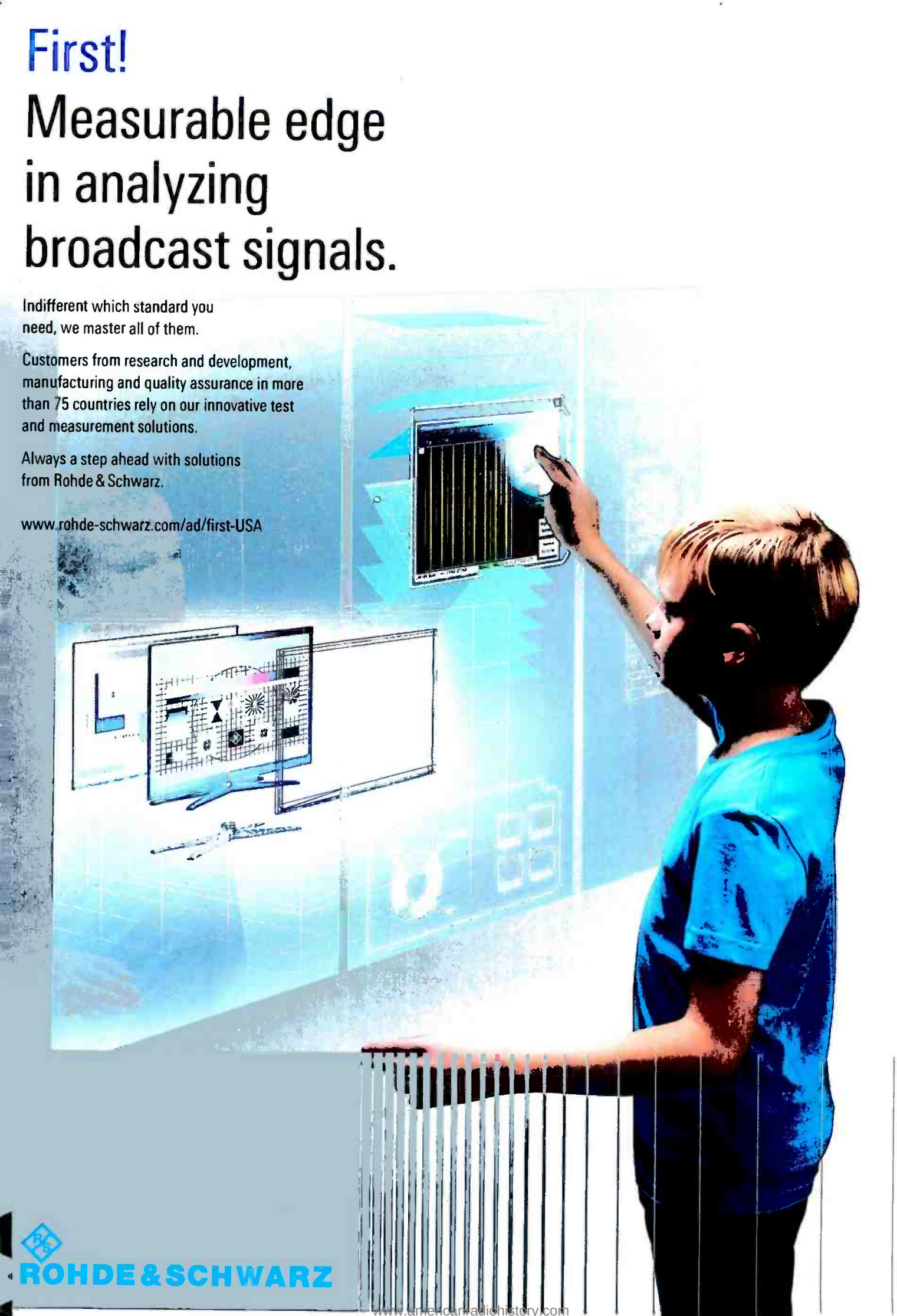

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Broadcast Engineering®

ON THE COVER:

This special report provides an in-depth tutorial on new solutions to building the latest production, post and broadcast studios.

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BEYOND THE HEADLINES

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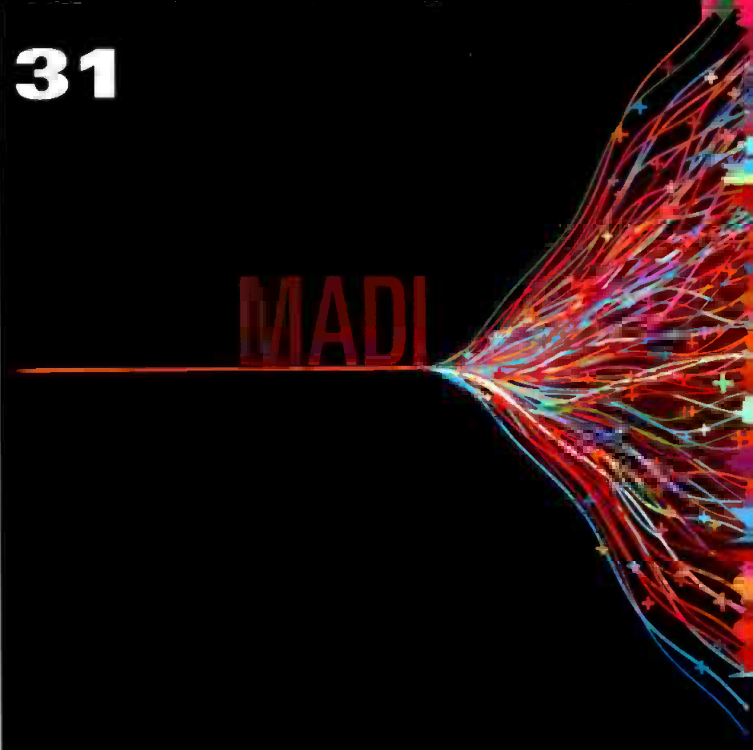

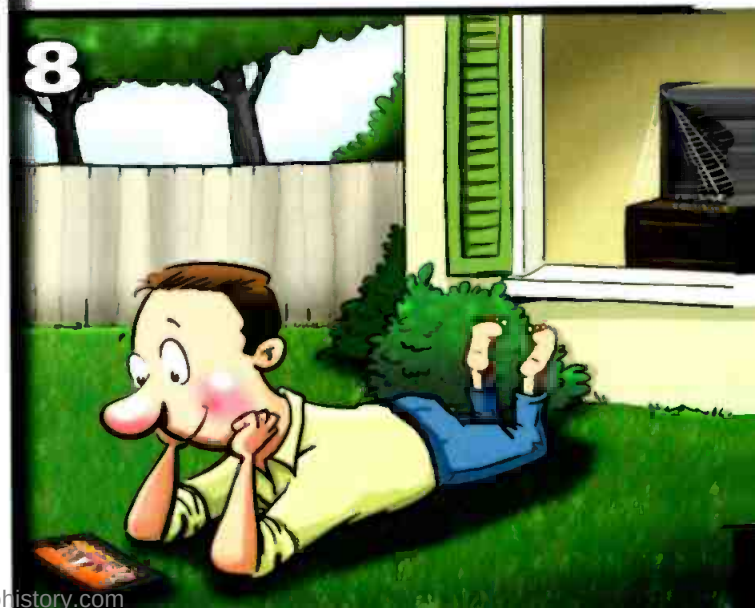

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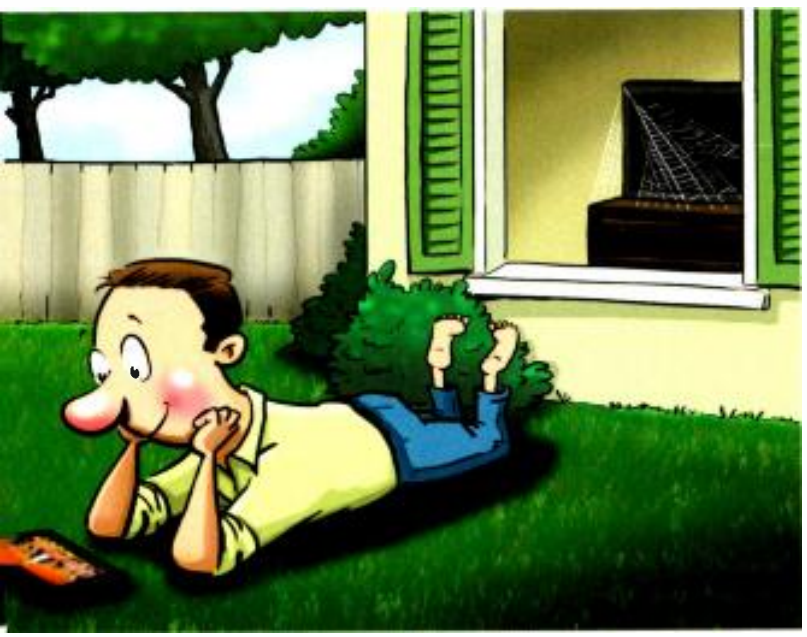
Are Americans quitting TV?

If Americans stopped watching television, we'd all be in a heap of trouble. So, when I spy a headline predicting a video apocalypse, I follow up and dig deeper to see how confused the story writer might be. That is how my investigation into the real facts behind the above headline began. The press release in question was based on a new Accenture report titled, "Always on, always connected." The story sounded ominous.

"Consumers intend to buy fewer televisions as they migrate to other consumer electronics devices," it said.



That is not particularly surprising or even news. And, given that the survey was released on the eve of the Consumer Electronics Show (CES), it made sense. Combine that thought with two particularly hot technologies (tablets and smartphones), and it should surprise no *Broadcast Engineering* reader that viewers want portable viewing solutions. People are looking for more ways to capture and watch television, stored video and other entertainment. Where is the buzz? Behind the headlines, the details emerge.

The Accenture survey claimed the percentage of consumers watching broadcast or cable TV in a typical week on *televisions* [emphasis added] fell from 71 percent in 2009 to 48 percent in 2011. And now (this is where the CES link exists), consistent with this drop in viewership was a smaller percentage of consumers who intended to buy new TV sets over the next year. Planned purchases declined from 35 percent in 2010 to 32 percent in 2011.

"Craving an always-on, always-connected lifestyle, consumers increasingly are using other consumer electronics devices in their daily lives to access the entertainment that only TV once provided," said Mitch Cline, global managing director of Accenture's Electronics & High-Tech group. "While consumers will no doubt continue to buy TVs, consumers' preferences are shifting. They are rapidly substituting other screens, such as laptops, desktops, tablets and smartphones, to view media content."

Here is an example of these changes. Although tablets are still in their infancy, ownership of these devices grew by 50 percent last year. Fully 12 percent of survey respondents said they already own tablets.

Further confirmation of viewers' desire for portability is that twice as many respondents said they had plans to buy tablets this year, as did last year, making planned tablet purchases, in terms of percentage, the highest among the 19 technologies Accenture surveyed. Calling tablets a hot commodity may be an understatement.

Further, buried halfway through the survey results, was another noteworthy tidbit.

"Consumers are using multiple devices for entertainment, including to watch shows and videos," the report said. "In a typical week, 33 percent of consumers now watch shows, movies or videos on their PCs, and 10 percent are watching such programs on their smartphones."

What the survey confirmed, and those of us in this industry already know, is that viewers expect to be able to access their entertainment both in and out of the home. They want portability. And, in spite of the misleading headlines predicting the end of the TV world, viewers may not be watching any less television. They are just watching it on more devices.

Would your station's management panic if the audience dropped 23 points in only two years? Darn right it would panic. Unfortunately, so, too, could Madison Avenue if surveys like this one are not read carefully.

Viewers are not quitting television. They just want to access content on their terms. **BE**

Brad Dick

EDITORIAL DIRECTOR

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Tomaz Lovsin,
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Cellular bonding

This technology can make live video uplinks more affordable and less cumbersome.

BY DR. RONY OHAYON AND BARUCH ALTMAN

Covering live news events via traditional SNG technologies has been an expensive and logistically difficult business. However, with the advent of cellular bonding technology, broadcasters and online video professionals can easily and cost-effectively report live from any location using a field-proven method.

Bonding combines multiple cellular and wireless networks — such as 2.5G, 3G, 4G LTE, Wi-Fi and WiMAX — to obtain a reliable, robust video uplink capable of transmitting HD video.

The bonding challenge

A high-quality video experience relies on smooth and uninterrupted video delivery, but cellular links are inherently unstable and fluctuate continuously. Transmitting video over such a link may result in black screens, video breaks, pixelization, jitters, audio problems, lost lip syncs etc., even from a stationary location over 4G. Parameters that affect the experience, such as bandwidth availability, latency, loss rate or all of them together, can change in a millisecond.

Therefore, there's an inherent gap between the desired experience of high-quality video and cellular technology. Cellular bonding has proven to bridge this gap.

Bonding architecture

Cellular bonding takes compressed video (H.264) and transmits some of the packets over each of the multiple cellular modems. Instead of relying on a single unreliable link with a single point of failure, bonding several cellular links together minimizes the inherent risks while achieving the desired or greater performance.

Bonding systems differ according to how low they can reduce the risks and to what degree they can increase the performance. To achieve this, the system has to continuously, and in real time, monitor all available links and understand how best it can use each of them — currently and in the immediate future. It also has to dynamically adapt the video encoder according to the momentary total available

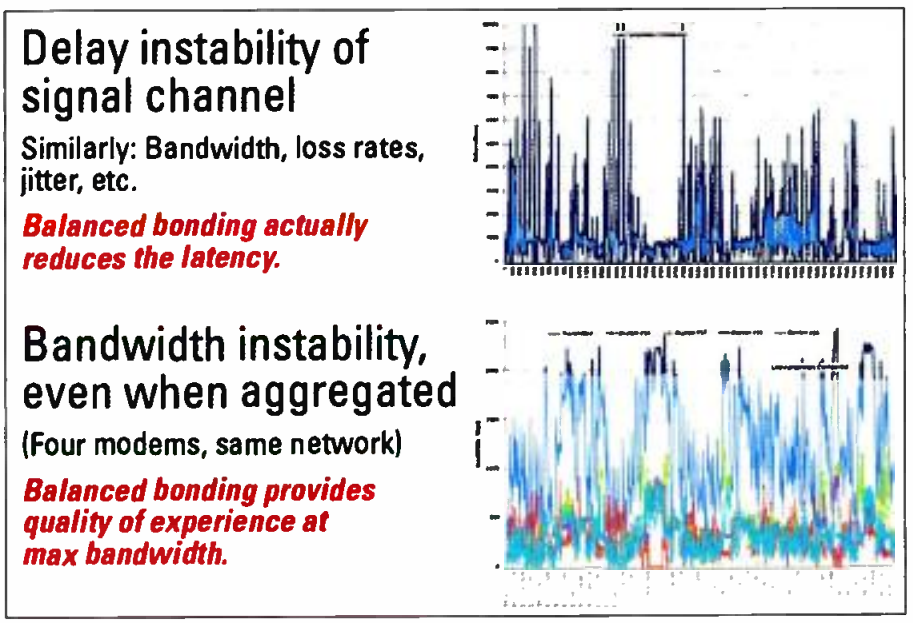
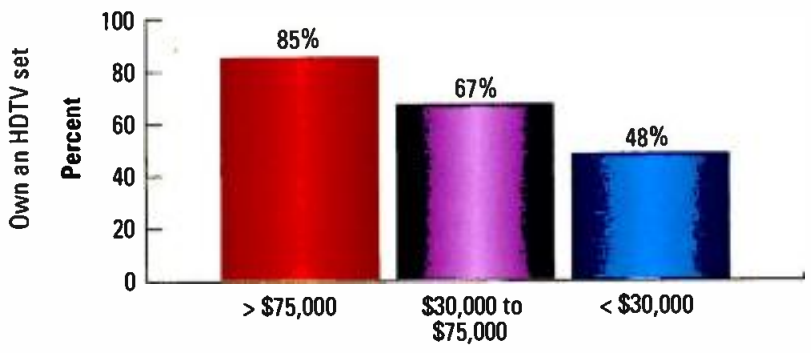


Figure 1. Examples of single 3G modem delay fluctuation and multimodem bandwidth instability

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

HDTV ownership by household income

Overall HDTV ownership is up, and 69 percent of U.S. households have at least one HDTV set, up from 17 percent in 2006.



Source: "HDTV and 3D TV 2011"

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bandwidth in all the links; compensate for, and recover from, any losses; and interact smartly with the operator to best manage its needs. On the receive side, which can be anywhere in the world, software installed on any Internet-connected PC receives those multiple packet streams and reconstructs the video.

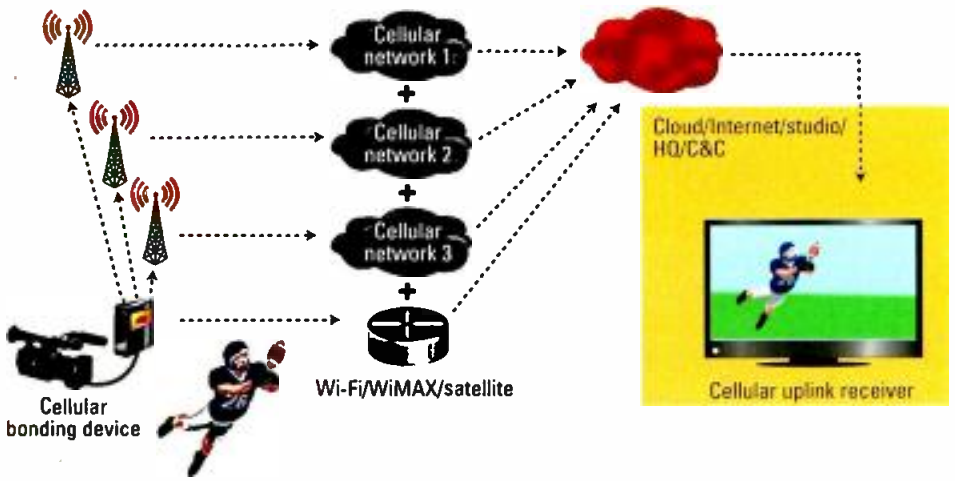

Figure 2. An example of bonding and transmission over multiple networks

Building blocks

- *The monitoring of all links in millisecond resolution (traffic analyzer):* Parameters per channel include: current bandwidth, latency, loss and jittery behavior. Monitoring is best done transparently without using nonpayload packets.
- *Modems/links usage:* Selection at any moment of which modems to use, at what loading and what type of packets to send on each modem.
- *Priority scheduling for optimal bandwidth use:* Assessing which information has higher momentary priority so it can be transmitted first or on better-suited modems. Prioritized packet types may include: I-Frame, P/B frames, audio frames, FEC packets or management packets.
- *Modem prediction:* The ability to anticipate the modems' behavior and proactively change transmission parameters so as to minimize fluctuations and potential link failures.
- *Multiple modems at any one time:* Keeping as many modems in operation as possible, so that if a problem arises with a few modems, it can be mitigated by using the others.
- *R (reliable) UDP or at least UDP-based transport:* As cellular networks may be too slow, or drop to being too slow for TCP traffic, effective bonding systems use (proprietary) RUDP. This ensures that the packets arrive while avoiding TCP mechanisms that are not built for cellular networks.
- *Buffers:* Buffers are used to reorder packets with different latencies, enable packets traveling on longer delayed links to be used and provide some time margins for sudden link fluctuations. The user can usually decide whether to aim for interview mode or best quality mode. Some systems achieve satellite-like subsecond latency with bonding, using several lowest-delay modems rather than a single low-delay modem, which might experience a sudden increase in latency.
- *Error/loss handling mechanisms:* Since cellular networks have mechanisms to "fix" erroneous bytes, it's more accurate to refer to "loss" rather than "error" packets. Continuous loss rates range from 2 percent to 40 percent. Application-level mechanisms are required to compensate for such losses, e.g. "retry" for resending packets, dynamic FEC for sending extra packets allowing the receiver or video decoder "error concealment" functionality.

To optimize network use, the software should automatically apply the best mechanism with the right parameters under dynamically changing link conditions, such as adapting the FEC payload/extra packet ratio, retry timing, etc.

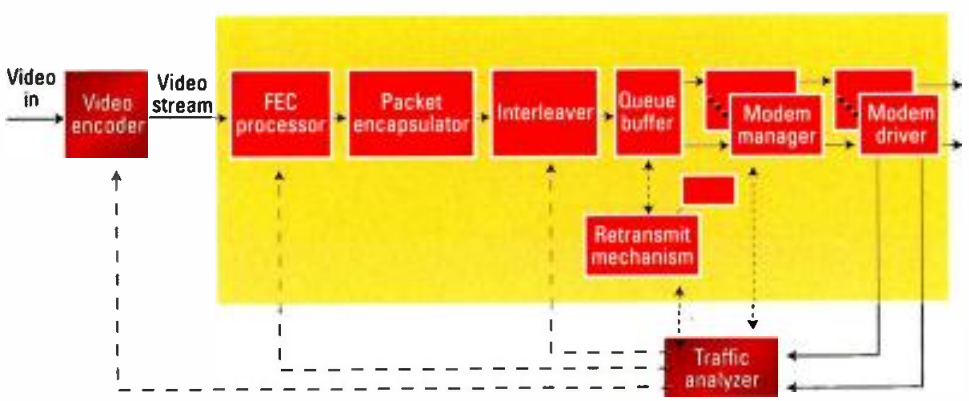

Figure 3. A functional block diagram of a typical cellular bonding transmitter

H.264 video encoder

Another building block is the H.264 encoder, which may or may not be integrated and coupled with the bonding application. There are clear advantages when the encoder is coupled with the application: The software has full control over the encoder, enabling an immediate response. For example, the encoder will respond in real time to quick and slow changes of the overall bandwidth.

More advanced encoders support H.264 High Profile. Although scalable video codec (SVC) has made its debut, it's still in its initial stages, and its maturity level is a concern. Furthermore, a bandwidth overhead is introduced.

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Continuous Innovation

There are two types of encoders: VBR and CBR. VBR encoders are intended to self-detect and react to the changes in total bandwidth. However, detection time and reaction time may be too long, resulting in lower than optimal performance (e.g. black screens, pixelization etc.). In addition, the software, which manages the transmission, can only react to the unforeseen encoder bandwidth changes and therefore cannot correlate optimization of other parameters such as scheduling or FEC.

CBR encoders should output a target bandwidth. This allows the software to control both the precise bandwidth and the other transmission parameters. In real time, CBR encoders can proactively be set to lower than the currently measured bandwidth to be prepared for any anticipated bandwidth drops. However, some CBR encoders are either too slow to react and/or not very accurate or consistent with their output bandwidth, usually outputting more than configured, and should therefore be checked.

Single-modem video delivery devices are still inherently unstable and may well experience performance fluctuations.

Encoder configuration changes should have a minimal response time (milliseconds) and shouldn't require an encoder reset, enabling the software to respond in real time to dynamic fluctuations. This also involves the right GOP configuration considering other implications.

Other considerations

• *Compliance with radiation standards:* A safe design and relevant standard certifications ensure that a system easily meets the U.S. and EU cellular health-related standards (i.e. SAR - Specific Absorption Rate).

• *Antennas:* Antennas must be designed to improve performance and reduce radiation, rather than merely serving a decorative purpose. Otherwise, each RF splitter/combiner, connector and cable can actually decrease performance.

Impact of 4G LTE networks

Although 4G LTE brings the promise of higher peak bandwidth and shorter delays to bonded cellular video transmission, single-modem video delivery devices are still inherently unstable and may well experience performance fluctuations, loss of transmission and the inability to go live. This is usually due to network overload, as operators start to promote networks more intensely, advertised vs. actual performance and slower 4G roll-out outside city centers.

Summary

The goal of cellular bonding is to find an optimal temporary equilibrium point over multiple channels, changing from one point to another as smoothly as possible, to deliver sustained high-quality video performance over inherently unstable heterogeneous links.

It's always prudent to test the system in live situations to check if it meets current and future needs — for example, underground (basements/ parking lots), on the move (walking in the city, in moving vehicles, through tunnels), in the air (helicopters, planes) or on special location (crowded stadiums or courthouses).

Cellular bonding changes the landscape of the broadcast contribution market. By having such a crosslayer technology from the physical layer up to the application layer, it is now possible to transmit full HD video with a very low delay, even while on the move. BE

Dr. Rony Ohayon is CTO of LiveU, and Baruch Altman is a director of LiveU.

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New spectrum use approved

The FCC authorizes the first "white-space" devices.

BY HARRY C. MARTIN

The FCC has approved the first "white space" database and the first user devices. Such devices were to begin operation on Jan. 26, 2012, in the Wilmington, NC, area.

White-space devices are supposed to provide Wi-Fi-like services, only better, using locally vacant television channels. Successful operation will depend on complex databases to help each device identify channels on which it can operate safely, without causing interference to television stations, radio astronomy, wireless microphones and several other services entitled to protection.

The FCC's action was in response to filings by Spectrum Bridge, which posted the results of a 45-day test of its system. In response to those tests, the FCC announced its acceptance of Spectrum Bridge's system and, simultaneously, its approval of a white-space device for Wilmington users that operates in conjunction with the company's database. Operators of the various services protected against the devices should make sure their facilities are properly listed in the database.

Dateline

- On or before April 1, 2012, noncommercial TV and Class A stations in Texas must file their biennial ownership reports.
- On April 1, 2012, television stations in Maryland; Virginia; Washington, D.C.; and West Virginia must begin their renewal pre-filing announcements. Renewal applications for stations in these states are due June 1, 2012.
- By April 1, 2012, TV and Class A TV stations in the following states must place their 2012 EEO reports in their public files and post them on their websites: Delaware, Indiana, Kentucky, Pennsylvania, Tennessee and Texas.

FCC proposes limited television ownership deregulation

• *Radio and television.* In its Quadrennial Regulatory Review proceeding, the FCC is proposing to eliminate current rules that prohibit cross ownership of commercial television and radio stations in the same markets. The restriction on such common ownership was first imposed in 1970 but was relaxed in 1999 to allow radio/television combinations in markets where a minimum number of independent "voices" would remain. However, the 1999 rules effectively precluded combinations of radio and television stations in smaller markets.

White-space devices are supposed to provide Wi-Fi-like services, only better.

The commission has tentatively concluded that in today's media marketplace, consumers do not consider radio and television stations as substitutes for one another. The agency also believes that elimination of the rule will not contribute to further consolidation of the media. Citing its own sponsored studies, the commission said it does not believe the proposed relaxation will decrease viewpoint diversity. Moreover, the FCC agrees with broadcasters that lifting radio/television cross-ownership restrictions will allow broadcasters to better compete in an increasingly Internet-dominated marketplace.

• *Newspaper and television.* The commission also is proposing to relax its television station/daily newspaper cross-ownership restrictions in the top-20 Nielsen DMAs. These restrictions were imposed in 1975 to preserve viewpoint diversity in local markets. In 2006, however, the FCC began considering waiver requests seeking newspaper/television combinations in the top-20 markets. However, the Court of Appeals for the D.C. Circuit rejected this relaxation on procedural grounds, causing the absolute ban on newspaper/television cross-ownership to go back into effect.

The new initiative tracks the 2006 relaxation in the top-20 markets, with a presumption that a waiver of the cross-ownership restriction is in the public interest if a daily newspaper sought to combine with commercial television station in the same top-20 DMA, and (1) the television station is not ranked among the top four in the market, and (2) at least eight independent "major media voices" (other television stations or daily newspapers) would remain in the market after the combination.

Comments on these proposed rule changes, and others included in the FCC's rule-making notice, will be due in March. BE

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

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Broadcast in transition

The industry is transforming on multiple fronts.

BY ALDO CUGNINI

Broadcasting is in a transition that goes beyond the mere conversion of analog systems to digital platforms. Various initiatives are leading the way to new methods for content delivery, with emerging solutions for both broadcast and content production. This and future columns will look at the expected changes in the ecosystem for content development and delivery.

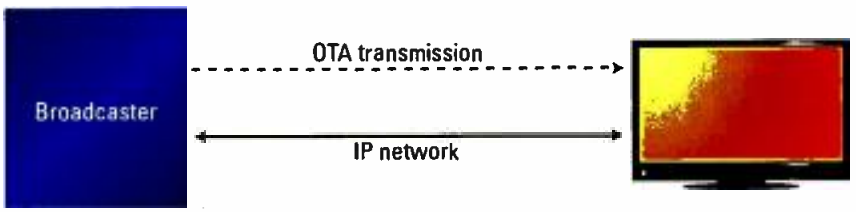

Figure 1. One of the new options in the works in this time of transition, hybrid broadcasting would tightly integrate content transmitted over the air with content delivered out-of-band, e.g., via the Internet.

The next-generation of broadcast

Last fall, the ATSC published its "Final Report on ATSC 3.0 Next Generation Broadcast Television," describing likely methods of enhancing broadcast TV with next-generation video compression, transmission and IP technologies. The report presents a comprehensive view of new elements that likely will constitute tomorrow's broadcast systems, including compression, modulation, transmission and hybrid architectures.

The latest MPEG compression, High Efficiency Video Coding (HEVC), shows performance that is substantially better than H.264/MPEG-4 AVC coding, with an efficiency that would allow more content bandwidth, i.e., higher throughput or higher video resolution. Studies suggest that HEVC could offer at least a 4X improvement in efficiency over that of MPEG-2. Higher resolutions receiving serious consideration include 8K (7680 x 4320) and 4K systems (3840 x 2160).

The ATSC report received little input on essence-related metadata, which suggests the topic is not high on the list of developers' priorities. The workflow and carriage considerations of metadata should not be trivialized, as more interactivity is being demanded by content consumers, and that requires an efficient infrastructure for developing and handling this component.

At the physical layer, modulation schemes that offer higher efficiencies (and/or performance) than existing technologies are being considered, including new error-correction coding, which could lead to a new, non-backward-compatible transmission system. New ideas also include adaptive transmission technologies, in which transmission characteristics and the network topology can be changed depending on receiver usage, but these have not progressed past the concept stage.

New content delivery options

Hybrid broadcast is a concept that allows a more-connected television service, including hybrid on-air/online content delivery, user interactivity, adaptive configuration and other enhancements. Such a system, offering an integrated, networked environment, has been tried in parts of the world, and likely will become a key part of broadcasting. Going beyond the current elements of Internet TV, hybrid broadcasting would enable

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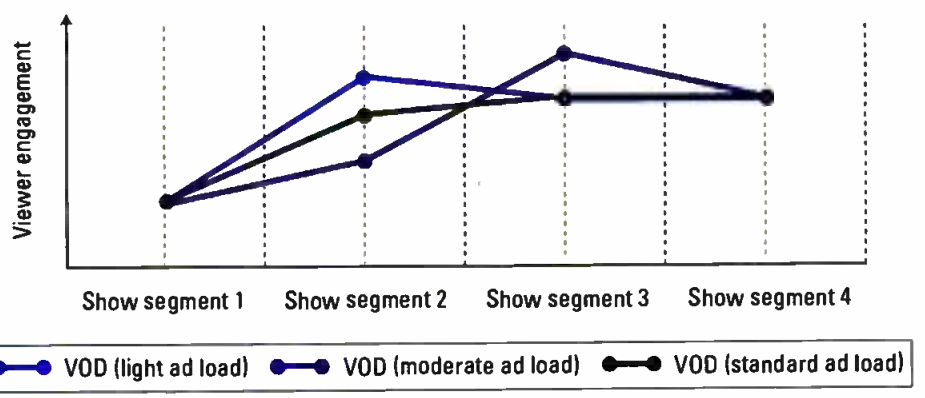

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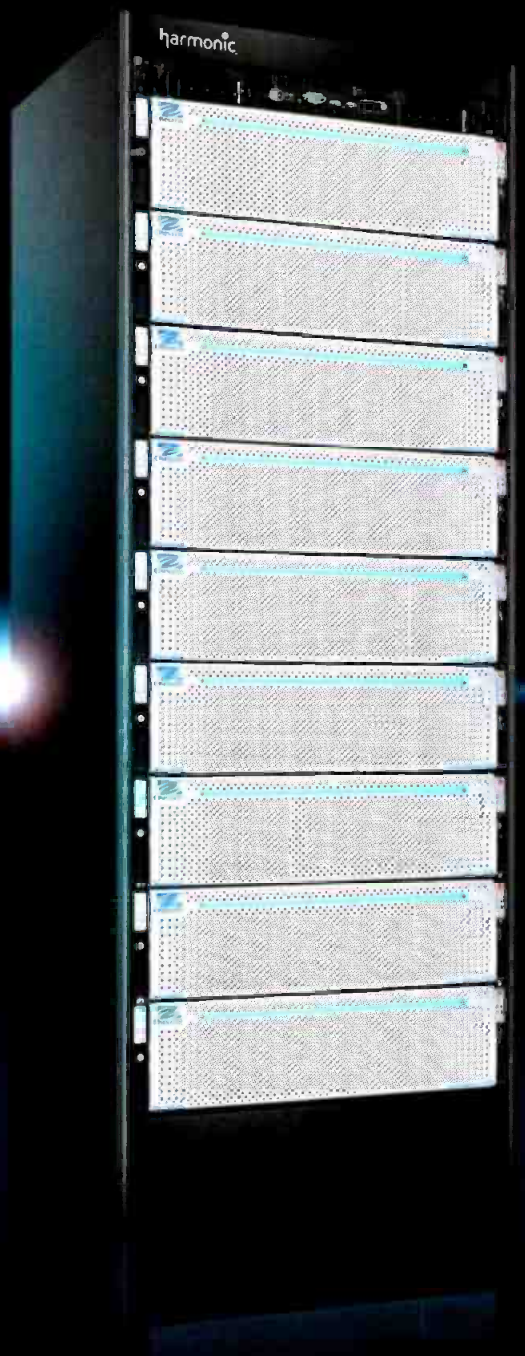

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a more efficient use of both wireless and wired communications channels for delivering content. Hybrid broadcasting would integrate OTA content with content delivered out-of-band, e.g., by Internet. (See Figure 1 on page 20.)

One version of hybrid broadcasting being discussed by some broadcasters is a hybrid heterogeneous network, in which digital television broadcasting is overlaid onto the wireless telephony infrastructure. Such a system would integrate the one-to-many broadcast transmission of video with the many-to-many connectivity of wireless Internet and cellular networks.

On the Internet side, many players currently are trying out new methods for distributing and receiving content, and lessons learned there will help define efficient hybrid networks.

Apple is thought to be planning an integrated television set to replace its current AppleTV set-top box, possibly equipped with the digital assistant that runs on the newest iPhone. Likewise, Sony is believed to be building a content distribution network. Google is redefining its GoogleTV offering, and many new televisions already have access to content from providers Netflix and Amazon; TiVo has similar built-in connectivity to Hulu, Amazon and Netflix. Microsoft has teamed up with Comcast and Verizon FiOS, as well as a variety of content providers, allowing subscribers to watch live TV and on-demand video via the Xbox 360.

The common element in all of these developments is that content increasingly will become available from a multitude of sources, and broadcasters need to move quickly to offer a compelling alternative.

Repurposing of captions

Providing captions is another area that is affecting content distributions. The Twenty-First Century Communications and Video Accessibility Act of 2010 (CVAA), signed into law by President Obama, requires the FCC to extend the Television Decoder Circuitry Act of 1990 (closed caption law), and its updates, to require the provision of closed captioning on video programming delivered using IP that was published or exhibited on television with captions. The proposed rules also require video programming owners to send required caption files for IP-delivered video programming to video programming providers and distributors along with program files. Furthermore, the proposed rules require the appropriate parties to reliably encode, transport, receive and render closed captions of video programming delivered using Internet protocol. The CVAA requirements thus mean that content developers and distributors must now build into their workflow methods that ensure that captions will be properly delivered and available to other content presenters.

Content will become available from a multitude of sources, and broadcasters need to move quickly to offer a compelling alternative.

A new global transmission system

It may be closer than some once thought. Late in November, the House Energy and Commerce Subcommittee on Communications and Technology approved the Jumpstarting Opportunity with Broadband Spectrum (JOBS) Act of 2011. The legislation is the culmination of hearings and bipartisan negotiations to use voluntary incentive auctions to make more efficient and effective use of the public's airwaves, and support the establishment of a nationwide, interoperable, broadband public safety network. One component of the bill proposes "a waiver of the broadcast service rules of the FCC to permit the licensee, subject to interference protections, to make flexible use of the spectrum assigned to the licensee to provide services other than broadcast television services."

The waiver provision appears to allow broadcasters the option of transmitting non-backward-compatible signals without a need to service existing DTV viewers, as long as at least one program is sent for free. This element could pave the way for alternate television transmission systems to be rolled out quickly. At press time, the House bill had been bundled with provisions for middle-class tax relief, and the new bill passed the House 234-193. Although it may not survive a presidential veto, there could be sufficient "line item" support for the service-rules waiver to re-emerge in other legislation.

Change is happening at the international level as well. Television broadcasting executives gathering in China last November agreed that a global approach to the future of terrestrial television broadcasting is the "ideal method to avoid competing standards, overlap and inefficient deployment of new services."

Delegates to the Future of Broadcast Television Summit held in Shanghai officially expressed unified support for a joint declaration calling for global cooperation to define new requirements, unify various standards, and promote sharing of technologies to benefit developed and under-developed countries.

Supporters of the declaration agreed to three major initiatives: defining the requirements of future terrestrial broadcast systems, exploring unified terrestrial broadcast standards and promoting global technology sharing. BE

Aldo Cugnini is a consultant in the digital television industry.

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Video over Ethernet

User requirements are vital to coming standards.

BY BRAD GILMER

Last month, we explored the merging of IP with SDI. This month, we will continue to explore this topic by looking at recent work on video over Ethernet.

This column has dealt extensively with the transport of real-time A/V over long-haul IP networks. By now, the SMPTE ST 2022 family of standards has been deployed in tens of thousands of units throughout the world. This family of standards works by encapsulating MPEG-2 streams in RTP and User Datagram Protocol (UDP) packets. The UDP is then inserted into IP packets and Ethernet frames. From there, carriers typically map the Ethernet onto long-haul SONET. Users can employ an optional FEC mechanism to correct errors introduced during transport.

Comfort level

This protocol stack offers a number of advantages in long-haul transport. The first is that all of the protocols are well-known and understood. RTP provides the required level of synchronization, UDP allows for efficient transport of large blocks of data, and both IP and Ethernet are ubiquitous. SONET provides ultra-reliable transport and precise timing over long distances. The optional FEC mechanism provides an interoperable, standardized solution for the sorts of errors frequently encountered when sending video over carrier networks. For all their strengths, however, these standards may not be appropriate for all A/V transport scenarios.

Recently, I attended a SMPTE users group meeting. A number of people spoke about the standards they would like to see developed over the next three to five years. It was interesting that almost every speaker mentioned video over IP or video over Ethernet. They may have been speaking about live, long-haul streaming of A/V over IP networks, but they were also definitely talking about A/V transport *within* their facilities. Frankly, the ST 2022 standards were not intended for this application. There are several reasons why 2022 is not ideal for local transport of v/a content.

When talking about moving video (and audio) inside a facility, there are several critical user requirements:

- Delay must be minimal.
- Delay must be deterministic.
- Synchronization must be maintained between different streams.
- Performance *must* be predictable.

Unfortunately, some of the underlying technology used in ST 2022 makes it difficult to meet these requirements, particularly in the area of delay. The inclusion of the optional XOR FEC mechanism in ST 2022 means, inherently, these systems will have delay on the order of several hundred milliseconds. The exact delay depends upon the video format and a number of configuration choices made by the manufacturer. Also, ST 2022 does nothing to ensure synchronization or network performance. The standard relies on mechanisms in MPEG-2 for synchronization of audio and video streams, and it allows the implementer to employ a number of available QoS schemes to lock down network performance. It is fine to require MPEG-2 and QoS infrastructures in a long-haul environment. But, is it really practical to employ this inside a facility with hundreds if not thousands of devices? Definitely not. Besides, even if using MPEG-2 did resolve the synchronization and QoS issues, the delay still must be dealt with. Clearly, the user requirements dictate a different solution.

As the professional media industry looks for a solution for deploying video over IP inside our facilities, it makes sense to see what other industries are

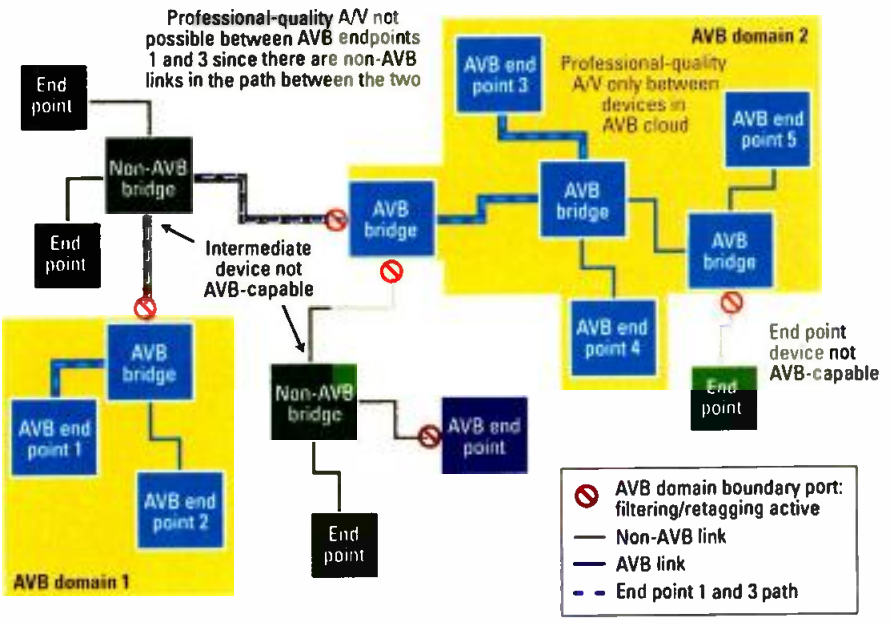

Figure 1. AVB will require AVB-aware bridges and end points in order to operate correctly. This means that if you want to use it, you will need to carefully qualify devices on your network to ensure they meet AVB standards.

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doing. The Institute of Electronic and Electrical Engineers (IEEE) has an effort called Audio Video Bridging (AVB). IEEE is working to provide A/V transport over local networks with low latency, accurate synchronization of streams and guaranteed performance. While it remains to be seen if this effort will meet user requirements, it is a substantial body of work being done by the people who invented Ethernet. Therefore, it would behoove us to pay attention .

The other side

There are a few key things to be aware of regarding AVB. It is trying to solve a specific problem — the provision of hundreds of time-synchronized video and audio streams across a LAN at latencies below 2ms. Designers want to be able to reserve bandwidth to ensure that once a stream is started, it does not fail even as other devices come online. Also, they want to be able to support a large number of independent clocks on the network and allow a wide variety of simultaneously-used sync sources. To that end, AVB specifications allow hundreds of audio channels to be delivered with a latency below 2ms over seven hops on a 100MB/s Ethernet network, all synchronized within nanoseconds. This is an impressive design, and all indications are it will be achieved.

Something else to consider regarding AVB is the effort involves video over *Ethernet*, not over *IP*. Specifically, this is about AVB on IEEE 802.3 unshielded twisted pair networks. (Although, support for IEEE 802.11 wireless networks are anticipated in the future.) AVB concentrates on providing high-performance transport at Layer 2, *not* Layer 3. If you're a little unsure what this means, remember that AVB provides video over Ethernet. Ethernet uses MAC addresses and is limited to a LAN. To access the Internet, or to operate across a large-campus environment, Layer 3 is needed so IP addresses will allow for creating separate networks. While it is true that Ethernet bridges allow you to direct packets across separate physical wiring groups, AVB, in current form, will not traverse Layer 3 network switches.

Given that AVB provides guaranteed high performance, the fact that it works at Layer 2 isn't surprising. Parameters like jitter and wander can be controlled more tightly there. Also, it's difficult to ensure the performance specified by AVB across physical distances usually covered by a WAN.

AVB will require AVB-aware devices — bridges and end points — in order to operate correctly. This means that if you want to use AVB, you will need to carefully qualify devices on your network to ensure they meet AVB standards. The introduction of a non-AVB bridge or a non-AVB end point to an AVB-compliant cloud means that AVB performance cannot be guaranteed. (See Figure 1.) However, Figure 1 shows that professional-quality performance is possible within an AVB cloud as part of a larger LAN, which raises interesting possibilities. Is it possible to create various AVB islands, for example, within a facility's audio production area? Is it possible to establish a guaranteed AVB path between sports production and audio? It appears so.

There is no question that crossbar routers, SDI and coax will be in media facilities for a long time to come. But, there is also no question that companies will add Ethernet and IP infrastructures that coexist with conventional video over coax. In fact, every facility already has both infrastructures in place. The question is whether AVB provides a pathway for migration of some A/V applications to the Ethernet domain. Given that one driver behind AVB is enhancing A/V capabilities of consumer home networks, if AVB takes off, costs for core networking components are bound to drop, providing an interesting new technology to media facility designers. BE

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

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AVB standards

The following is a list of standards developed by the IEEE for Audio Video Bridging:

- **IEEE 802.1AS — *Timing and Synchronization:*** This standard specifies the protocol and procedures used to ensure that synchronization requirements are met for time- sensitive applications, such as audio and video, across Bridged and Virtual Bridged LANs.

- **IEEE 802.1Qav — *Forwarding and Queuing Enhancements for Time-Sensitive Streams:*** This standard allows bridges to provide guarantees for time-sensitive, loss-sensitive, real-time, audio/video data transmission.

- **IEEE 802.1Qat — *Stream Reservation Protocol:*** This standard specifies protocols, procedures and managed objects, usable by existing, higher-layer mechanisms, that allow network resources to be reserved for specific traffic streams traversing a bridged LAN.

- **IEEE 802.1BA — *Audio Video Bridging (AVB) Systems:*** This standard defines profiles that select features, options, configurations, defaults, protocols and procedures of bridges, stations and LANs that are necessary to build networks that are capable of transporting time-sensitive audio and/or video data streams.

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Editing systems

Each NLE excels in some form, so match a system's strengths with your content.

BY CHRISTOPHER WALKER

As a broadcast consultant and college media instructor, I'm often asked about NLEs. Probably no other product technology has had such a huge effect on the amount and type of video content that's available. Being able to easily assemble video segments to form longer-form content is key to today's vast array of programs.

There are basically three types of professional editing systems. The simplest is a newsroom editing system. These systems allow journalists to complete simple pieces or rough cut their items and send the script, cut list and notes to a craft editor for final conforming. They typically require minimal computer resources, allowing them to be easily deployed at journalists' desktops. In many cases, they are tightly coupled with a particular manufacturer's storage system and have direct interfaces to the other newsroom components.

At the other end of the editing spectrum is the finishing system. Finishing systems are used in high-end post for such tasks as color correction, motion graphics and compositing. These systems can be expensive, but they provide all the bells and whistles needed to create cinema-quality programming.

In between these two extremes is what's called a craft editing system. This is what most people think of as NLEs.

The craft editor

Let's first examine the task of craft editing. In my classes, I tell students that it takes talent to get the audience to buy into the story you are telling. Give the same project with the same footage, script, etc., to 10 different editors, and each of the resulting videos will have a different feel. Craft editing systems are designed to allow the editor to tell the story the way he or she "feels" it. So, craft editing goes beyond simple cuts, fades, titling and even some effects. It requires skill to merge video, audio and effects to creatively tell a story.

Most craft editors rely on one of two operator interfaces: a timeline or a storyboard. While other systems have come and gone, these two remain the most common. And, although some manufacturers may claim to do both, you will usually find that they excel at one or the other.

The storyboard interface displays the first frame of each available clip, sometimes called picons, in a storyboard format. (See Figure 1.)

Figure 1. The storyboard interface displays the first frame of each clip.

Figure 2. The timeline interface ties clips to a visual time reference.

A timeline NLE interface focuses more on tying clips to a visual time reference. (See Figure 2.) Clips are placed (drag and drop) onto the timeline. The NLE connects the clips into a sequence, and the timeline automatically adjusts.

The above is a simple description of the two major interfaces. I'll make no attempt to venture into each system's benefits or drawbacks. Such discussion is best left to those whose jobs are dependent upon them.

What the buyer needs to understand here is that storyboard or timeline interfaces have strengths and weaknesses. One may be a preferable interface for the type of material you are producing. Ask your editors what type of interface they prefer and why. However, know that human editors are as passionate about their particular choice as PC

and Mac users about their computer religions. You will need to filter out opinion from fact.

Features

With hundreds of NLE features and options, comparing each across multiple vendors is impractical. Start by narrowing the list of desired features to something manageable. Here are important aspects to consider.

GUI, ease of use

An NLE's GUI provides the interface to all the sophisticated processing that is going on in the background. How responsive the GUI is given certain tasks, i.e. trim to fit, link/unlink sync, multicamera cutting, change fade duration, type and timing, etc., is not only dependent upon the hardware, but also on the system's design. That is one reason NLE prices range from hundreds to tens of thousands of dollars. Like other technologies, you often get what you pay for.

Sequencing forms the basis of all storytelling. A storyteller needs the ability to quickly and easily move clips around, and trim the start and end points to create the tension and release required to hold viewers' attention. The ability to arrange clips to control time, not in the technical sense of time remapping, but rather to move back and forth in time and stretch or shrink time by using the arrangement and length of the available video material is at the heart of editing. Such basic tasks should be easily learned and quickly executed by the NLE.

In today's connected production environment, the handling of metadata is often the key to improving performance.

Both the speed of the underlying hardware and the interface design affect the overall responsiveness of the system. If the cutter cannot respond to the requests of the director and achieve the required results without delay, then he or she is lacking in skill, or the system is not up to the assigned task.

Metadata is king

In today's connected production environment, the handling of metadata is often the key to improving performance. Whether the metadata is in XML or EDL, MXF or AAF

format, the way the system handles the data in the containers' headers can be critical to a smooth workflow.

This means that NLE performance is highly dependent on accurate and inclusive metadata. Comprehensive content metadata may not be required for every craft editing task, as the shots have already been selected and may already be sequenced. But for long-form content, having good metadata hooks can mean the difference between a stressful and stress-free operator environment.

The first place to look at how an NLE handles metadata is within the bins. What data fields can be selected for display? Is it possible to automatically fill the bins (or storyboard) with data from the asset management system?

Is versioning information stored in the resulting file? In other words, can we come back later and easily change logos, voice-overs and subtitles?

Consider audio

Close your eyes and watch television. Now open your eyes, but plug your ears. In which case was it easier to follow the plot? I've asked nearly all of my media production students to perform this simple test to help them understand the importance of audio.

Be sure you understand how the NLE handles panning, multichannel sound, EQ and various bit rates. Does it have the ability to record voice-over? Can it cut on the beat? Will video-centric editors be able to easily handle similar audio tasks?

When a fade to black is made, the outpoint audio should be adjustable without having to unsync the sources. Resampling should automatically happen in the background as required. When a clip is stretched or shrunk slightly, the system should know if repitching the audio will suffice. Is it easy to add a live voice-over into the timeline?

While there are high-end editors that focus on audio sweetening, the required audio toolset for craft editing need not be as comprehensive, but it does need to be a lot easier to use.

Mixed timeline

Being able to implement a mixed timeline is the ability to drag and drop a file, regardless of source, into the timeline and simply edit. Editors should not need an engineering degree to edit together divergent video formats.

Examine how long it has taken the manufacturer historically to implement new formats. How flexible is the frame server running in the background? Obviously there are certain minimum performance requirements for each format such as EX, D10, ProRes, AVC Intra, DNxHD, etc. The question is: How are these implemented? Is there a plug-in to run or a delay while some conversion takes place, or is it transparent, with no operator intervention?

Determining TCO for an editing system is difficult because they are configured and supported differently.

Look at how the system handles various wrappers such as MXF, QuickTime, AVI, etc. Can the NLE still use the essence even if the wrapper is not 100 percent conformed? Ask about any intermediate codec used when rendering effects. Does the use of mixed codecs increase render time? How good is the frame rate conversion and scaling?

Effects

Probably the most used effect is the crossfade. But how is a crossfade inserted into the edit? Can the editor specify a group of cuts and apply crossfades to all of them at once with or without a black or white frame?

No editing system can compete with the variety of effects available through plug-ins. If effects are an important element in your production, consider how many third-party suppliers are out there creating products for the system being considered.

Calculate TCO

Over the past 20 years, engineers have had to add an increasing number of business skills to their technical toolboxes. In addition to price, CFOs and GMs are asking about total cost of ownership (TCO) and return on investment (ROI).

Determining TCO for editing systems is difficult because they are configured and supported differently. In addition, performance (throughput) is highly operator dependent.

Some vendors offer support contracts, which may include software upgrades and loaner hardware. Determine exactly what you are paying for with each supplier.

In some cases, the NLE software package is a download, and support comes through user groups. In a top-market TV station, this option may not be viable. In other situations, this approach may provide the high-quality video you desire at the rock-bottom price you can afford.

Warning: Be careful about relying exclusively on your own in-house engineering resources for installation and maintenance. While this may allow you to reduce the initial investment, the TCO will probably be the same.

Involve the users

Finally, involve your editors in the investigation and decision process. You must have their early buy-in to ensure long-term success. Be certain that your decision is firmly based upon the organizational goals and needs, not just price. Initial cost is but one factor in these highly operator-intensive systems.

Start with a prioritized list of features and performance. Add to that your own operators' input. Follow up by talking with both vendors and their customers. There is no one best editing system and plenty of good products from which to choose. BE

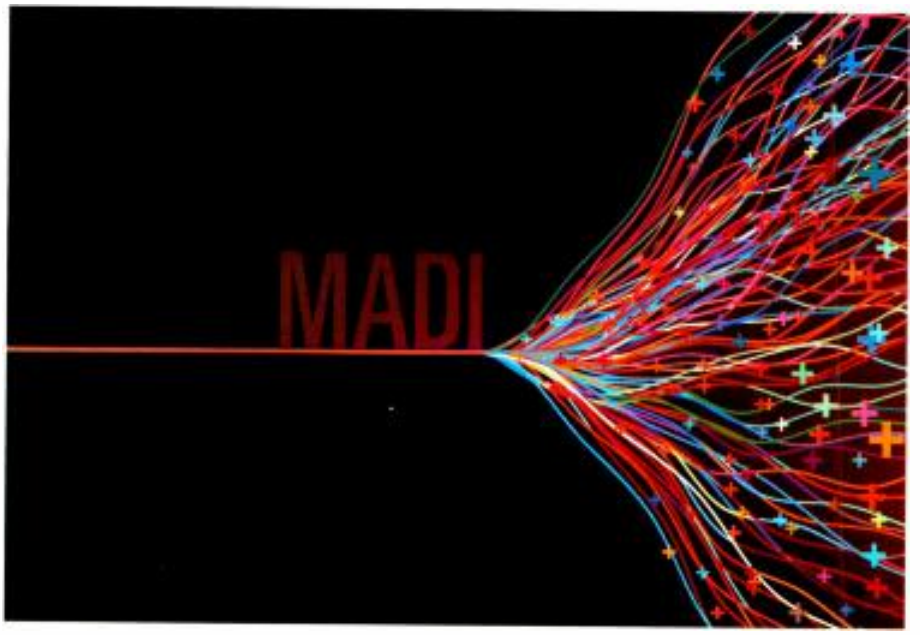
Christopher Walker is a broadcast consultant and college media instructor.

MADI

Learn how to use MADI to route and manage multiple audio signals to and from consoles.

BY RYAN SALAZAR

When the acronym MADI (Multichannel Audio Digital Interface) appears, it may invoke thoughts of the 1980's MIDI (Musical Instrument Digital Interface). The two, however, are unrelated. The MIDI standard, as everyone knows, allows two devices (a trigger device and a sound source) to both communicate and understand each other in the realm of music, with MIDI technology standardized and maintained by the MIDI Manufacturers Association (MMA). MADI technology, however, was developed shortly thereafter, in 1991 (revised in 1993), and initiated by four professional audio equipment manufacturers: Solid State Logic (SSL), AMS-Neve, Sony and Mitsubishi. The MADI standard was finalized as AES10 and is controlled by the AES. MADI is a digital audio routing technology that sends literally dozens of audio feeds through one cable.



MADI technology allows the transmission of 56 or 64 channels of digital audio data at up to 48kHz, or 28 to 32 channels of digital audio data at up to 96kHz.

Used by professionals in the studio industry, MADI technology allows the transmission of 56 or 64 channels of digital audio data at up to 48kHz, or 28 to 32 channels of digital audio data at up to 96kHz. The 24-bit maximum resolution makes the MADI standard ideal for work with a large number of audio channels, such as when a digital audio workstation is used with a large format mixing console. There is so much practicality for MADI technology because you can send audio through literally hundreds of feet of cable and it is lossless.

Although optical connections are one method of sending a signal, the preference of many, including myself, is doing so via coaxial cable. A single, 75Ω coaxial cable or optical cable is sufficient to handle 64 channels, which can dramatically reduce the amount of cabling necessary in any studio. BNC connectors are used for the MADI coaxial format, for runs of 30ft to 50ft or so, while SC-type fiber optic connectors are used for the MADI optical format. These allow runs up to 2000ft, give or take. As with any cabling, the quality and strength of the signal is reliant on the quality and manufacture of the cable or wire, with higher-grade preferred because it provides the best transmission.

MADI was finalized as AES10 and is controlled by the AES. It sends literally dozens of audio feeds through one cable.

For some time, audio was routed in facilities via analog patch bays. Setup was laborious with soldering and labels before, eventually, "crunchy" audio resulted when patch channels went bad. MADI eliminated the need for short runs with multitudes of connections and junctions. The MADI interface was conceived for serial transfer of digital multichannel audio in recording and broadcast studio applications, specifically to allow the simplification of multichannel digital audio equipment interconnection. So, how does it MADI do it? The secret is, of course, the encoding.

MADI's secret

MADI encodes and transmits multichannel audio in a clever way. It starts with Linear Pulse Code Modulated Audio (LPCM), a subtype of

Pulse Code Modulated Audio (PCM). PCM is a digital representation of an analog signal where the magnitude of the signal is sampled regularly at uniform intervals and then quantized to a series of symbols in a digital (usually binary) code. Sending a simple, two-channel stereo signal is described in AES3, the main thrust of which concerns cabling and the physical interface between devices. Essentially, for a left and right stereo signal, data is sent in audio blocks, each of which is made up of 192 frames numbered 0 to 191. Each frame is divided into two sub-frames (or channels): A (left) and B (right). Each subframe contains the information for a single sample of the PCM audio. This is the AES interface format for serial digital transmission of stereo or two-channel LPCM sound. MADI adds an entirely new dimension.

The AES specification outlines transmission of 56, mono, 24-bit resolution channels of audio data with a common sampling frequency in the range of 32kHz to 48kHz. In layman's terms, 28 stereo "AES" audio channels (AES3-1985 data, to be precise) stream on a common bearer, but are not "networked" per se; in other words, MADI is only a point-to-point interconnection.

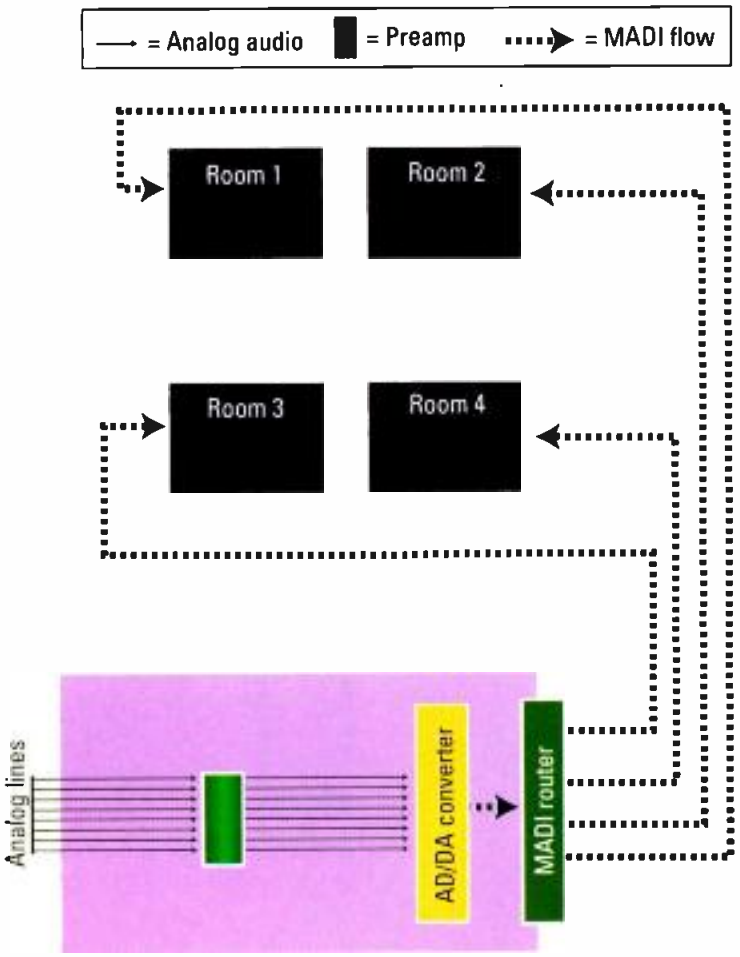


Figure 1. In some settings, a DAW is connected with MADI to an ISDN. Because MADI accepts analog signals, it can route duties like talkback to assigned channels.

As outlined in the AES10 Standard, a signal from a studio component device is sent into the MADI encoder (which contains a clock generator). Then, it is converted it into 4B/5B code (or a 4-bit value sent as a 5-bit codeword — the extra bit for synchronization). Next, it is transmitted via non-return-to-zero-inverted (NRZI) stream to the MADI decoder (containing clock synchronization and a clock regenerator tied back to the transmitter). The decoder intercepts the 4B/5B code and converts it back into a recognizable data signal. Then, the signal is transmitted to a studio component device. You may have noticed the clock provision; this is because MADI is asynchronous, meaning that the data is transmitted at its own rate, without regard to the sampling rate. (A common synchronization source linking all devices is a good idea in order to prevent errors in data recovery, as an example. It is a good idea, regardless.)

A common synchronization source linking all devices is a good idea in order to prevent errors in data recovery, as an example.

As mentioned earlier in this article, the MADI serial data stream is organized into frames. Each comprises 56 channels (numbered 0-55). These channels are consecutive within the frame, with audio data remaining in linearly coded, 2's-complement form. This means data remains just as it is within the original digital audio interface. Each channel consists of 32 bits (called a "packet"), with 24 assigned as audio data (or non-audio data if the non-valid flag is invoked). Additonally, four bits are assigned for the validity (V), user (U), channel status (C) and parity (P) bits as they are used in the AES3-1985 standard audio interface. Thus, structure and data within contributing

dual-channel AES bit streams can be preserved intact when traveling in the MADI multichannel bit stream. The other four bits per channel (referred to as "mode bits") are used for frame synchronization on the MADI interface, for preserving information concerning A/B preambles and for start of channel-status block within each of the contributing audio channels. MADI's transmission rate is fixed at 125Mb/s without regard to the sampling rate or number of channels, with the actual data transfer rate being 100Mb/s because of the 4B/5B-bit encoding scheme.

For post-production applications, the MADI interface is miraculous. Despite manufacturers creating proprietary interfaces (which are mostly based on the AES standards anyway), MADI remains a tried-and-true communication method. Even a CD player can be inserted into the line. For example, in the engineer's room, there is typically a DAW connected with MADI to an ISDN box. The great thing is that MADI accepts an analog signal, so you can create a MADI network and assign different channels for different things, like talkback. If your voice talent is in Mexico, you can route through MADI (via ISDN on one of the channels) his or her part in the production with two-way communication. Of course, this is more of a long-distance application, whereas I'm concentrating on local coaxial connections. But, the point is to show the ability exists. Despite having more channels available on fiber, I prefer HD-SDI coax, which can be expensive.

MADI's transmission rate is fixed at 125Mb/s, with the actual transfer rate being 100Mb/s because of the 4B/5B-bit encoding scheme.

Here's one last thing: I mentioned clocks. A separate or external clock is usually what is called for in larger systems. Some devices feature their own digitally-controlled clocks, allowing for operation without an additional word or AES clock line. That said, clocks are another discussion in themselves, for another time. BE

Ryan Salazar is director of engineering and post production technology for StudioZ Productions.

Special

From Broadcast Engineering

BUILDING PRODUCTION, POST AND BROADCAST FACILITIES

Report

Building a post-production facility

BY RYAN SALAZAR

Audio suites should include broadcast-quality reference monitors, and every suite should have the exact same equipment.

So, you're going to build a post-production studio from scratch. I've done that, and I hope to impart some of the wisdom I've gained from the experience. One important key is this idea: When building audio and video suites for a post-production facility, consistency is king. Audio and video suites should have the exact same hardware, software, plug-ins, etc. This allows for transparency across any suite of that type within your facility. It also prevents workflow bottlenecks in the event of needing to alter a job but having to perform the work on a particular machine because it has a unique plug-in not installed elsewhere. There are also a myriad of other important things to consider when building.

First off, use broadcast-quality reference video monitors instead of consumer-grade displays. While it's great to save money, your reputation is only as good as your last job. In other words, look at what you're doing.

Audio suites

Audio mixing requires quiet suites, and all of them should be configured the same way — size, shape, everything. An identical room configuration for audio production is important for job revisions because different-sized rooms will produce different-sounding mixes.

There are two ways to build voice-over booths: affordably and expensively. I have had the pleasure of doing both. Naturally, an audio room needs microphones. Every engineer will have his or her favorite. Without too much trouble, you can find the best-of-the-best of them on the Internet quite easily. Invariably, one manufacturer in voice-over recording microphones (for literally decades in the motion picture and commercial production industries) will pop up.

Breakout boxes are obviously required for integration between equipment like audio I/O (e.g., connecting audio reference monitors, etc.) and digital routing. No external audio gear other than your breakout boxes, talkback and monitoring devices should be used. This is to ensure that produced jobs are using digital processing as opposed to something processed externally. External processing is asking for trouble, especially for future revisions and matching.

Video suites

First off, use broadcast-quality reference video monitors instead of consumer-grade displays. While it's great to save money, your reputation is only as good as your last job. In other words, look at what you're doing. Any other type of monitor (i.e. consumer television, computer screen, etc.) will not give you a true black register, which is necessary in the trade. Resist the temptation for quick, easy and cheap. Video reference monitors will be needed in both audio and video suites for total transparency, and video breakout boxes will be needed for video I/O (e.g., connecting reference monitors, etc.).

Cables, cabling

You're going to need a lot of cable. Coax is the way to go for long runs using MADI technology, with high-quality insulated/shielded

wire for the rest. (See the "MADI" article beginning on page 31)

Color correction suite

Many facilities have color correction suites, and other houses farm the work out. If you plan on color grading in-house, it can generate significant income for your organization. Keep in mind that having a talented colorist is important, and they don't come cheap. Post houses usually hire a permanent in-house colorist due to the demand for real talent.

Each color suite should have the same broadcast reference display for consistency after the job moves to full-on production. Actual hardware will vary, based on preference.

Motion graphics suite(s)

No proper facility can be without motion graphics/visual effects suites. No matter how many you have, I highly recommend that your motion graphics suites also have the same broadcast reference displays as every other system in your facility. This only makes sense. These systems should also have identical hardware, software and plug-ins. Again, actual hardware will vary, based on preference.

3D animation capabilities

As the post industry evolves (and it's happening so quickly), many studios are competing with others via high-end CG work. These systems should be powerful and have high-end graphics cards, a lot of RAM and fast storage.

No matter how many you have, I highly recommend that your motion graphics suites also have the same broadcast reference displays as every other system in your facility. This only makes sense.

Render farms

There comes a time in many post facilities where jobs — specifically animated projects — become almost impossible to render. These projects can be large and require a

massive amount of computing power. There is an art to having the right combination of equipment to form a render farm and many things to consider, such as a high-speed separate network just for your render farm, the fact that render farms can draw unimaginable loads of power, and space. Many facilities pool desktop-sized machines together and fill an entire room. However, in many cases, they consume double or even triple the electricity that an actual render node should. Find render nodes that are small, compact, packed with processors and, of course, have plenty of RAM.

Yes, asset management can be expensive, but it's necessary, and it will make your life easier. Consider a system that will allow you to continue growing, while keeping older media online — for years if needed.

Multimedia/new media suite

I like to call our Multimedia department a New Media department because we are constantly providing newer forms of media to clients and distributors. Depending on the volume of work going through your New Media department, this suite should have at least one full-on edit suite capable of producing work and pulling the same jobs that were produced in video and motion graphics suites. CD/DVD/Blu-ray labeling is important for client presentations as well as mass duplication when needed.

Video machine room

Many facilities have gone tapeless, while others truly need tape-based media. Consider how media will arrive at your facility and how it is to be ingested into your system. Also consider the fact that storing everything on hard drives and expensive storage systems may be more expensive than just building a machine room.

If you build a machine room, here are items that need to be considered for your facility as a whole and the room itself: Tri-level sync (a video signal generator device used to create multiple types of sync signals), broadcast reference monitors (in your machine room, to see what you're doing), HD-SDI video routing system (to route/port signals to various devices), video decks (to record what you're doing) and at least one editing station within the machine room to have the same functions as your New Media department.

Asset management

This is one of the most neglected things in the post industry. Yes, asset management can be expensive, but it's necessary, and it will make your life easier. Consider a system that will allow you to continue growing, while keeping older media online — for years if needed. Also, think about a system that has auto-archive features and offloads projects from your expensive shared storage to near-line disk-based storage or tape-based systems.

Shared storage

When creating a post facility, shared storage is extremely important. Working from external volumes is not only dangerous and reckless, but those drives can't handle really large jobs. Imagine working on a 4K job from a single external drive; you are likely to have performance issues. Shared storage will open a new world to your facility. I recommend Fibre Channel over other technologies such as iSCSI. Ethernet can get scary, so I wouldn't even try that route. It isn't worth the risk, and I have spoken to many companies that claim to provide a superior product over GigE. No way.

In regards to any software licensing that you purchase, try to obtain floating licenses. 3D animation software and many visual effects plug-ins are quite expensive. Floating licenses will give you flexibility at a better overall price point.

These are simply the basics for what you would need to construct a post-production studio. Specifics, of course, would include a budget listing equipment and software by name, with incidental and ancillary costs included. Physically, this is essentially the bare minimum of what you should be thinking about if you're planning to build your own post-production studio.

Ryan Salazar is director of engineering and post-production technology for StudioZ Productions.

Routing demystified

BY RENAUD LAVOIE

Routers have been present in the broadcast industry for a long time; I was in school when the first redundant router was introduced. The reason for redundancy is quite simple: Viewers do not like to see messages like "Coming soon" or "Technical difficulties, please wait." Imagine the stress in the studio to resolve these issues. These days, critical equipment on the live path has built-in redundancy, or at least an automatic changeover (ACO) implemented to make sure that viewers do not see the screen in Figure 1 too often.

There are two main categories of routers: video and audio. Nowadays, these two types can be combined to form one signal router inside the studio. Another major trend is the IP router and agnostic (universal) router, thanks to SFPs and emSFPs, capable of transporting any type of signals over any media (coaxial, fiber, Ethernet, etc.).

The behavior of the traditional broadcast router is simple. It takes numerous inputs and reroutes, or connects, these inputs to numerous output ports. This is the basic function of the video and audio router. The second important task of the router is to correctly switch the output source (i.e., output 1 equals input 1 and will be changed for input 2) at the correct time and even perform glitch-free switching (i.e., no error in the data or no visual effect, no audio glitches, no metadata disturbances).

What does this mean? In a modern system, a variety of signals are present in the studio, including SD, HD and 3G at refresh rates of 50Hz, 60Hz and 59.94Hz, depending on the destination. The router has to switch the signal correctly to one of the switch lines (RP168), depending on the new input to be sent out. Naturally, if the router changes from an SD signal to an HD signal, this change will affect visual effects.

Figure 2 shows an example of switching between two asynchronous HD signals. There are two types of input routers: synchronous and asynchronous. In synchronous routers, all the inputs should be synchronized to allow a clean switch, or at least a change between signals on the switch line. In asynchronous routers, the router has the ability to "frame synchronize" the asynchronous inputs on the input cards of the router. This means that all the SDI signals sent to the crosspoint switches become synced with the studio reference — i.e., the pixels of every video of the same format (SD, HD and 3G) are at the same frame rate at the same time. (See Figure 2.) Modern systems also can include advanced functions: audio embedding/de-embedding, up/down/cross-converters, composite video blanking and sync (CVBS) conversion, and advanced diagnostics at the input and output.

The case in Figure 2 is a simple one that

Shown here are input and output cards using SFPs and emSFPs that enable the routers to handle formats such as HDMI, NTSC/PAL, SDI and 3G-SDI.

Figure 1. Technical difficulty color bar

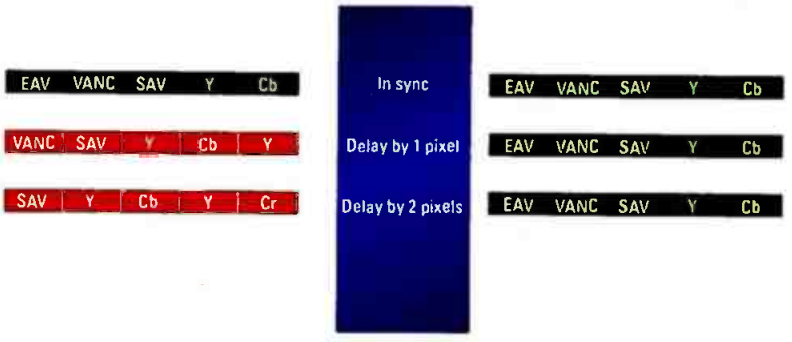


Figure 2. Simple frame synchronizer

Format	Typical switch line
SD (525)	10/273
SD (625)	6/319
HD (1080i/720p)	7/569
3G (1080p)	7

Table 1. Switch lines typically used for the various standards

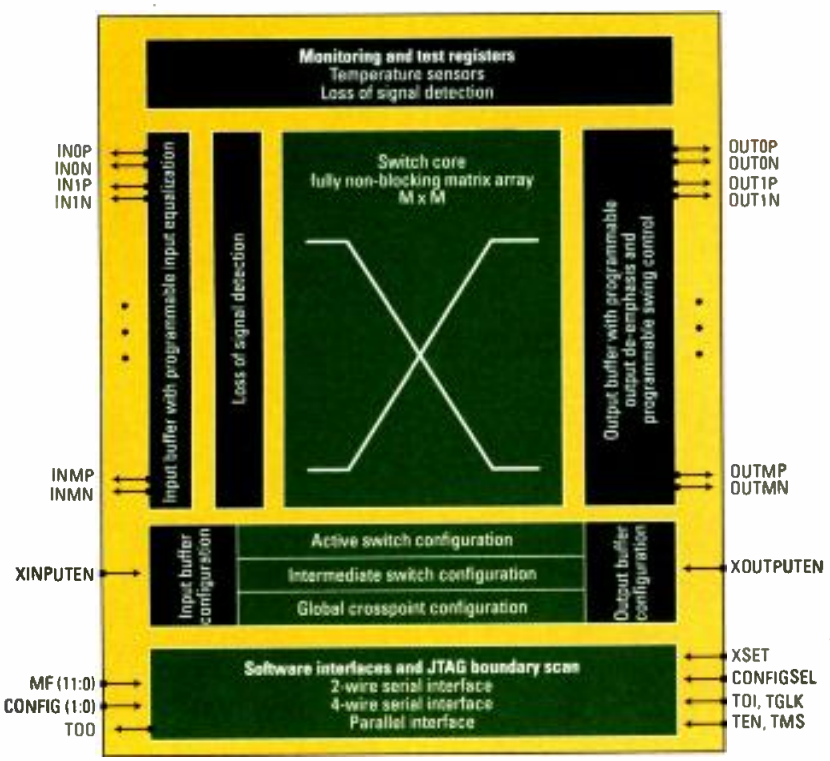


Figure 3. Block diagram of a crosspoint switch. Image courtesy of Mindspeed

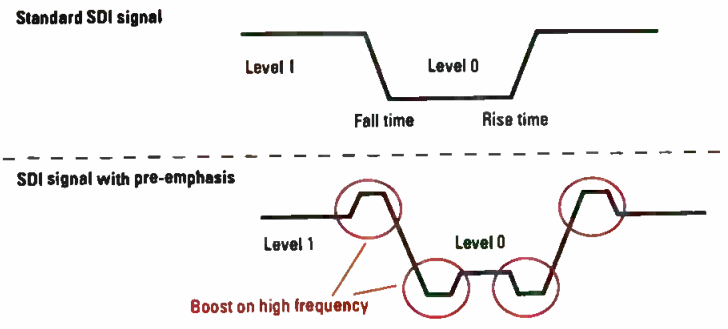


Figure 4. Digital signals without pre-emphasis (top) and with pre-emphasis (bottom)

the frame synchronizer should deal with — same vertical refresh rate, same format, line aligned (e.g. HD-SDI). In fact, a simple line buffer can be used, but the reality is much more complex.

Next up is the line switch. Table 1 shows the switching (or change) line number in the video frame of switch lines typically allowed for by the various standards. Nowadays, routers allow the user to delay or change these lines to make the router even more flexible. The switch lines are in the vertical blanking, and sometimes ancillary data could be in conflict with the switch lines. The new routers bring flexibility that could correct this potential problem.

As a reference, the SMPTE RP168 gives a recommended switch-point location.

The central piece of a video and audio router is called the crosspoint switch card. The major difference between the telecommunication\data communication router and the video router is the fact that the video router does not interact with the content inside the stream.

These days, the router may interact with the inputs and outputs. For example, if a broadcaster feeds a CVBS signal to his or her router, he or she now can convert the CVBS to SDI signal immediately at the input and propagate the SDI signal to any of the outputs. The crosspoint switch can take any input signals present and redirect those inputs to output signals. At one extreme, one signal can be sent to all the outputs (big crosspoint switches have around 290 inputs x 290 outputs), so 290 times the input. At the other extreme, the configuration can be one to one. Figure 3 shows the typical crosspoint switch.

The crosspoint switch card

The new 3G-SDI crosspoint switch cards integrate new pre-emphasis and equalization functions. The pre-emphasis/de-emphasis function is to boost high frequency to compensate for the FR4 (PCB) trace attenuation. As will be discussed later, in the section on distribution amplifiers, high frequency is more attenuated in the copper medium than low frequency. The pre-emphasis and the equalizer share the same function on the input/output. The pre-emphasis is used at the output, and the equalizer is used at the input. I prefer using the equalizer, because the pre-emphasis brings more noise and EMI into a system, but the pre-emphasis is simpler to use and to set up than the equalizer.

Figure 4 shows two waveforms. The first one is a digital signal without pre-emphasis, and the second one is the same signals with pre-emphasis. As the figure shows, the pre-emphasis increases the amplitude of the edges of the signal, so the high-frequency increases.

By using multiple crosspoint switches, the manufacturers are able to create a large router. Two behaviors of routers that could be implemented are blocking and non-blocking behaviors. A non-blocking router is one that allows all the inputs to be sent to all the outputs without having any limitations. Almost all of today's routers are non-blocking, but it might be interesting to explain the difference and to highlight how to create a non-blocking 576 x 576 router.

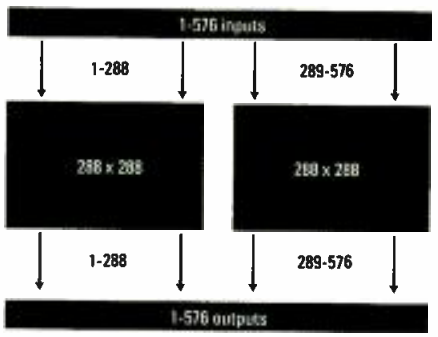


Figure 5. Blocking 576 x 576 router

Figure 5 shows the configuration of 288 x 288 crosspoints connected together to form a 576 x 576 blocking router. It can be seen clearly that input 1 cannot be rerouted to output 576.

From Figure 6, it can be seen that in non-blocking routers, the inputs should be split into at least two copies, but more ideally, into four copies to allow redundant crosspoint cards. Redundant power supplies are also an important feature of the router. The router is vital equipment in the studio, and it should work around the clock without failure.

Another interesting aspect of the configuration presented is the 144 outputs per crosspoint. If the manufacturer uses the same crosspoint, then the architecture allows for double outputs, e.g., integrating DA functionality or even a non-square (576 x 1152) blocking router. As a side note, other connection architectures are also possible. Documentation is available on the Web for more details on those architectures.

The input card

Now the major board has been covered. But the router is not composed only of the crosspoint switch cards — input, output, synchronizer and control. The input card in Figure 7 is composed of equalizers (like those discussed earlier) and reclockers. The trend of the market is now using SFP with reclockers instead of putting the reclockers onboard. Figure 8 represents a block diagram of the architecture based on SFP.

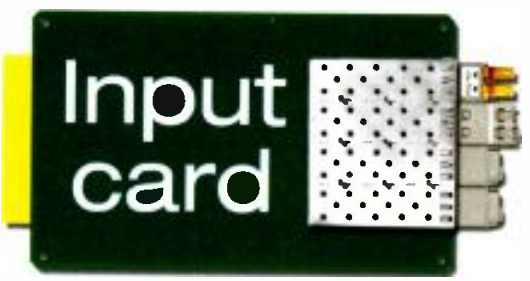


Figure 7. Input card

The advantages of using an SFP-based architecture are many. Optical or coaxial

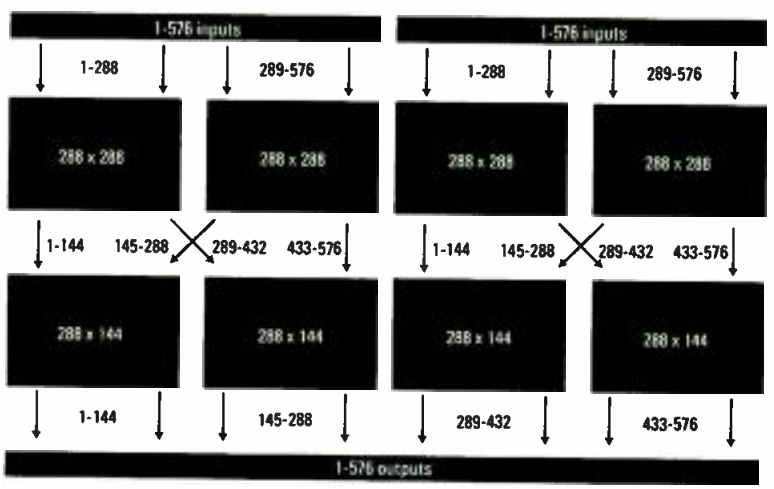


Figure 6. Non-blocking 576 x 576 router

can be used and reclocked, or non-reclocked inputs are possible. Also, conversion at the edge is possible, such as receiving a composite signal and converting it to SDI or receiving an HDMI/DVI signal and converting it to a 3G, HD or SD-SDI signal. By doing so in the edge of the input card, the router stays a simple router handling only the SDI signal type.

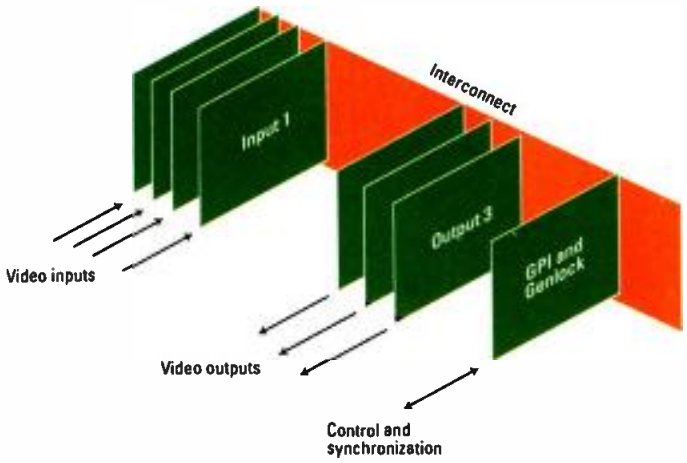


Figure 8. Router interconnect card

Like the multiviewer, one important and underestimated card is the interconnect card. This card attaches the input card to the crosspoint switch card and the crosspoint switch card to the outputs. There is not a specific way to accomplish this interconnect. One popular approach is to build a backplane or midplane and attach the specific cards to it.

This card is more critical because it carries a large amount of power to the input, crosspoint and output cards. Additionally, this backplane/midplane has to carry a large number of signals. Simply think about the 576 x 576 router shown previously, i.e., 576 inputs x 2 + 576 outputs links = 1728 links in this example, those high-speed signals. (As a side note, the 3G-SDI signal carries up to 2.97 x 10^9 symbols per second. This is the equivalent of sending level 1 and level 0 2,970,000,000 times per second).

To carry this information, the signal transition is extremely fast. This transition creates energy on the trace, and this energy creates a magnetic field. If the magnetic field touches the adjacent link, the energy is transferred back to the new link. This energy transfer creates the crosstalk phenomenon. To avoid any undesired crosstalk, the backplane design should be done carefully, and the connector used to interconnect the input, output and other control cards to the backplane should be chosen carefully.

The output card

The output card is composed of the cable driver and optional onboard reclockers, or emSFP, similar to the input card.

The third important card is the switching-line generator card. Let's consider that all the inputs are synchronized to the studio reference before entering the router. The switching-line generator (the actual name may vary) receives the reference vertical sync at least and sometimes one of the inputs as the free-run switch line. Like the input card, the output card should have flexible inputs and outputs, so the SFP-based design is the new trend to allow customers to configure each output and to add outputs on the installed router. By using the SFP cage, customers can upgrade or install any outputs of any type: composite NTSC/PAL, coaxial SDI, optical SDI or HDMI/DVI output.

The SFPs also allow users to create a dense router with the best failure point of two inputs or outputs.

The control card and software

Last but not least, the control card and the control software are also crucial in the router. Some people will say that this is the most crucial part of the router and the studio.

The software that controls the entire studio has to control the router, and major router vendors give the protocol and sometimes the application program interface (API) to control the router and to gather the information from the SFPs. One popular way to get information around the world now is the SMNP.

The new generation of routers

New routers combine increased functionality with the robustness of electronics. The new generation of routers now integrates multiviewers, frame sync, and audio embedders and de-embedders. The next generation will be able to handle higher speed rate (up to 10Gb/s), as well as different formats. With the emSFP, the router now can handle different formats such as HDMI, NTSC/PAL, SDI and 3G-SDI. The new emSFP enables a higher level of diagnostic by allowing the user to see an eye diagram of inputs and outputs.

Renaud Lavoie is president of Embrionix Design.

Combining LTO-5 data tape with LTFS

BY MARK OSTLUND

While HD television, 3-D films, Web 2.0 user-generated content, file-based acquisition from new digital film and video cameras, and the coming Ultra HD have opened new creative possibilities and greatly enhanced the end-user experience, they have also created vast amounts of digital data that need to be stored, accessed and retained.

According to the analyst firms Coughlin Associates and the Clipper Group, HD video generates more than 500GB/hour of data and quintuples the storage needs over SD. Additionally, 3-D films require twice as much storage as HD, and Ultra HD is predicted to require 20 times storage of HD. The result is that between 2009 and 2015, the media and entertainment industry will see a 10-fold increase in the required digital storage capacity per year. By 2015, more than 46 exabytes of digital storage will be needed for digital archiving and content conversion and preservation.

For many years, professional videotape was a mainstay of the media and entertainment industry, valued for its portability and low cost. And while production needs often rely on disk file-based storage, long-term storage represents a different challenge. Today, many users find that data tape is a cost-effective way to maintain large amounts of data for long periods.

Linear Tape-Open (LTO)

The advancements in Linear Tape-Open (LTO) technology have made it an ideal long-term data retention solution for video applications. Tape has a potential 30-year shelf life. The LTO standard is supported by more than 3.7 million drives, and 150 million LTO Ultrium cartridges have been shipped since the technology was first launched in 2000. Each LTO-5 cartridge has a native capacity of 1.6TB, making it easy to scale storage needs simply by adding more LTO tapes.

Finally, an LTO-5 solution can reduce physical storage requirements. A standard wall rack (6ft by 6ft or 1.8m) with 14 shelves can store approximately 1000 cartridges — or the equivalent to 120,000 hours of 25Mb/s SD or 30,000 hours of 100Mb/s HD content.

Shown here is a Cache-A archive appliance installation at BBC America.

Linear Tape File System (LTFS)

Linear Tape File System (LTFS) specification is a self-describing tape format using the LTO Ultrium 5 open standard. LTO-5 data tapes can be exchanged between systems that understand the LTFS format, and software systems that understand the format can provide users with a file system view of the media.

The LTFS format specification defines the organization of data and metadata on the tape. Files are stored in a hierarchical directory structure. LTFS is enabled by the dual partitioning capability of LTO-5 technology. LTFS technology provides file system access at the operating system level, using one partition to hold the file content data and the other to hold the associated file metadata.

This allows LTFS LTO-5 tapes to be self-describing. Data tapes written in LTFS format can be used independently of any external database or storage system. This enables a standard file

system view of the data stored in the tape media. Because each tape has its own file system, files stored on the LTFS-formatted media can be viewed and accessed the same way as other files stored on any other portable storage media, such as disk, USB drives and flash drives.

Advantages of LTFS

With LTFS, tape systems can be easily indexed for fast and easy retrieval while ensuring data portability and data interchangeability. Users can interchange content across different operating systems, software applications and physical locations. An LTFS solution combines the economy, robustness, high density and low power consumption of tape, with much of the functionality and usability of a hard drive.

One of the clear advantages LTFS has over the proprietary archive formats used by traditional back-up and archive solutions is that it preserves the file system structure of the source file system and leaves the files as identical copies of the source files. That may seem like an obvious thing to do, but most proprietary archive systems encapsulate the source files into objects. This has the advantage of encapsulating a group of files with their associated metadata, but it has the disadvantage of requiring an extra layer of software to access, extract and interpret what is in the archive. Any additional required software beyond the basic and ubiquitous standards provided by IT manufacturers could reduce the chances of being able to access the archived content in the future. With LTFS, the files will always be accessible from common platforms at the file system level without requiring another application to extract them.

Folders are a natural way to encapsulate groups of files and their metadata using just a file system. Most digital media professionals are already arranging their disk storage this way such that all sources shot on a particular day in production or an entire project in post-production can be found in a unique directory tree. Giving the highest level folder a meaningful name can facilitate finding a past project or footage from a particular shoot easily.

Because LTFS brings a disk-like file system to LTO data tape, it allows digital media professionals to use a simple drag and drop process. This keeps folders and files in the same hierarchy as on the source disk or digital media. At any time in the future, users can restore a single file or an entire directory tree with a simple drag and drop.

As compared to standard tape implementation, LTFS provides digital media professionals with a several benefits:

- *Faster access to data:* When a tape is mounted, the stored tape files and directories can appear on the desktop in the same way as a disk directory listing.
- *Simple drag and drop file operations:* LTFS increases ease of use, allowing users to simply drag and drop files to and from tape.
- *Compatibility across customer environments:* LTFS uses a non-proprietary data format file system that is independent of specific software applications. LTFS can address long-term archive strategies by creating a self-describing tape that is not dependent on the software and hardware environment.
- *Increased data mobility:* LTFS allows users to easily share content with any LTFS-enabled system using open source software to increase data mobility.

Limitations

There are, however, limitations to LTFS. LTFS cannot be used by itself in a network or multi-user environments because the open code or "base level" deployment requires that the LTO drive be dedicated to a single computer. Also, LTFS has inherent problems that result in long waits when used with file management tools like Windows Explorer or Finder. List views are generally fine, but icon and other graphical views cause these programs to undertake painfully long seeks to read each file.

In addition, restoring more than one file at a time with Explorer or Finder will be inefficient if sorted by anything other than archive date. This is because such operations will attempt to restore in sort order rather than the order of the files on the tape. The result is that restores can literally take days.

Finally, LTFS should not be used like random access disk because, due to the inherent nature of tape, accesses must occur over a linear arrangement of data. If an application tries to update a file, it will be rewritten to the end of tape, resulting in long delays when restoring such files.

Going beyond the standard LTFS implementation

It is clear that LTFS works better when leveraged by third-party software. Some manufacturers are planning layers of software above the standard LTFS implementation to

address its limitations. None of these limitations exist when LTFS volumes are accessed, for example, from an archive appliance web-based user interface.

Other benefits of embedding LTFS in an archive appliance the Cache-A system include:

- *File manager utility*: file moving that avoids issues with Finder/Explorer;
- *URL encoding*: allows archiving of file names with illegal characters;
- *Networked*: makes LTFS volumes available across a LAN;
- *Easy formatting of media*: no shell command line is required;
- *Easy mount and unmount*: no shell command line and no locked eject due to folders in use; and
- *No client-side software*: every computer can instantly work with it.

An LTFS solution offers several important operational benefits. To the user, the tape both looks and behaves like a disk, and all tape operations are handled transparently in the background by the archive appliance. An archive appliance will be able to deliver a solution that is:

- *Self-contained:* platform neutral to stand the test of time;
- *Interchangeable:* easy to distribute and interchange assets; and
- *Extensible:* scalable to meet future needs.

As a complete archive solution for digital media professionals, LTFS can simplify operations and improve manageability while meeting a facility's long-term data retention requirements. Self-contained, easy to deploy with no assembly or installation required, LTFS appliances know where every file lives on each tape and can organize and restore the content for efficient linear access. Users should still use hard disk caching for file transfers. That will protect them from the latencies and access issues associated with linear tape.

Conclusion

Combining LTO-5 data tape with LTFS creates a powerful IT solution for the media and entertainment industry. LTO-5 based products using LTFS make an ideal archiving and interchange solution, enhancing both production and post-production workflows, as well as improving asset management and interchange.

Because LTFS makes the contents of the tape compatible and accessible to any facility with an LTO-5 tape drive, it provides an interchangeable and future-proof content storage format on secure LTO-5 media. Third-party archive solutions that leverage the LTFS format can provide easy-to-use archive solutions based on open standards that help ensure content will be searchable and accessible many years in the future.

Mark Ostlund is vice president of sales & marketing at Cache-A.

Clearing video's Internet path

BY ISRAEL DRORI

Shown here are a Court TV production truck and a Fox 35 news vehicle in front of the Orange County Courthouse, covering the trial of Casey Anthony in Orlando, FL, on June 1, 2011. Photo courtesy Carl Stewart/Shutterstock.com.

Networks, content providers and production companies have long been interested in delivering high-quality, high-definition video over the Internet to PCs and mobile devices. However, technical issues have prevented the dream from becoming a reality. While the Internet is an effective means of transport for a range of applications and services, anyone who has used it to watch a YouTube video or an episode of their favorite television program can attest that it's not always a great way to broadcast HDTV.

Internet video transport is unreliable and non-deterministic, rendering it largely unsuitable for broadcasters that need to deliver high-quality video. This is often blamed on a lack of bandwidth. However, in fact, today's Internet has plenty of capacity to transmit broadcast-quality live HD video; it's the existing Internet protocols that are the problem. The bandwidth on "first mile" and "last mile" downlinks is more than sufficient to carry broadcast-quality HD traffic. However, connecting the first and last miles via traditional Internet IP frequently results in service problems such as start-up delay, buffering and frame freeze. If a video stream doesn't start within seconds, the screen freezes or the stream starts buffering, viewers quickly become frustrated and abandon the video.

Broadcasters that want to transport high-quality video over the Internet need a solution that uses the end-to-end bandwidth already available and delivers outstanding performance with superior reliability. Specifically, the solution should ensure split-second latency, and near-zero packet loss, and deliver the highest video quality — up to 1080p/60f/s — without any sacrifices to delivery time or resolution.

The challenges

From a technical perspective, the challenges involved in delivering broadcast-quality HDTV over the Internet are due to the larger amount of information involved; how packet loss, latency and jitter are handled; the requirement for uninterrupted video streaming; and the way that Internet transport protocols work.

The Internet's TCP transport protocol was written decades ago, when physical network conditions were far more subject to transmission errors, delivery delays and broken links. While ensuring guaranteed delivery of data over unreliable connections, TCP is not time-sensitive, and it does not maximize use of the network bandwidth. Tests reveal that with only 0.1-percent of packet loss over the Internet, TCP-based video streaming solutions drop the available bandwidth for video by 80 percent. In short, TCP has not been designed optimally for real-time video transport. Today, popular video streaming and transport methods over the Internet make only 15 percent to 50 percent of the available bandwidth for the user's video. Live content and mobile access add further challenges to make these video streams not viewable.

Selecting among existing Internet protocols to optimize reliability has meant increasing latency and adding overhead to the video stream. For example, the Real-Time Streaming Protocol (RTSP) does not define, exactly, how video can be streamed without startup delay, buffering or pauses, or lowering

the video resolution. Other TCP-based streaming protocols have suffered from maximizing efficient use of available bandwidth in the midst of constantly changing Internet conditions due to varying degrees of packet loss, latency and jitter.

One impact has been high latency — delivery delays due to the video stream arriving to, going through and exiting the Internet. Some of this is inescapable due to transit time and distance. You would see it even at the speed of light. Latency is also a major factor even when using conventional dedicated landlines, and even more so where satellite relays, in orbit around the Earth, are used. (See Figure 1.)

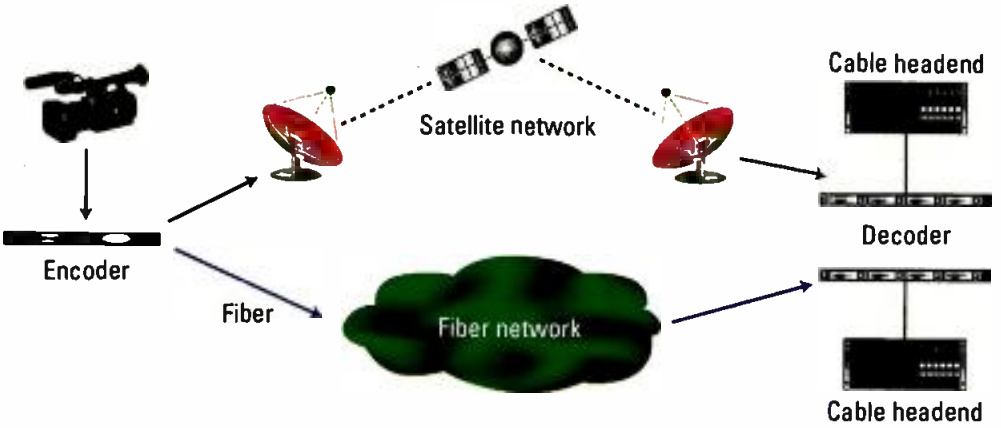


Figure 1. Even when using dedicated landlines, latency is still a major factor in delivering HD-quality video. This is even more the case when satellites are in play.

Some of the delay is caused by the processing required to push a signal through the Internet's hardware. First, encoders need to compress SDI video into H.264 or MPEG-4 content and turn it into packets. Routers must then switch packets from one link in the Internet to the next, before decoders finally depacketize the stream at the other end. (See Figure 2.) Additionally, network devices may also be performing compression, adding encryption or other security measures so that unauthorized users can't watch it. All of this adds latency.

Another source of delay is the need to buffer, which prevents video streams from starting up fast and can take anywhere from several seconds to minutes. Even the delay-before-play, which happens when a viewer selects an on-demand video through a cable box, is faster than the buffering needed to play H.264 content over the Internet.

A third source of delay is packet loss. IP video streams need to be assembled and played in the right order at the right time. Some applications, like e-mail, web surfing, file transfers and peer-to-peer downloads, can tolerate packets that do not arrive in real-time, or arrive in the wrong order. Multimedia applications can be designed to be "lossy," with some packet loss, or to require the entire original signal to be received with no packet loss. Even telephone calls can handle some

level of packet loss while still providing good service. However, broadcast-quality HDTV needs the entire original stream with near-zero packet loss. Packet loss creates overhead. The network has to re-request the missing packets, or request extra packets in advance, forcing buffering and overhead, which holds up the delivery of the video stream until the missing packets are accounted for. This affects real-time performance, which can suffer for a variety of reasons. One, the application may need enough time to buffer so it can accommodate packet loss, which could take up to several minutes. Or, it needs more bandwidth from the end-to-end network to compensate for the extra packets captured. Or, it needs to be video-aware and ensure that the more important packets such as I-frames are always captured, while some other less-important frames may be missed. As a result, the video will be distorted periodically, creating a frustrating delivery and viewing experience.

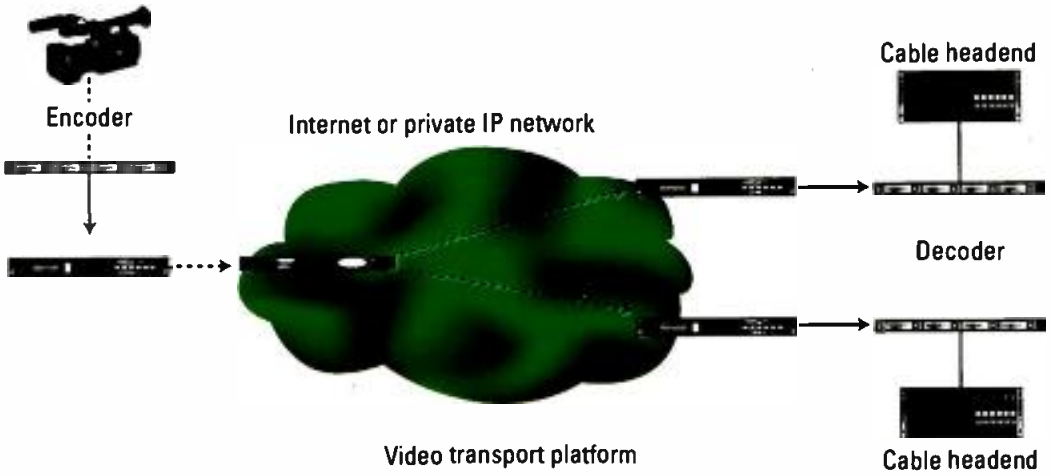


Figure 2. Another source of delay is a signal's push through Internet hardware. Content has to be packeted, sent and then unpacked.

The solution

To date, there have been interesting solutions to the problems noted above, yet none of them make the most efficient use of available bandwidth. For example, common approaches such as FEC and Scalable Video Coding (SVC) are designed for short-video interviews and multi-way video conferencing, respectively. They are designed to minimize latency while adding excessive overhead to the available bandwidth for video but not ensuring near-zero packet loss. This overhead, which does not guarantee packet recovery, may also not be suitable for continuous-play, broadcast-quality video where the video bit rate approximates the available bandwidth. Such alternative video transport methods can provide low latency but cannot guarantee recovery from packet loss due to unpredictable behavior of the network and statistical nature of its packet-recovery mechanism. These solutions are not designed for 24/7 continuous play or viewing a two-hour movie.

What is needed is a platform that addresses different video applications, such as over-the-top HD video viewing, 24/7 satellite or fiber-alternative video distribution, low-latency field reporting, sports, and mobile broadcasting. It needs to address fundamental challenges associated with transmitting high-quality video over the Internet, whether it is designed for low-latency or flawless HD movie viewing. The optimal platform must be able to deliver pristine, uninterrupted, low-latency video despite the Internet's inherent varying and nondeterministic network conditions.

Summary

Today, new technologies are emerging that address the needs described above. These revolutionary video transport platforms are based on the RTSP framework and leverage the efficiencies of the standard UDP-over-IP protocol to maximize use of available bandwidth. Additionally, methods are being designed to address packet loss, latency and jitter to ensure on-time and reliable streaming and delivery of video over the Internet, dynamically resolving issues in sub-millisecond response time.

Without adding overhead to physical bandwidth, these new video transport methods provide low end-to-end latency, eliminate jitter, smooth video flow, and recover and re-order packets so the video is restored to its original form — all before it starts. These solutions are enabling broadcasters to finally use the Internet to deliver high-quality video, at the highest quality, more affordably and effectively than ever before.

Israel Drori is founder and CEO of ZiXi.

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4K2K sensors and more

Several paradoxes lay in the path from NTSC to 4K2K production.

BY STEVE MULLEN

Several paradoxes lay in the path from NTSC to 4K2K production. First, although it is trivial to build a CMOS sensor with several times the 8.3MP needed for 4K2K, it is not trivial to read such a sensor 60 times per second. Second, although compressing 8.3MP is possible, recording the data is challenging. Third, although 4K2K (4096 x 2160 or 3840 x 2160) will be imported during post production, most editing will be done with a full-HD (1920 x 1080) timeline.

As described in the previous two articles ("4K2K" in the December 2011 issue and "4K2K, part 2" in the January 2012 issue), 4K2K has evolved from DSLR cameras that shoot video. The evolution is natural because 4K2K can be described as shooting 35mm pictures at video frame rates. The need for frame rates of 5X to 10X the maximum photographic burst rates creates the first issue.

Camera designers have a myriad of ways to read out and process a sensor's photosites. This article will look at a few of these with the goal of

4K2K cameras
(Top: JVC GY-HMQ10
Middle: RED Scarlet
Bottom: Sony F65)

being better able to understand current full-HD and future 4K2K cameras and camcorders.

This article will use an APS-C 16MP sensor for its examples. The sensor has 4912 x 3264 photosites with a 1.50:1 aspect ratio. Using a 16:9 window, the chip can provide a 4912 x 2760-pixel, 13.6MP capture.

The first design choice depends on the answer to the question: How rapidly is the sensor to be read? Obviously, the simplest way to keep a sensor's clock rate low, thereby keeping heat under control, is to limit a camera's frame rate to 24p and/or 30p. Unfortunately, this rules out the ATSC standards of 59.94p (1280 x 720) and 59.94i (1920 x 1080). Nevertheless, the initial generation of video-shooting DSLRs used this approach. Current DSLRs and camcorders can capture 720p59.94, 1080i59.94 and even 1080p59.94. Therefore, today, the question is how many photosites can be read 60 times per second.

As described in the "Understanding de-Bayering" sidebar in the December installment of the series, for a single-sensor camera to provide luminance resolution equivalent to that from the three-chip camcorder, the image to be de-Bayered must be 3.4MP (full HD) or 13.6MP (4K2K). A 16MP chip is able to provide the necessary pixels for both frame-sizes. For a full HD camcorder, two sensor-read options are possible.

The first option reduces the amount of data to be read and processed by a factor of two. To preserve the Bayer pattern, sensor control logic skips every other pair of rows. With the example sensor, 2760 rows are reduced to 1380 rows. Skipping rows, as is done by several popular DSLRs, introduces aliasing and moiré.

When the sensor and DSP are fast enough, no rows need be skipped. In this, the second design option, all rows are de-Bayered. Therefore, aliasing and moiré are reduced to only that caused by an inadequate optical low-pass filter (OLPF).

As each pair of rows is read, they are de-Bayered to YCrCb values. Assuming a de-Bayer efficiency of 78 percent, sensor horizontal luminance resolution will be about 3830 pixels.

With either option, unless the sensor has exactly 1920 or 3840 columns, YCrCb row values are downscaled to the target line width — in pixels. The downscale factors from 4912 to 3840 and 4912 to 1920 are 0.78 and 0.39, respectively. And, unless the sensor has exactly 1080 or 2160 rows, the frame must be downscaled to the target number of lines.

During a downscale, post-de-Bayer luminance resolution is reduced by an equal factor. For the example sensor, when shooting full HD, the estimated horizontal luminance resolution is about 840 TVl/ph, i.e., 3830 x 0.78 ÷ 1.78 (aspect ratio). When shooting 4K2K, estimated horizontal luminance resolution is about 1680 TVl/ph, i.e., 3830 x 0.39 ÷ 1.78 yields.

Once 4K2K has been recorded, focus shifts to post production. How will data be imported into an NLE and edited?

The resulting image is 4:2:2 sampled. Of course, chroma resolution is reduced if the camera's codec supports only 4:2:0 sampling.

Once a de-Bayered and downscaled image has been obtained, the next steps are compression and recording. Although this presents no problem for a full-HD camera, currently there are no 4K2K versions of AVC-Intra, DVCPRO HD or HDCAM.

The H.264 specification does include Level 5.1 supporting 3840 x 2160 at up to 25fps and Level 5.2 supporting 3840 x 2160 at up to 30fps. To employ AVCHD encoding of 4K2K, its specification would need to be enhanced to at least Level 5.1.

The JVC GY-HMQ10 camcorder illustrates one way compression and recording problems can be solved. The HMQ10's 1/2.3in CMOS sensor has 8.3 million active photosites and delivers 3840 x 2160 video at 23.976p, 50p and 59.94p.

From the sensor onward to the SDHC/SDXC recording cards, each 8.3MP frame is processed by the JVC Falconbrid LSI chip. Falconbrid de-Bayers the QuadHD frame (QFHD), divides it into four streams and simultaneously compresses these streams using H.264/AVC at 36Mb/s. The aggregate data rate for 2160p is, therefore, 144Mb/s. The four H.264 data streams are written to four memory cards.

During playback, these cards are read, and the streams are decompressed and output via four HDMI ports. (Projectors and monitors that display 4K2K have four HDMI input ports.)

Post production

Once 4K2K has been recorded, focus shifts to post production. How will data be imported into an NLE and edited? One solution for the JVC HMQ10 is the transfer of data from four cards, via USB, from the camcorder to a utility that merges and transcodes them to an intermediate codec. (Under OS X, I have had no problems creating and editing 2160p60 ProRes files.)

Those shooting QFHD with an F65 and recording on SRMemory cards using a Sony SR-R1000 can make use of HD-SDI connections to transfer files in real time. (During shooting, four HD-SDI connections send QFHD data from an F65 to a pair of SRK-R201 input boards installed in an SR-R1000.)

Two SRK-202 output boards installed in an R1000 provide four HD-SDI output ports. Each port provides uncompressed digital video.

With a DeckLink 4K board from Blackmagic Design installed in a PC or Mac, users can transfer QFHD digital video to uncompressed files. To accomplish this, first they will also need a powerful RAID because 2190p24 video requires 380MB/s.

Second, four AJA HD10AM AES audio embedder/disembedders will be needed. Each HD10AM inputs one 1920 x 1080 signal (from one of a pair of HD-SDI output ports on a SRK-202) plus a pair of audio signals (from two AES output ports on an SRK-202). Each audio embedder sends a 1920 x 1080 signal with embedded audio to one HD-SDI input port on the DeckLink 4K board. Once 4K2K files have been imported, online editors choose a workflow. When delivering a 4K2K file, one can only use certain NLEs. FCP 7, FCP X, EDIUS 6 and Premiere Pro support 4K2K timelines and exports.

Although the Media Composer 6 from Avid does not support 4K2K sequences, it will accept 4K2K ProRes and uncompressed files via AMA. (When source files are 2160p60, edit them in a 1080i60 sequence.) Media Composer's Resize filter creates a 1920 x 1080 image from a 3840 x 2160 image. Pan-and-scan of the larger image is possible by key-framing the X and/or Y position control. (See Figure 1.)

Sony SR-R1000 memory storage unit

Sony SR-R1000 connections to four AES audio embedders

An NLE, such as FCP X, that can apply a Pan-Scan-Zoom (such as iMovie's Ken Burns effect) can use the "extra" pixels to zoom in and out of the larger image as shown in Figure 2 (3840 x 2160 downscaled to 1920 x 1080) and Figure 3 (crop of 3840 x 2160 to 1920 x 1080).

Although working with 4K2K requires a greater understanding of camera technology and more effort during post, these issues are surmountable with a moderate amount of effort. BE

Steve Mullen is the owner of DVC. He can be reached via his website at http://home.mindspring.com/~d-v-c.

Figure 1. Scale at 200 x 200 places a 1920 x 1080 window within a 3840 x 2160 frame.

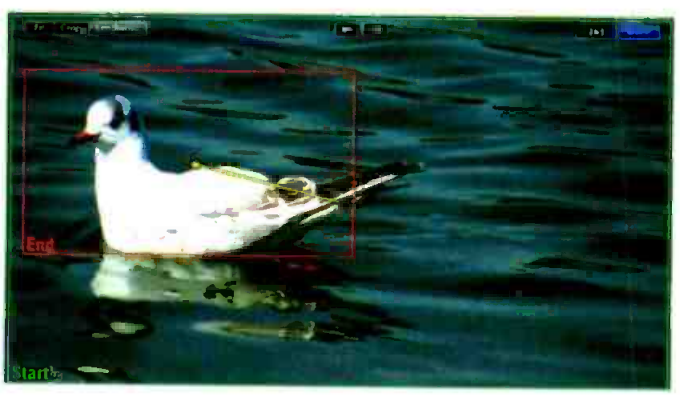
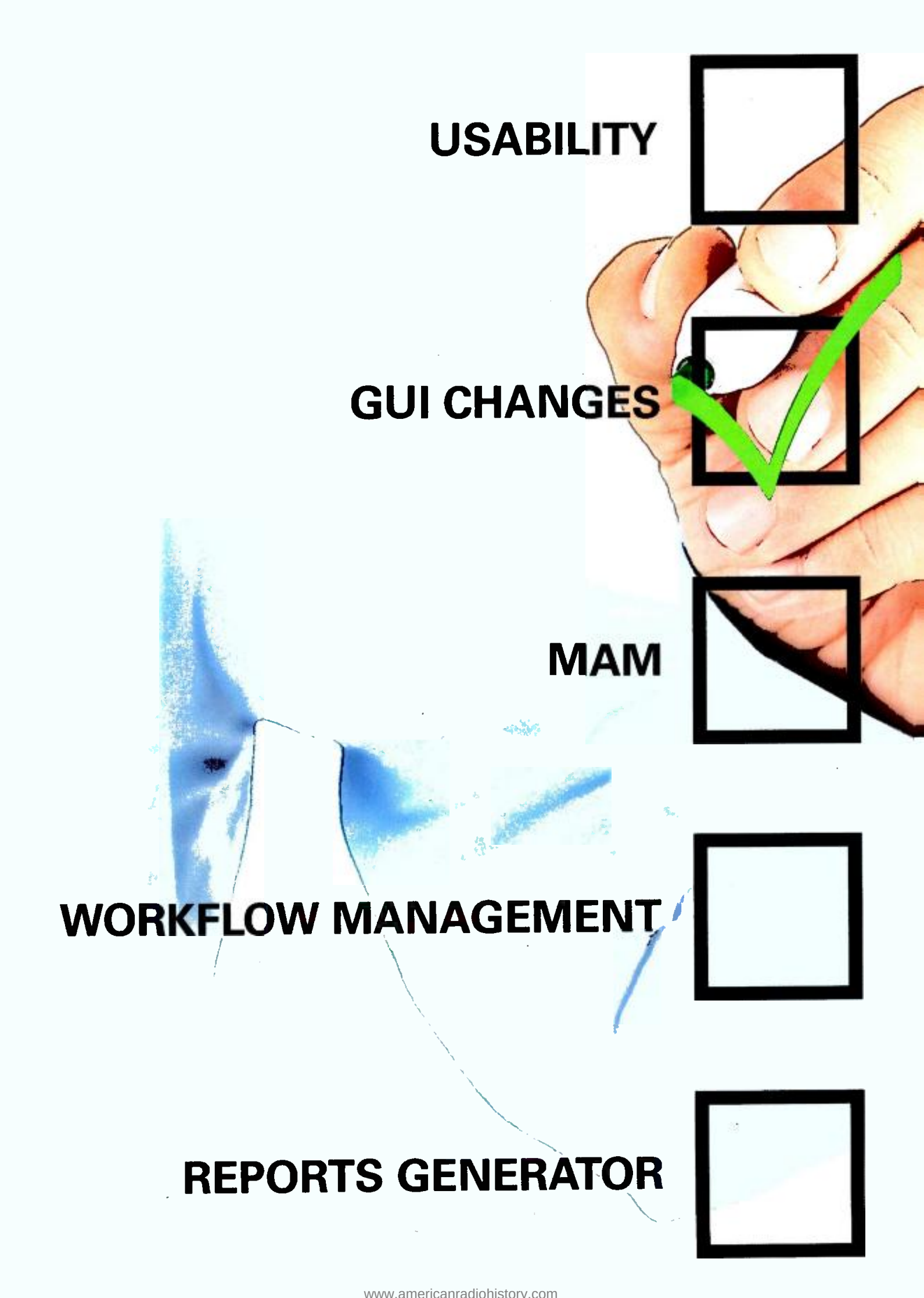


Figure 2. Start (green frame) of pan and zoom at full frame

Figure 3. End (red frame) of pan and zoom to minimum size



A BMS checklist

When choosing a broadcast management system, here's what to look for.

BY DAVID SHAPIRO

Today's broadcasting management environment presents us with many new challenges, such as nonlinear scheduling, multiple platform broadcasting and advertising, and increasingly complex broadcasting rights, to name just a few. As a result, more broadcasters are considering the introduction of a new Broadcast Management System (BMS) for managing acquisitions and programming, broadcasting rights, promotions, airtime sales, scheduling, etc. The objective is to obtain an enhanced control of data, streamline workflows and offer better service to both clients and viewers.

There are many BMS systems on the market from which to choose. Product selection ranges from solutions focused on small and medium-sized operations to larger plans designed for global TV networks. Every system obviously has its advantages and disadvantages, and it is not always easy to know which would best serve a broadcaster's specific requirements.

As part of the procurement process, careful definitions of objectives, requirements and business goals need to be clearly identified. In the final analysis, the selected solution should be able to offer the most efficient answer to both present and future needs.

However, functionality and business workflows are not the only criteria to look for. In this article, we will look at other important aspects that should carefully be taken into consideration when selecting a BMS solution.

Usability

One of the most important but commonly overlooked aspects of a system is its usability and user-friendliness. In the BMS market, there are some very feature-rich systems, but it is not until they are actually used that you discover, although they perform everything as promised, straight-forward, day-to-day tasks may take longer than expected.

So, how exactly can system usability be measured? And, how can users themselves assist in this process?

Potential users of any new system should already have played a definitive role during the requirement-gathering process. Users' day-to-day activities, processes and workflows will have been properly documented and translated into requirements. However, the users' role should not end there. They are the ones who will be operating the system, and they really need to feel comfortable with it — especially after so much time, effort and money will have been spent on implementation. Entire projects have failed, not because a system performed incorrectly, but because the users were unhappy with "how" it did it. Such scenarios must be avoided.

That said, perhaps the most important step in system definition is to get the operators involved in the selection process. Let these hand-picked users participate in the vendor presentations. The operators will be more focused on usability and workflow, as opposed to management, which is likely to focus more on features and cost.

GUI changes

In the implementation of a new BMS system, it is almost inevitable that GUI changes will be required, especially in the case of larger broadcasters. This can result in additional work by the vendor, which means additional costs. Therefore, an important aspect to look for in the new system is the ability for the customer to make his or her own GUI changes. There are major differences in how vendors address this issue. Generally speaking, vendors approach GUI development/changes in three ways or categories.

- *Category 1:* Even the slightest change to the GUI can be executed only by the vendor. This may also include basic actions like making a field mandatory. The system may have a mechanism for GUI changes, but, due to its complexity, only the vendor can carry out the required changes.
- *Category 2:* The system permits the customer to define his or her own fields, but this can be executed only with specialist knowledge. This may entail not only a deep understanding of the system's data structure, but also specific programming capabilities. Larger broadcasters with an IT department may have the necessary skills set. Smaller broadcasters will be more dependent on the vendor for the necessary changes.
- *Category 3:* The system offers a user-friendly mechanism by which new fields can be added, and basic GUI changes can be made. Some systems make this an easy procedure, while others may involve certain configuration and "fiddling" to get it right. The bottom line is that a system administrator should be able to make many, non-complex GUI changes without having to involve the vendor.

Perhaps the most important step in system definition is to get the operators involved in the selection process. Let these hand-picked users participate in the vendor presentations.

(Please note that although some of the systems allow for GUI changes to be made, it is important to check with the vendor in order to confirm how these changes are viewed under the SLA agreement.)

MAM

In the current broadcasting environment, media management has become even more complex. BMS has always played an important role when it comes to media management. However, BMS functionality falls short of what standard MAM systems have to offer. Some BMS vendors have identified this and are working to close the gap. Some vendors have even announced their BMS systems now feature full MAM capabilities.

If you are thinking of implementing a MAM system, it is definitely worthwhile to run a comparison; you may be pleasantly surprised. If the BMS system can be tailored around your MAM requirements, it may save an additional lengthy and costly implementation, not to mention double keying, integration headaches and having to work with two vendors instead of one.

Workflow management

Today's broadcasting environment has made workflow management extremely challenging. As a result, broadcasters often seek out good, robust, workflow-management tools that help ensure that all data and processes are carefully monitored and managed. BMS vendors recognize this need, and today many systems have some kind of workflow management solution. Here, also, the different BMS systems can be divided:

- *Category 1:* The system does not offer any type of workflow management, meaning that if automatic workflow management is required, it will be necessary to interface online with an external tool. This is far from ideal.
- *Category 2:* The system has a workflow management solution, but the ability to manage workflows lies solely

in the vendor's hands. In such cases, the vendor will need to be commissioned for each required change.

• *Category 3:* The system uses an internal workflow engine, or seamlessly integrates with a third-party solution. However, such a solution may require more than casual programming skills in order to maintain the workflows. Although it may be possible for the end user to define his own workflows, there can be a considerable learning curve to making any changes. In most cases, it may be better commissioning the vendor to carry out the work.

• *Category 4:* Similar to Category 3, the system uses an internal mechanism or integrates with a third-party solution. However, care has been taken to make these tools as user-friendly as possible, allowing a system administrator to easily create and maintain workflows. Ultimately, this can be the best option.

Reports generator

Every broadcaster will want its own unique set of reports. Consequently, it is important to leave a lot of flexibility when new reports are needed or updates are required to existing reports. As above, different BMS systems offer different levels of flexibility:

• *Category 1:* Systems where the reports can only be created and maintained by the vendor.

• *Category 2:* Systems where the vendor has created its own report generator, giving the customer the option to create and manage reports. However, it may still be necessary that the staff person making any changes has an understanding of the product's data structure along with well-developed programming skills.

• *Category 3:* Systems that fully integrate with a third-party report generator, meaning that the reports are created using the third-party tool. The reports are then uploaded into the BMS system, allowing them to run from within the BMS system itself. This can be a real advantage because most of these third party tools are easy to use.

Regardless of whether the BMS falls under one of the above categories, it is always possible to use a third-party report generator that is connected to the BMS database. However, in this scenario, reports would need to be run externally from the BMS systems.

As previously stated, selecting the most suitable BMS system is not an easy task. However, careful planning and clear requirement definition, as well as considering some of the points discussed above, can result in a successful implementation, better workflows and increased revenue. BE

David Shapiro is the founding director of DS Media Consulting and specializes in BMS implementation worldwide.

Utah Scientific's UTAH-400/144

WDRB converts to an all-HD news operation.

BY GARY SCHRODER

In April 2010, Louisville-based station WDRB-TV became the first station in the city to completely convert to an all-HD news operation.

Maintaining technical superiority in a competitive market meant thinking several steps ahead in its choice of production equipment systems and vendors. That is why the station turned to Utah Scientific for routing and master control switching solutions to anchor its new HD operation. The station's latest Utah Scientific acquisition is a UTAH-400/144 digital routing switcher, which provides routing for all incoming and outgoing HD signals supporting WDRB newscasts, as well as those of sister station WMYO, a MyNetworkTV affiliate broadcasting on channel 58.

The fact that the new switcher controls signals for both stations is a real benefit in many key situations. For instance, even though WDRB is still broadcasting live FOX sports at 10 p.m., it is still able to air the WDRB newscast on WMYO. When the sports program has ended on FOX, WDRB engineers simply punch up the "re-entry" of the on-air WMYO switcher on WDRB, and simulcast the news on both stations until the newscast is completed. Weather cut-ins on both stations are a cinch as well.

Back in its analog days, the station purchased two Utah Scientific AVS1-B routers and two MC-500 master control switchers. They were still working the day they were decommissioned. Based on that experience, the station engineers chose the UTAH-400 because they knew the switcher would work — and if it did not for some reason, they knew Utah Scientific would provide support for its product.

WDRB selected a UTAH-400/144 digital routing switcher to support its transition to HD news production. The 9RU switcher offers crosspoint redundancy and signal presence detectors on all inputs and outputs.

Housed in a compact 9RU frame, the switcher provides audio and video frames for up to 144 inputs and outputs — giving the station lots of growing room as its operation expands into the future. In fact, the switcher's unique matrix architecture means it can be scaled easily up to 1152 x 1152 and beyond using a single family of matrix building blocks, while offering reductions in physical space and power consumption requirements.

One feature that station engineers especially appreciate is the signal-presence detectors on all inputs and outputs, which allow the matrix to perform functions ranging from simple alarms to automatic restoration of service on critical signal paths. Also, the switcher's crosspoint redundancy offers a high degree of operational reliability.

The UTAH-400 joins other key pieces of Utah Scientific gear in the station's operation: a GS-4000 graphics station and a two-channel MC-4000 master control switcher controlled by two MCP-2020 master control panels.

For instance, as a FOX affiliate, the station previously had to enter specific GPIs manually with its old automation system. After installing the new MCP-2020 panels, the GPI triggers can be tailored for each button on the switcher — making switching to FOX programming completely automatic. When it installed the new automation system, the station was able to interface it with the master control switcher in less than 15 minutes.

The new suite of routing and master control equipment provides a technology foundation for WDRB's HD operation that will serve the station for years to come — and help ensure a reliable, cost-effective and energy-efficient operation. BE

Gary Schroder is chief engineer at WDRB.

Clear-Com's Encore

The partyline intercom system anchors a Kansas county's post-tornado media center.

BY GRANT NEUHOLD

Following an EF-5 tornado in 2007 that destroyed most of Greensburg and parts of Kiowa County, residents were left without the means to relay important information to one another. To avoid similar problems in the future, it became a chief priority to design a communications platform, with state-of-the-art technology, in Greensburg, KS. At the end of a four-year planning and building stage, many people finally celebrated the grand opening of the HD television production studio and mobile production trailer, which has been named the Kiowa County Media Center.

Sustainable innovation

The new center features two studios. One is a TV production studio with a green screen and lighting grid for full studio broadcasts. The other is an Internet radio studio equipped with an interview room that enables people within the community to produce their own radio shows. During planning, the goal was to construct a sophisticated, energy-efficient media center that would set an example in both sustainability and innovation for rural communities throughout America. To achieve this, reliable and high-quality technologies that could tackle any production challenge were sought out. Intercoms, in particular, would play an important role in equipment setup as communication was pivotal to coordinate efforts in the studio and in the field.

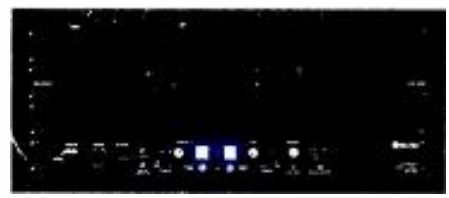
Through company sponsorship, we installed a Clear-Com Encore partyline intercom system in the media center. The intercom system resolved the communication challenge, helping the County deliver programs and information to local residents. Further, it also positioned the media center as a pioneering, model media outlet for rural American communities. Several months after beginning operations, results have been positive and encouraging.

Solidified teamwork

In addition to serving as an information hub on natural disasters, the center is also used to coordinate news, local events and sports broadcasts, along with productions, educational programming and other materials like advertising for area businesses and organizations.

Clear-Com's MS-702 Encore partyline main station is set up in the control room, while an RM-702 Encore partyline remote station is installed in the audio area. From the control room, the director can collaborate with the lighting designer, who manages the lighting board; the technical director, who oversees the video switcher; and the graphics operator, who updates the scoreboard, name identification and other elements during sports coverage. The director also corresponds with the audio technician, who controls the sound levels and mix-minus for the production, as well as the floor manager, who advises the talent and camera operators in the television studio. The same setup has been replicated in the mobile production center to allow communication between the different crew members.

Clear-Com's RS-603 wired beltpacks offer great audio clarity for easy information exchange between all members of the broadcast team, which has strengthened teamwork. One channel of the beltpack is designated for the entire crew, while the second channel is assigned to the talent, enabling them to receive distraction-free instructions from the director over an in-ear monitor. The most dramatic benefit lies in the ease of coordinating communication across far distances. Even for distant productions (on the football field or in the gymnasium, for example), the Encore partyline can still be used since the wired beltpacks seamlessly operate several hundred feet from the main or remote station.



The Kiowa County Media Center employs a Clear-Com MS-702 Encore partyline main station in its control room.

Next generation

All programming produced by the center is transmitted through the Internet. Some content consists of live broadcasts streamed through the center's website. Other content is made up of pre-recorded pieces uploaded to the site. Whether it's sending out information or promoting local events, every second counts. In order to keep things running smoothly while making that happen, clear communication is key.

Clear-Com's intercom systems are remarkably clear and have provided full communications capability for all of the Kiowa County Media Center's production needs. Not only is it able to connect more than 3000 citizens to the pulse of breaking news, but it has made the distribution of information over broadcast easier than ever before. BE

Grant Neuhold is programming and technical producer for the Kiowa County Media Center.

Blackmagic Design's ATEM 1 M/E

Matchpoint Studios used the switcher for its coverage of the 2011 Presidency 5.

BY BOB ZELIN

Matchpoint Studios contracted me to build a new production system for the 2011 Presidency 5 Republican National Convention in Orlando, FL. The production and post-production company wanted a system that could be repurposed for future Republican conventions in the 2011-'12 season. After seeing Blackmagic Design's ATEM 1 M/E production switcher at NAB2011, I decided to make it the centerpiece of this new production system.

Blackmagic Design's ATEM 1 M/E can instantly ingest graphics and QuickTime files from the DVI output of a second Mac computer.

Configuration

The switcher comes as a thin, 2RU-high package. While an external control panel was included, my client wanted to keep costs down and opted to use the software interface. The switcher is configured and controlled with an Apple Mac computer. Communication between the computer and switcher relies on a USB connector and an Ethernet cable.

Once you set a static IP address for the switcher and a corresponding static IP address for the computer's Ethernet port, you are connected. It's that simple. A GUI of a switcher control panel instantly appears on the computer screen.

Based on the number of features the ATEM offers, I expected to find a 400-page manual. However, the switcher's manual comes in PDF format on a CD and is actually quite short. Being familiar with the complexity of other switchers, I was not looking forward to a long learning curve about the functions this switcher offered. And I did not want to read through another large manual. I was pleasantly surprised at how intuitive everything was. There were no hidden menus or functions that you could discover only by plowing through a large manual. All functions and controls are managed within control three tabs.

Once you set a static IP address for the switcher and corresponding static IP address for the computer's Ethernet port, you are connected. It's that simple.

Assigning crosspoint names is easy. Just click on the pictorial display, and type in a name. All the configuration is like this: Click, drag and drop.

Production features

One surprising feature about the switcher is its ability to instantly ingest graphics and QuickTime files from the DVI output of a second Mac computer. When we initially investigated the ATEM, we thought we'd need an external scan converter. To our surprise, all we had to do was use a DVI to HDMI cable to connect the graphic sources directly into an HDMI input of the switcher. Everything locked up instantly. Because all of the switcher's inputs have frame sync, everything instantly genlocks. There is no need to worry about timing or syncing various cameras and other sources — including free running computers — to the switcher.

The ATEM 1 M/E has eight inputs. Four are SDI/HD-SDI and four are HDMI, one of which is also component/composite. If you have more than four HD-SDI sources, you will need additional HD-SDI to HDMI converters. The switcher does not upconvert to HD-SDI, but it does offer a downconverted SD-SDI program output.

Also, when doing HD-SDI, you cannot crossconvert within the switcher. You must choose between a 1080i or 720p HD format. Conveniently, Blackmagic Design does offer an array of inexpensive up/down/crossconverters, as well as HDMI to HD-SDI, HD-SDI to HDMI, and analog CAV to HD-SDI converters.

The switcher takes in analog audio

and embeds this into the HD-SDI program stream. We simply connected the analog output of an audio mixer directly into the ATEM's analog audio inputs.

As we were setting up the switcher for the first time, we kept looking for things to not like about this product. But as we discovered, the device always offered a good solution to any issue. For instance, we discovered that we could use the computer's number keys to switch between cameras, eliminating the problems posed by the use of a mouse. Because we had only two motion clip players, we assumed that this configuration might be too slow for a live operation, because an operator would have to switch out of the main control panel and go to the clip player screen.

When we realized that this was a *networking* product, all we had to do was put the ATEM and several Mac computers on a simple network using an inexpensive Ethernet switch. Now, we were able to have an operator with an iMAC load lower thirds directly into the clip player, freeing the technical director from having to ever enter this screen while operating the switcher. We were also able to have the operator doing playback to cue up his own clips on an iMAC in QuickTime and play them across the network directly into the switcher.

The ATEM 1 M/E production switcher is as solid as any high-end professional video switcher. It's packed full of advanced features seen only in much more expensive products.

For transmission, we used another MAC Pro with a Blackmagic DeckLink SDI card to stream the video out to the internet. We used one of the AUX outputs of the ATEM to feed the Blackmagic card's SDI input. This switcher performed flawlessly during the actual production.

Having been around expensive production equipment my entire life, I was certainly apprehensive about a product this inexpensive and equipped with so many features. It seemed too good to be true. And even if it was true, it would probably be a cheap piece of junk that was not reliable. I was proven wrong on every account.

The ATEM 1 M/E production switcher is as solid as any high-end professional video switcher. It's packed full of advanced features seen only in much more expensive products. And, it is quite inexpensive. BE

Bob Zelin is a video engineer for Maxx Digital.

Haivision's HyperStream

Cloud-based live streaming removes the complexity and lowers the costs of multiplatform content delivery.

BY PETER FORMAN

The trend toward multiscreen content delivery is having a profound influence on the way people access, view and use media — fueled by the explosion of smartphones, tablet computers, Internet-connected TVs and streaming services for on-demand programming. Broadcasters realize that the era of linear distribution and traditional playout has passed. Now, they're eager to take advantage of emerging technologies that enable live OTT streaming of events such as sports, concerts and live pre-event, post-event and fan-oriented programming to the platforms that viewers demand.

Live event streaming to multiple platforms can present significant challenges. In many cases, on-location uplink bandwidth is severely limited, and preparing the multiple renditions needed for adaptive bit-rate streaming to each different type of mobile device requires additional investments additional investment in on-site encoding hardware, bandwidth and infrastructure. Haivision Network Video has addressed these challenges with its HyperStream Live cloud-based live video transcoding service, designed to reduce the cost and complexity of OTT multiplatform content delivery. The system automatically transcodes live video source streams into the many formats and data rates required to distribute live video via the Internet and deliver the streams to any screen regardless of device, player, screen size or bandwidth.

Cloud-based transcoding and delivery

HyperStream Live makes maximum use of limited uplink bandwidth, providing the equivalent of more than 30Mb/s of H.264 multibit-rate, multiplatform video streams from a single 2Mb/s source stream. In extreme situations, it is possible for broadcasters to stream high-quality multibit-rate, multiplatform video from the field with as little as 1Mb/s in available uplink bandwidth.

The system moves the task of transcoding the live stream to the cloud, where computing resources and bandwidth are abundant. At the event location, a video encoder is used to compress the source video to the highest quality RTMP or transport stream allowed by the uplink bandwidth and then deliver it to a HyperStream Live cloud transcoder. The service uses Haivision's KulaByte H.264 transcoder to turn the source stream into the multiple formats and bit rates needed for the required delivery platforms.

The cloud-based service then repackages the transcoded streams for delivery to the playback devices, freeing the on-site technician from the detailed setup. Finally, the system directs the output streams to a content delivery network (CDN). (See Figure 1.) For customers lacking video player expertise, HyperStream Live specialists can also provide player development.

The same software that drives the cloud service is also available in the KulaByte (KB) Transcoder, which can be implemented as software or as a turnkey transcoding server in the broadcaster's data center or on their own cloud-based account. This option is suited to organizations that would prefer to operate their own transcoding service internally or that have 24/7 transcoding requirements that make cloud services less economically attractive.

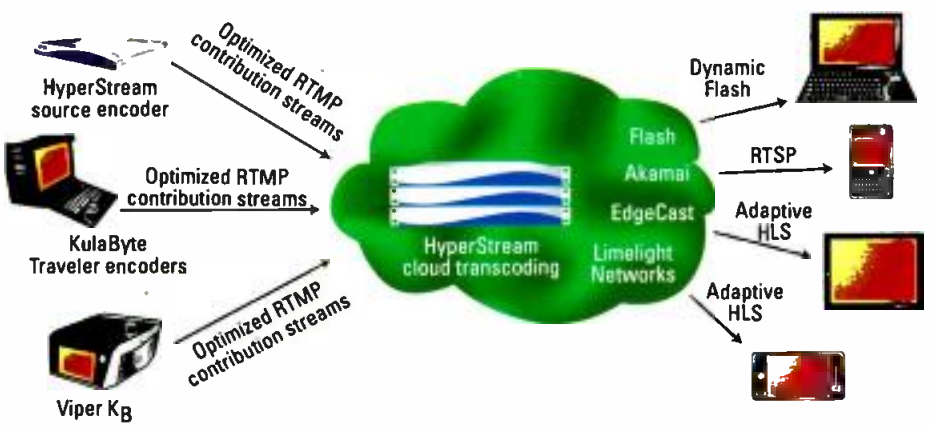


Figure 1. The Haivision HyperStream Live cloud transcoder can be set up to direct content to a tier 1 CDN or the customer's existing CDN.

Multiple delivery protocols and standards

The cloud service supports H.264 video and AAC audio compression, as well as Adobe's Flash (RTMP) and Apple HTTP Live Streaming (HLS) protocols. It is interoperable with any device supporting live Flash playback, including desktops, laptops and

mobile devices such as Android, and the Apple iPhone and iPad.

The cloud transcoder also is compatible with the most prevalent streaming servers in the Internet streaming ecosystem, including Flash Media Server from Adobe and Wowza Media Server from Wowza Media Systems. Likewise, it is compatible with top-tier content delivery networks, including Akamai, Limelight Networks, EdgeCast, StreamGuys, CloudFront and more.

Ease of configuration

The source encoder provides an easy-to-use graphical interface with preset selection, video preview, audio gain adjustment, local archive file chaptering control and status monitors. With sufficient workflow information up front, Haivision specialists can provide ready-to-run presets for the source encoder to simplify system setup. Using Haivision's Hydra software, the company's engineers or the broadcaster can operate both the source encoder and the cloud service (or the transcoding server option) remotely for testing, stream optimization, and to monitor and manage resources during an event.

Range of applications

HyperStream Live is based on Haivision's KulaByte encoding technology, in daily use by major broadcasters for highly challenging live sports coverage such as football, golf and auto racing, as well as for live events as varied the Nobel Peace Prize Awards from Oslo, the South by Southwest Music Festival, the Newport Folk Festival, the New Year's Phish concert series from Madison Square Garden and extreme sports throughout Europe.

Conclusion

With audiences increasingly consuming media on many different types of devices and networks, HyperStream Live and KulaByte Transcoders provide high-quality, reliable, multibit-rate output streams to the full range of playback devices, even from challenging low-bandwidth locations. The system gives content publishers a multibit-rate, multiplatform live video delivery system without the need to invest in expensive, dedicated encoder hardware and preprovisioned bandwidth. Finally, it significantly reduces the technical complexity of configuring and executing multibit-rate, multiplatform live online video streaming. BE

Peter Forman is vice president of the Internet Media Division at Haivision Network Video.

SGL's FlashNet

Ensuring content is protected and available is imperative.

BY HOWARD TWINE

The term "disaster recovery" is synonymous with the IT industry. It means the continuity of business processes following a catastrophic failure through natural disaster or human error. It has long been vital in our industry, too. The digitization of assets is a big commitment for broadcasters both financially and logistically, and disaster recovery processes are an essential part of this process. The complexities of disaster recovery techniques and technologies deployed vary depending on the size of the failure or potential failure. When the decision is made to move to a digital archive, how can broadcasters be sure that the stored material will still be available in the event of any technological meltdown?

Ensuring that material is always protected in the event of a failure of any size is imperative. SGL FlashNet's scalable architecture means that, regardless of the scope of disaster recovery requirements, the customer's valuable assets are protected, automatically. Rules-based implementations provide fully automated data duplication across multiple storage layers and locations. The disaster recovery system enables multisite operations to mirror and synchronize data across the globe. If one site becomes inoperative, it can be rebuilt entirely from data that has been replicated at other sites. This makes automated site redundancy a reality. (See Figure 1.)

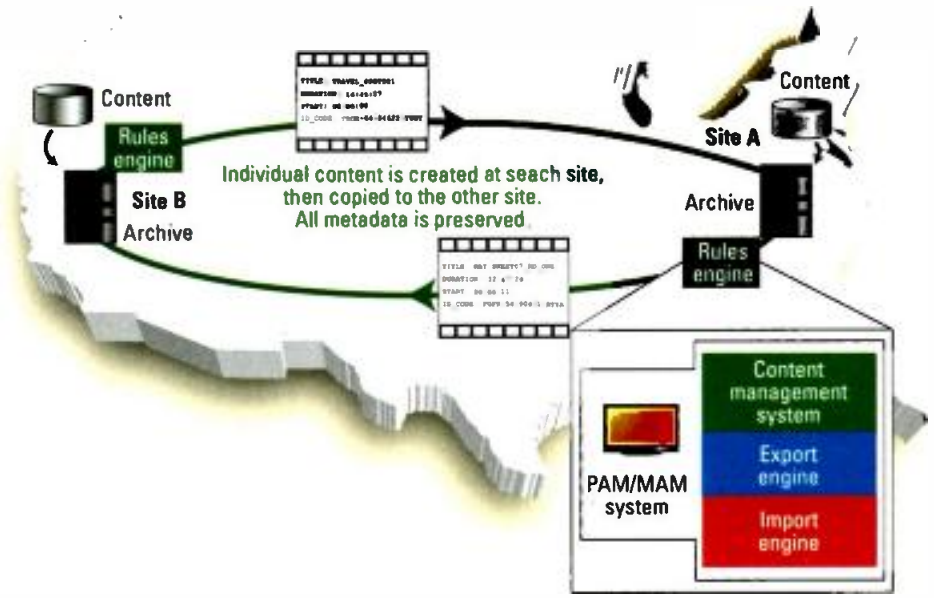


Figure 1. Rules-based implementations provide fully automated data duplication across multiple storage layers and locations. The disaster recovery system enables multisite operations to mirror and synchronize data across the globe.

If one site becomes inoperative, it can be rebuilt entirely from data that has been replicated at other sites. This makes automated site redundancy a reality.

How does a broadcaster take the first step into the disaster recovery process from an archive perspective? The execution of a failure mode effect analysis (FMEA) policy is imperative to analyze potential failure in small to large components from disk drive failure to complete denial of access, which equals site meltdown.

By looking at the systems around a FMEA, a structure can be put in place to counter failures, taking each component in turn. In the event of a small failure, a broadcaster can increase protection by adding more drives and RAID-protected servers. In the event of a large component failure, protection includes more than one tape library, redundant disk storage and an infrastructure that means that all applications aren't hosted on a single server, providing a distributed approach to controlling the software environment.

A broadcaster can also take a multisite distributed approach to its archive. Instead of putting all of its content in one site, distribute to multiple locations and link those sites together. In this instance, it's imperative to link the metadata with the content. It's all very well sending content to a remote site, but if the building that houses the core database is lost and all the assets are elsewhere, they're as good as useless.

Another option is to take a distributed approach to maintaining content across multiple sites. This scenario highlights a fundamental flaw because there's still one database at the center. So how do you protect the database? The answer is to build a clustered architecture around the database so that multiple host

servers are attached to the storage that holds the database. Secondly, provide RAID protection for the storage that holds the database and the database engines hosted on a clustered architecture. By taking this approach, the broadcaster also creates regular backups of its database as part of standard archive schedules.

The ultimate disaster recovery scenario would be to have two completely separate content management systems with their own archives at independent sites.

The ultimate disaster recovery scenario would be to have two completely separate content management systems with their own archives at independent sites. This then becomes intelligent disaster recovery, because the broadcaster can then set up rules engines at both sites that define which content is transferred between sites. This can, however, raise rights management issues with the transfer of content for disaster recovery purposes. In this case, it's important to define how and when the material is moved across. A model is evolving that will see content pushed in both directions, where site A is the redundant site for site B and vice versa.

Digitizing material and creating a digital workflow is just the start. Ensuring that material is always protected in the event of a failure of any size is imperative. SGL FlashNet is a scalable content storage management system available to the broadcast industry, and it provides resilience, flexibility and adaptability in tailored systems. Regardless of the installation size or environment. The system's clustered architecture and open system approach provide secure, future-proof systems that fit seamlessly. This multilevel protection is unique to SGL FlashNet, providing a completely secure storage environment. BE

Howard Twine is product manager, SGL.

Video storage technology

Metadata holds the key to reliable video recall.

BY JOHN LUFF

John Watkinson spoke at a SMPTE conference in New York a number of years ago. The conference featured many papers on the topic Computers and Television: Convergence or Collision. Watkinson's intellectual and thoughtful style and understated British manner were perfect for the topic. He described hierarchical storage, and asked the question, "If you get your video back without fail when you hit the play button, do you really care how it was stored?" Mark Schubin once referred to this same talk, saying, "In Watkinson's view, all recording should be done in non-specific 'bit buckets', with a computer figuring out what got recorded where and when." Does location matter? One might be tempted to answer yes or no depending on whether his or her "bent" is technology or operations.

To the operations person, the most important thing is that the record/play process is 100 percent reliable, 24/7. Anything less is simply inexcusable and will generate a request for a backup recording, or two perhaps. Other attributes may be important, such as stunt modes, play while record, proxy generation and perhaps compatibility with other parts of the production process.

To the technologist, the question is more complicated, as it always is. First, is the quality appropriate to the intended use? Second, is the hardware and software reliable and understandable so it can be fixed if necessary? Third, are transcoding steps necessary to use the content? Fourth, does the storage system interface with other hardware and software systems in place? And there are perhaps many more equally important questions.

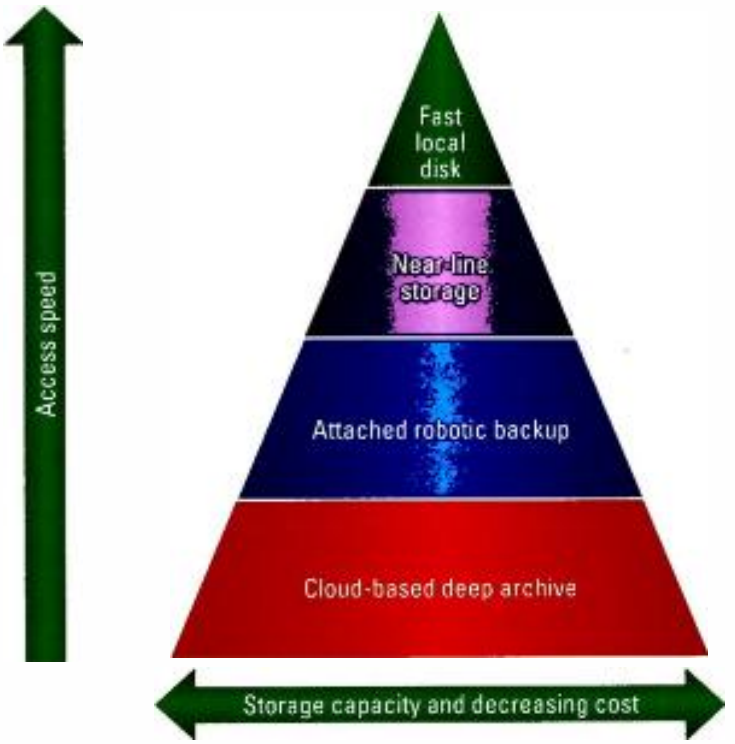


Figure 1. Metadata can provide details about where and what content is and how to get it back once it is sent to a new storage location, whether that new location is in an underground mine or on a spinning disk next door.

But today the most critical questions are rather simple. Is the content preserved and replayed appropriately, and is the metadata describing the structure of the essence (content) and the descriptive metadata related to the content preserved and made usable in the future? I believe Watkinson was absolutely correct in asking if one even cares where it is recorded. In a networked environment, the location of the content is a rather abstract concept anyway. At the deepest level, of course we care about the process of storage and retrieval, but at the operational layer, it is much more important to have access to the existing metadata, and equally important to be able to add or modify descriptive metadata at will.

"If you get your video back without fail when you hit the play button, do you really care how it was stored?" — John Watkinson

In fundamental ways, this is a new model of which some in the industry are not fully aware. Today, delivering content most often means delivering files. Although it is possible to put the file on physical media to transport it to a new system remotely or locally, more often the content (essence and metadata) is passed over a network to the next process, or storage location. That physical media is a second instance of the content, a clone. It is indistinguishable from the original content, which of course necessitates that a management layer know where the instances live. Media asset management and archive management software can be the repository of the tags that are attached to each instance, allowing intelligent content control. One needs to know where content is, what it is in full detail, and by implication how to get it back once it is sent to a new storage location.

That new storage location might be an off-site deep archive of data tapes (LTO or other format), or it might be simply a spinning disk in the next room. (See Figure 1.) Watkinson would say it doesn't matter, if a user asks to play the content and it seamlessly plays at the time requested. If the advance warning of playback requirements is received minutes before air, a tape stored in a mine is of little value. But Watkinson was alluding to a scenario in which users might have the first 10 minutes of the content cached in a location immediately available, but a request has to be issued to a connected archive to retrieve the rest while the cache is playing to air. As long as the playout does not run out of content before the archive is restored to an appropriate playout location, it really is immaterial where each of the bits of essence were located before they were sent to air.

I prefer to think of this as virtual storage rather than hierarchical. Virtual because from the output spigot it looks like a single playout pool, and the physical nature of the processes is abstracted and kept out of view from the playout application. The recording process thus can be arbitrarily complex and obtuse, and yet the users will not know or care.

Increasingly, the metadata has taken on particular importance. The structural metadata describes the essence's physical makeup (compression standard, sampling grid, frame rate, number of audio channels and how they are coded, SMPTE UMID, etc.). Structural metadata is often taken for granted, but without it often the content cannot be decoded without considerable sleuthing and reconstruction of the missing structural metadata. Most often carried in the recorded header of a file, it is quite limited in size.

Descriptive metadata can be arbitrarily expansive and often contains things such as title, episode, ISBN/AdID/ISCI/ISO registration tags, digital rights management information, and even extensive information such as script information and full text translation of the content. In many cases, the intent is to be able to modify descriptive metadata, or add/delete individual descriptors. This rich source of information about the file can be contained in the file itself, or carried in a "side car" file, using the registration tag (or SMPTE UMID) as the reference tying the essence and metadata together.

Though I have ignored removable media used in ENG and production venues, all of the above applies to any essence recorded as a file, which is to say the vast majority of the output of all modern recording technologies. The broadcast industry has become dependent on the "essence/metadata" paradigm precisely because it allows abstracting the recording technology from the use of the content, enabling features we would have loved to have 30 years ago. I remember searching on a shelf for a missing tape while editing "The Johnny Cash Show" 40 years ago — because the metadata on a 3in by 5in card was illegible. That makes me appreciate the stunning improvements in recording technology. BE

John Luff is a television technology consultant.

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

Volicon — Observer Enterprise 6.0

Video content logging and monitoring system has been enhanced with the same transport-stream logging capability as the Observer TS; this gives broadcasters, networks and cable operators the ability to handle MPEG-2 and MPEG-4 transport streams natively as high-resolution streams, or efficiently over the WAN as low-res proxies, while retaining the content and associated metadata within the stream; additional updates include new loudness-monitoring capabilities, as well as support for CEA-608/708 closed-captioning data within the transport stream.

www.volicon.com

Audio-Technica — AT2005USB

Cardioid dynamic handheld microphone has both USB and XLR connections; features a durable metal construction and a headphone output with volume control that allows users to monitor the audio signal right from the microphone; USB operation is compatible with both Windows- and Mac-based hardware and software; cardioid polar pattern reduces pickup of unwanted sounds from the sides and rear; its low-mass diaphragm and smooth, extended frequency response make the mic ideal for applications such as field recording, voiceover and live performance.

www.audio-technica.com

DiGiCo Solutions — UB MADI

Allows any computer to instantly connect to MADI via a USB 2.0 connector; uses the latest Stealth Digital Processing FPGA technology from the company's SD range of consoles; fits into the user's pocket; delivers 48 simultaneous inputs and outputs, totaling 96 channels of audio I/O over USB 2.0; once the low latency driver is installed, the unit is a simple plug-and-play device, automatically detecting the MADI input format and clock selection; the unit then communicates with the user's preferred PC or Mac as a standard ASIO or Core Audio interface; requires just a single USB cable, providing both audio and power connectivity.

www.digico.org

Digital Alert Systems — R198

Multichannel AES switch/converter converts an incoming analog source to digital AES audio and distributes it to four different AES switches; enables users to convert a stereo analog signal into AES and seamlessly switch it in and out of four other AES program streams; ideal for older Emergency Alert Systems without native AES support and for facilities looking to add digital program streams; housed in a 1RU chassis; features a built-in Web server and therefore can be configured and operated from any standard Web browser on any standard platform.

www.digitalalertsystems.com

Grass Valley — EDIUS 6.06

Latest version of the multiformat nonlinear editing software includes new hardware drivers that provide support for 1080 50p/60p projects on the Grass Valley HDSPARK, HDSPARK Pro and STORM Mobile editing platforms, as well as video output in the 1080 50i/60i format; improved workflow gives P2 camera/source deck users the ability within EDIUS to create waveform files in a project folder and delay creating waveform cache files until required; additional enhancements include improved compatibility with XDCAM MXF files stored on SxS solid-state memory cards and support for Sony's XDCAM STATION with the latest XDS firmware (1.14) upgrade.

www.grassvalley.com

Gepco International — RunONE

Powered speaker cables enable users to run a single cable in place of multiple cables; each cable combines one channel of power with two, eight or 12 channels of 110Ω balanced audio for line level, mic level or digital AES audio signals; can be used with self-powered speakers or in DMX lighting control; additional configurations include two channels of Cat 5e cable that can be used for data drops in remote power or audio applications; snakes with optional data can be used for digital audio transmission while running power to Front of House for remote locations.

www.gepco.com

Litepanels — Croma

LED light is a compact, portable fixture that's designed for users who move rapidly from one light environment to the next without time to change equipment; camera-mounted unit provides infinite control of both color temperature and lighting intensity via two ergonomic on-fixture dials; one offers the ability to dim from 100 percent to zero percent with no noticeable color shift, while the other lets users dial-in the fill light to any point between daylight (5600K) and tungsten (3200K) to precisely match the ambient light; draws 9W, and provides the equivalent luminance output of 40W to 90W traditional fixtures.

www.litepanels.com

Yamaha — DXR series

Range of active loudspeakers consists of four models: the DXR8, DXR10, DXR12 and DXR15; designed to deliver high-definition sound in a more compact, versatile design; includes high-efficiency 1100W Class-D amplifiers and Yamaha-mastered DSP, as well as an intelligent on-board mixer with flexible in/out connectivity; features a three-channel signal input on the speaker's back panel, enabling end users to mix their own settings; also offers a mixing/link function for daisy-chaining additional powered speakers.

www.yamahaca.com

Eyeheight LE-3D

Stereoscopic 3-D video legalizer allows legalization parameters for left and right video channels to be adjusted from a single operating panel to ensure precise compliance; user-adjustable settings include RGB, YUV or composite mode selection, as well as clipping level, soft clipping knee, luma and chroma gain, black level, and hue rotation; six user memories are available to store group settings; has two independent HD-SDI inputs and outputs; processing is to full 10-bit depth throughout.

www.eyeheight.com

Vaddio ProductionVIEW HD MV

All-in-one camera control console has been enhanced with multiview input screens and dual bus multiview outputs; new Multi-View Input Screens allow users to select between screen layouts that display four, five or six inputs, along with Preview/Program outputs and video thumbnail presets; with TeleTouch touchscreen monitors, all live feeds can be accessed, and up to 12 video thumbnails presets can be created, recalled and stored simply by touching the monitor; Dual Bus Multiview output allows users to switch the Preview and Program buses as discrete outputs — with one output going to an IMAG projector and the other going to a recording device.

www.vaddio.com

Sonnet Technologies Qio ES

Three-slot SxS memory card reader includes an integrated two-port 6Gb/s eSATA interface for connecting external storage systems; doubles as a bus expansion system for ExpressCard/34 adapter cards; provides users with the ability to transfer data concurrently from three SxS memory cards for Sony XDCAM EX professional HD camcorders; users can copy files between any cards, attached storage and the computer with aggregate bandwidth of up to 400MB/s, with an aggregate ingest speed for three SxS cards of 300MB/s; designed for both in-studio and on-location use.

www.sonnettech.com

DK-Technologies DK Meter

Compact Audio Loudness Meter (CALM) has been upgraded with new software (V.2011-12-06), designed to enhance the user experience and improve the meter's performance; meter is no bigger than a smartphone; comes in two versions — the stereo DK1 and the 5.1 surround sound DK2; ideal for location recording as both versions are engineered to be easy to use and easy to install, and can be powered from a computer USB port; accept digital inputs; are supplied with all known loudness measurement recommendations, as well as the standard DK-Technologies meter scales.

www.dk-technologies.com

Sonifex RB-VHDDD8

Dolby E and Dolby Digital decoder and de-embedder de-embeds 16 channels of audio within any audio group of an SDI video signal and a further two, which are sent to the Dolby decoder; up to 10 channels from the decoder or any of the 16 channels from the de-embedder can then be re-embedded onto either of the two SDI outputs and also transmitted on a BNC or D-type situated on the rear panel.

www.sonifex.co.uk

Sennheiser XS Wireless series

Series consists of two vocal sets, an instrument system and presentation sets with clip-on microphone or a head mic; designed for users who want to easily go wireless; transmitters have a battery life of up to 10 hours, while a switching bandwidth of up to 24MHz allows for flexibility in the choice of frequencies; systems are operated via intuitive menus; they automatically search for free frequencies, and transmitters are synchronized with their receivers via a wireless link.

www.sennheiser.com

DVS Pronto4K

Disk recorder allows compressed or uncompressed material from HD to 4K resolution to be played out, as well as compressed or uncompressed SD, HD and 2K material to be captured in real time; content is played out via one HDMI 1.4a or four HDMI 1.3 interfaces; stereoscopic material can be played out via one HDMI 1.4a, two HDMI 1.3 or two 3Gb/s SDI interfaces; supports uncompressed as well as compressed formats such as MPEG, DVCPRO, AVC-Intra, XDCAM and DNxHD.

www.dvs.de

Auralex ProMAX Panels

Stand-mounted, portable StudioFoam absorbers are designed as a lightweight yet effective absorption treatment for run-and-gun recording and performance applications such as live events and temporary recording; can be used in any location where mounting acoustical treatments to the wall are not possible or ideal; panels can be grouped together to form a portable vocal booth on the fly; can also be positioned around a drum kit to tune room sounds in recordings and live performance venues; able to extend up to 8ft high.

www.auralex.com

Archion EditStor ES

Shared storage system now provides Avid project sharing, enabling complete collaboration between multiple Avid editors simultaneously working on the same open project; other features include on-the-fly volume expansion without interruption, high-performance 10GigE to support demanding file types, hot scalable storage that enables expansion without shutting down, and a user-friendly administrator console that offers simple management.

www.archion.com

Sencore VB330

Web-based probe for monitoring and troubleshooting 10GbE IP networks in large cable, IPTV and satellite broadcast chains; can be equipped with up to two 10GB Ethernet inputs, providing the ability to monitor thousands of IP streams in central headends and architectures; features a patented, easy-to-use visual interface for measuring and monitoring IP signals throughout the network; can be controlled directly via a standard Web browser or by a VideoBRIDGE controller system.

www.sencore.com

Vela ArgoNavis Universal Encoder

Encoder comes in a 1.5RU form; supports HD MPEG-4 H.264 and MPEG-2 encoding in real time at 1920 x 1080i and 1280 x 720p resolutions at both NTSC and PAL frame rates, and 1920 x 1080p encoding at the Cinmea/Blu-ray frame rate; offers a full range of input/output options, including analog (composite, component, audio) and HDMI only, or HD/SD-SDI only, or fully configured analog, HD/SD-SDI and HDMI options; supports 608/708 CC capture from VANC or Line 21 CC from analog VBI.

www.vela.com

JVC GY-HMQ10

Handheld 4K camcorder captures, records and plays video images at four times the resolution of high-definition television; powered by JVC's Falconbird large-scale integration chip for high-speed signal processing and a 1/2in CMOS imager with 8.3 million active pixels; delivers real-time 3840 x 2160 footage at 24p, 50p or 60p; using MPEG-4 technology and a variable bit rate H.264 codec operating at up to 144Mb/s, the unit records up to two hours of 4K video to economical SDHC or SDXC memory cards.

http://pro.jvc.com

Cel-Soft Reel-Check Solo-QC

Multi-mode broadcast signal analyzer enables a complete set of quality-control tests to be performed on live or file-based video and audio; compatible with all signal standards and media file types in common use; can perform automatic checking of ingested or finished file content on local or networked drives; users can preset a table of test parameters and tolerances; any excursions outside these defined limits are automatically logged with associated timecodes and details; a thumbnail image generated at the time of detected events can be inserted in an easy-to-read RTF log.

www.cel-soft.com

EditShare EditShare Ark V2.1.3.2

New release of backup and archiving system features an enhanced user interface that displays extensive information about Ark system activity support for additional tape loaders, as well as more options for configuring network interfaces to maximize performance across the EditShare tiered storage platform; adds Quantum Superloader 3, Scalar i40 and i80 solutions, Spectra Logic Spectra T50e and PowerVault 124T Tape Autoloader to its list of supported tape libraries.

www.editshare.com

Small Tree GraniteSTOR Titanium

Ethernet-based shared storage system is configurable up to 14GbE ports or eight 10GbE ports; offers a storage capacity from 16TB to 48TB; storage, file server and networking are all contained within the chassis, so users can connect an editing workstation directly to the system with no other networking equipment required; ideal for post-production environments; supports editing software such as Final Cut Pro, Avid Media Composer, Adobe Premiere and Adobe After Effects, while enabling Windows, Linux, Unix and Macintosh clients to share media files.

www.small-tree.com

TV One C3-540

CORIO master video system incorporates CORIO 3 technology, which offers features such as Simultaneous Multiple Image Processing, Real-time, 360° Rotation (independent for all PIPs and outputs) and Image Warping to allow off-axis and curved screen protection; allows a single product to do the work that was previously done by several pieces of equipment, such as routers, seamless switchers, multiviewers and video wall processors; has 16 Universal AV Module slots available; automatically recognizes the modules inserted as either input or output modules; this allows up to 32 I/Os, and since there are no dedicated input or output slots when using two-channel DVI-U or 3G-SDI modules, configurations can range from 30 x 2 to 2 x 30, and anything in between.

www.tvone.com

Belden Brilliance Audio Snake Cables

Additions to the product line include three cable series — waterblocked, plenum and Banana Peel constructions; waterblocked series consists of six standard product codes with constructions ranging from one to 12 pairs and are suitable for direct burial; plenum series consists of nine product codes, including the recent additions of four-, six-, eight- and 12-pair constructions with an overall jacket; Banana Peel series includes two-, four- and six-pair audio snake cables, which are easy-to-install composite cables; each series features a foil shield that is bonded to the jacket, which is designed to maintain high performance while improving ease of termination.

www.belden.com

never.no Synchronized Companion App Framework

Newest feature of the company's Interactivity Suite (IS) is designed to make it easy for broadcasters to develop distinctive, branded applications that push/pull information or media relevant to real-time TV broadcasts to a second screen, such as a tablet, smartphone or PC; monitors frame-by-frame changes in broadcast programming or live production; uses the changes to trigger delivery of relevant content to the second screen.

www.never.no

Career Opportunities

WALB (TV), *Raycom Media's NBC station serving Albany, GA,* is seeking an experienced television engineering management professional to join its staff as Chief Engineer. The successful candidate will need to be a hands-on leader possessing strong skills in all areas of digital broadcast maintenance, including transmitter operations, news/studio/master control functions, Internet/mobile platforms, station infrastructure and design as well as building management.

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Broadcast Engineering, February 2012, Vol. 54, No. 2 (ISSN 0007-1994) is published monthly and mailed free to qualified persons by Penton Media, Inc. 9800 Metcalf Ave., Overland Park, KS 66212-2216. Periodicals postage paid at Shawnee Mission, KS, and additional mailing offices. Canadian Post Publications Mail Agreement No. 40612608. Canada return address: Bleuchip International, P.O. Box 25542, London, ON N6C 6B2. POSTMASTER: Send address changes to Broadcast Engineering, P.O. Box 2100, Skokie, IL 60076-7800 USA. CORRESPONDENCE: Editorial and Advertising: 9800 Metcalf, Overland Park, KS 66212-2216 Phone: 913-341-1300; Edit. fax: 913-967-1905. Advert. fax: 913-967-1904.

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Marginalization

This is the first step toward your extinction.

BY ANTHONY R. GARGANO

Countries, and the robustness of their economies, rise and fall on the basis of fiscal policies. All too often, those policies are dictated by the latest theories for economic well-being. Another key driver of the economic growth engine is telecommunications policy, which can also be a measure of a country's technological leadership. But, telecoms policy, too, can fall victim to flavor-of-the-day thinking. One of today's benchmarks in evaluating a country's position of technological well-being is its level of broadband infrastructure and penetration of its population's access to high-speed Internet. Thus, we find current telecoms policy in the United States is being strictly driven by Internet access.

With a birthplace at the European Organization for Nuclear Research (CERN) laboratories in Switzerland, despite its European roots, it was in the United States where the World Wide Web was nurtured and developed into the interactive information, entertainment and commerce resource that totally revolutionized all aspects of life as we know it. However, ironically enough, it is access to broadband resources where the United States lags behind. China, France, Germany, Japan, Korea, the Netherlands and the United Kingdom all surpass the United States in percentage of the population having broadband access.

Recognizing the critical importance of this gap, the Obama administration set out a policy and established goals aimed at maximizing the availability of broadband access across America from inner cities to rural America. The policy is laudable, but not in its absolutely single-minded focus. It has been through this policy that, as broadcasters, we have witnessed a spectrum grab onslaught that can only be compared to the firing of cannons at noon on that September day in 1893 that launched the greatest land rush in our history. And, like those "Sooners" in Oklahoma who took unfair advantage of the "Boomers" who actually waited for the cannon blast, the U.S. wireless industry is taking unfair advantage by laying claim to broadcasters' spectrum under the banner of advancing this administration's telecoms policy.

The wolf is at the door, and the industry continues to fiddle while the spectrum burns.

The broadcast industry is past the point of needing a wake-up call. The wolf is at the door, and the industry continues to fiddle while the spectrum burns. As I previously wrote months ago on these pages, the television broadcast industry continues down a dangerous path, woefully impotent in fighting the spectrum grab. Is this a fight to the death? No, it is a fight to marginalize you — to reduce your value to advertisers and content providers. The loss of spectrum and the attempt to repack over-the-air delivery represents a diminution in the ability to reach audience and to develop new services. That, in turn, directly impacts ad dollars and competition for program distribution.

So, why is no one leading the charge? Why are individual broadcasters not using their inherent outreach resource to meet this challenge? There is ammunition aplenty. Despite the battle for eyeballs with viewer temptations of movie rentals, video games and computer screens filled with web browsing and social networking pages, television viewing continues apace.

In its recently released 51st Annual Television Audience Report, Nielsen reported that, once again, total television viewing per household increased during the 2010-2011 season, this time to an average of 34 hours and 12 minutes — up from 34 hours and 1 minute the previous viewing season. Interestingly enough, 10 years ago when there were fewer distractions, and with much less competition for viewers, average weekly television viewing stood at 28 hours and 7 minutes. You owe it to yourself to view the report, which can be found online at Nielsen's web site. It shows continuing, year-on-year growth of television viewing, up by almost 25 percent over the past 10 years. And remember, the interesting consideration is that this was all during a period of unprecedented digital technology development and new products introduced and designed to compete for viewer attention.

2012 is a year of positive convergence for the broadcaster. Quadrennially, when both an Olympics year and a presidential election year come together, they bring additional, extensive, viewing time and advertising dollars. Broadcasters should take advantage of those additional viewers and that extra revenue to drive home the message of risk and drive viewers to action. This needs to happen, broadcasters, in order to avoid your marginalization, which is the first step toward extinction. BE

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

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

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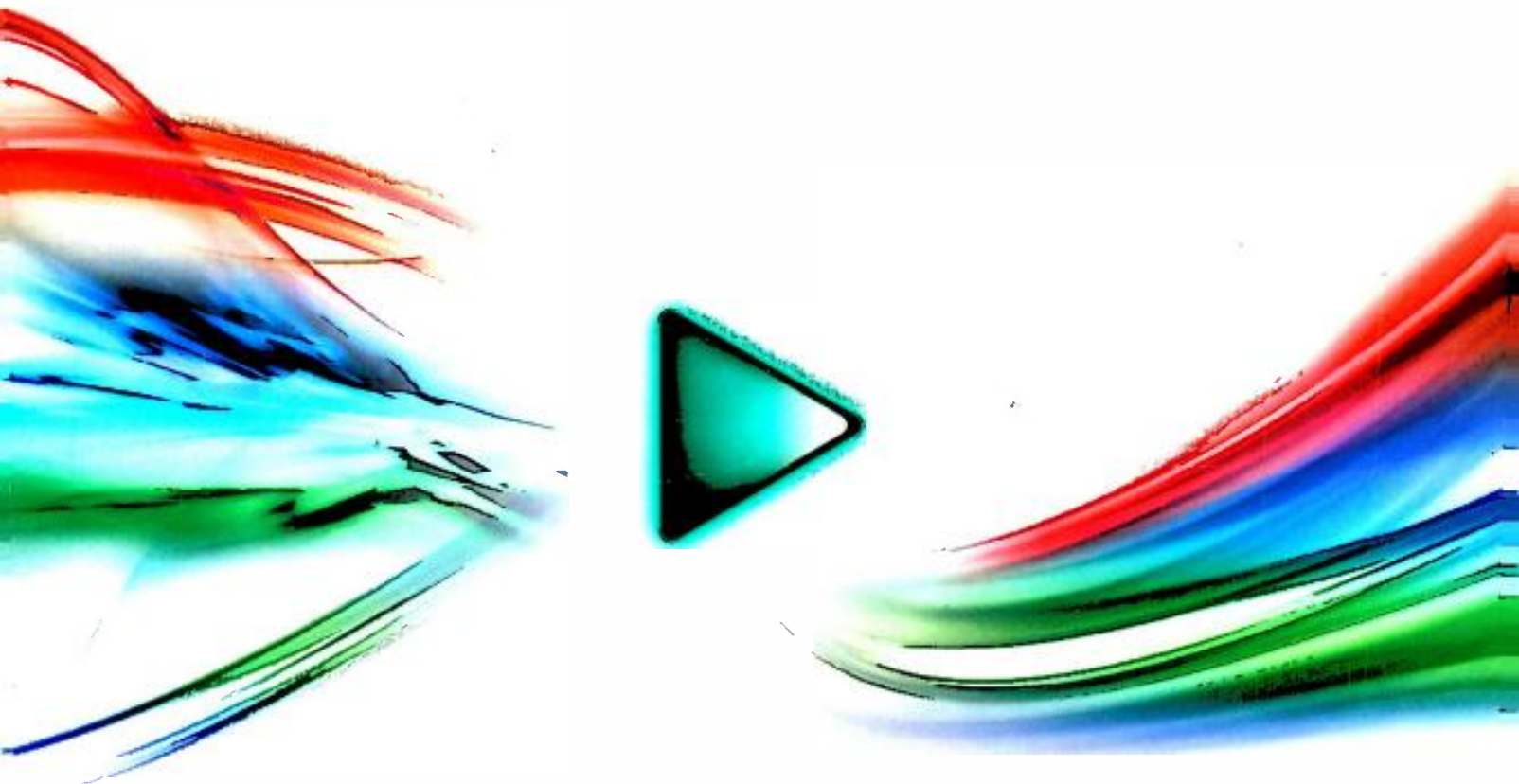

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