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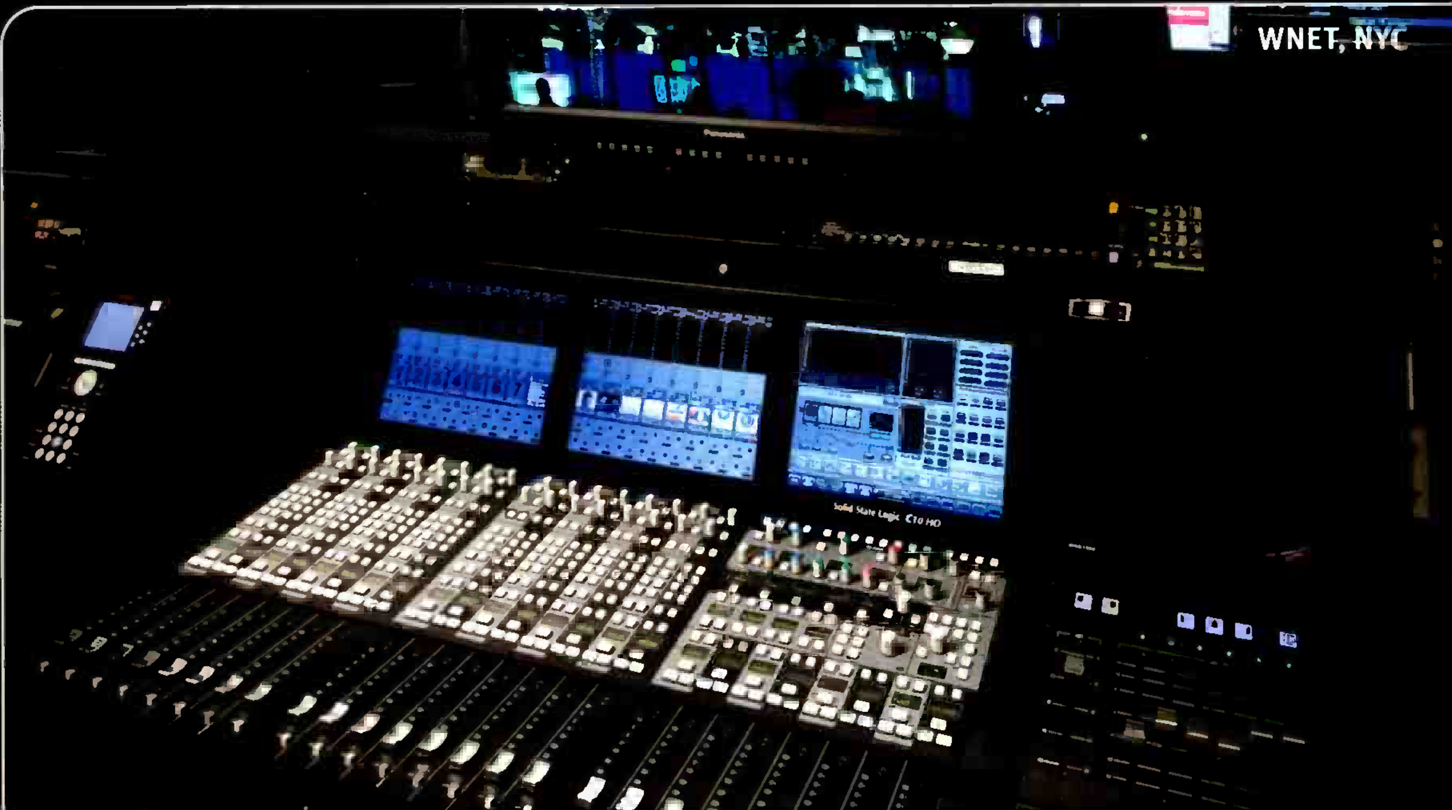

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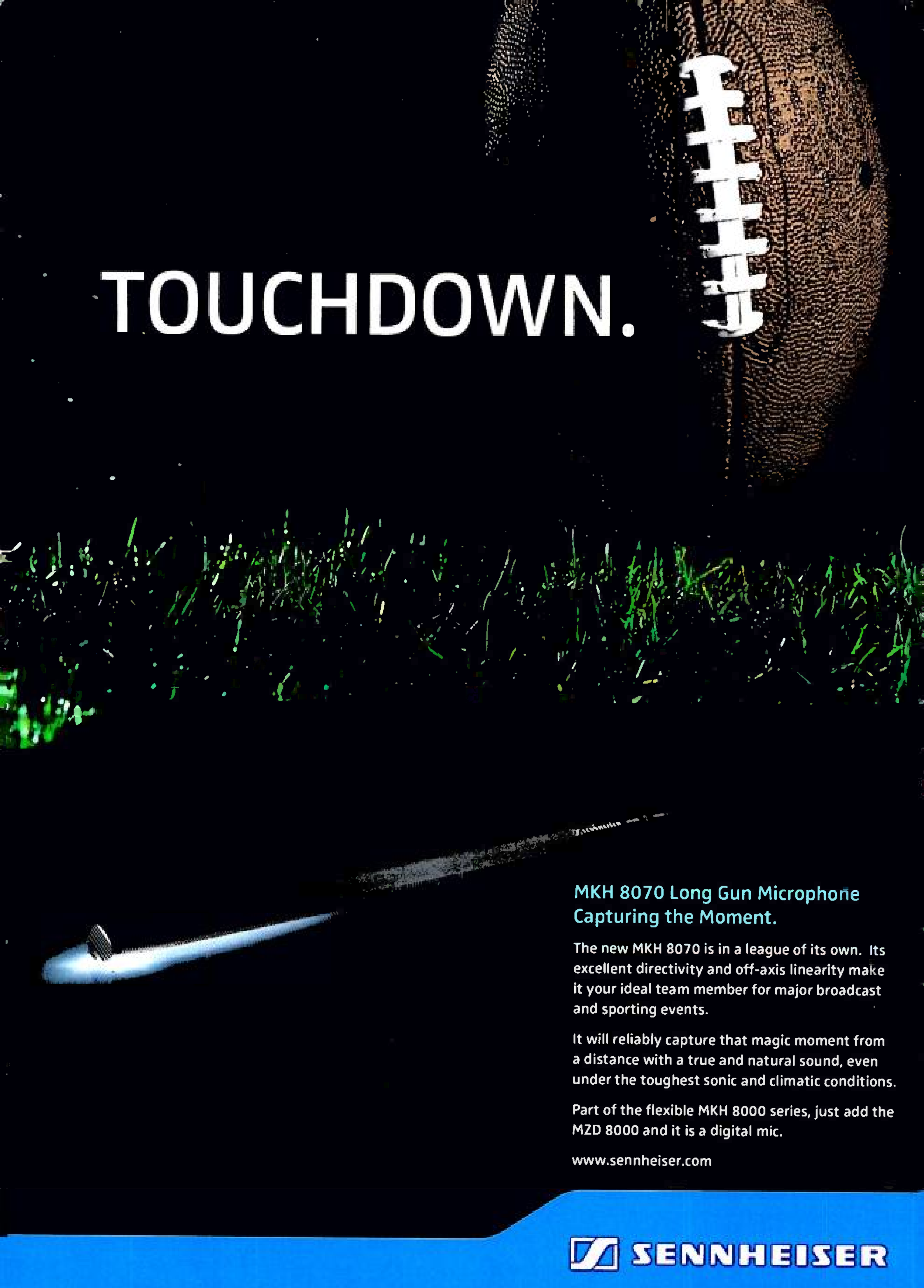

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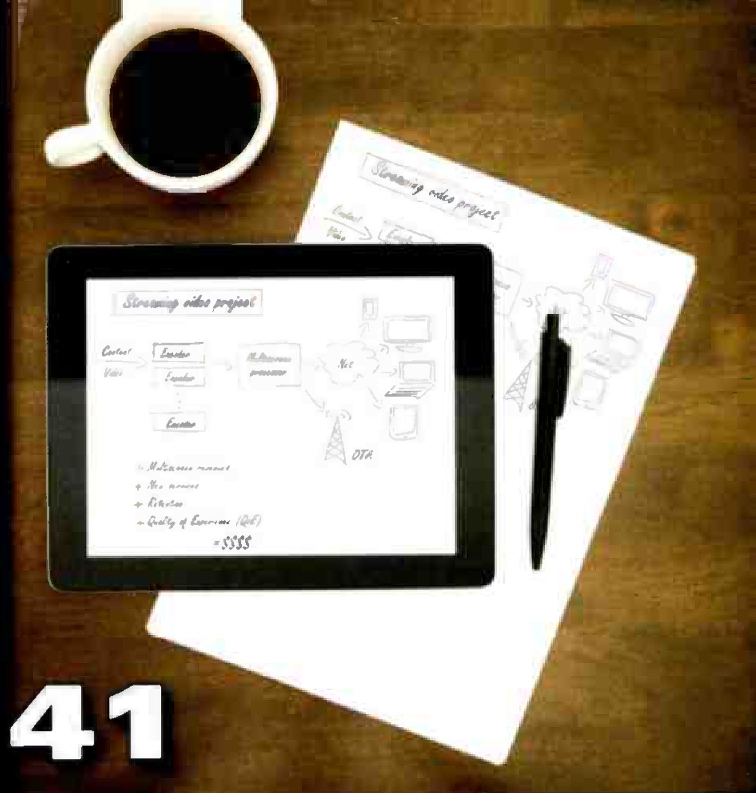

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A streaming video project has many variables, but the monetary equation's root is video quality.

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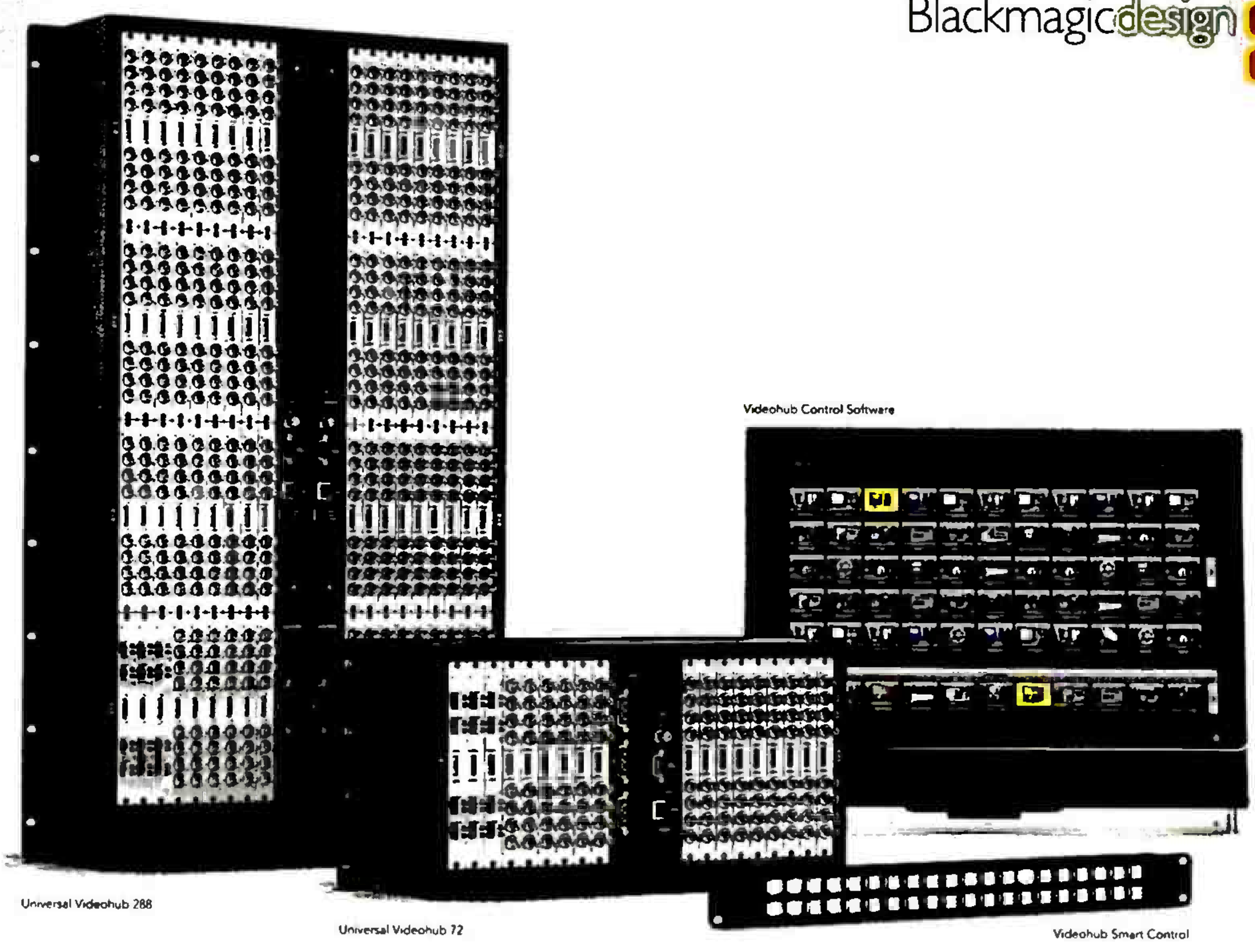

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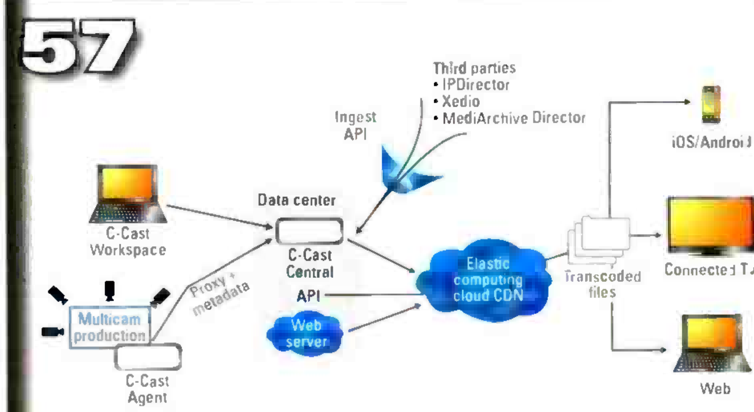

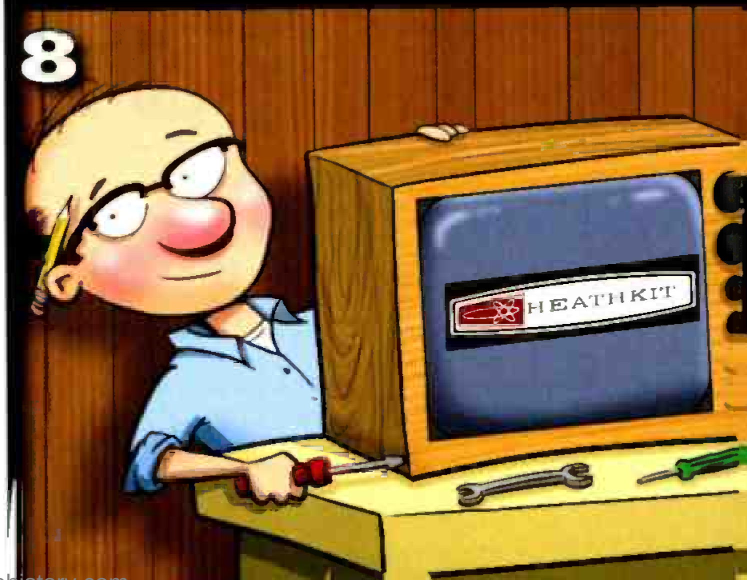

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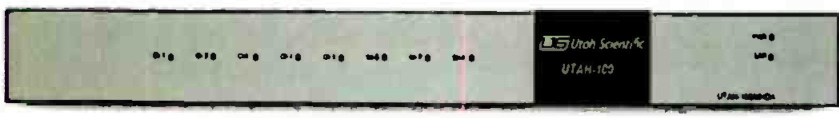
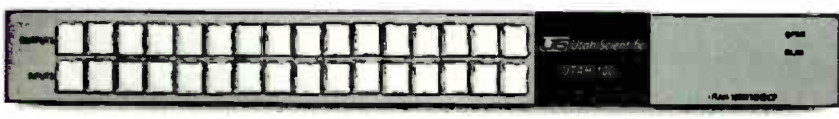


The **UTAH-100/XHDA** is a 3G-capable High Definition Distribution Amplifier with a big difference. It has 8 amplifier blocks, each of which can be programmed by the internal web interface to serve 2, 4, 6 or 8 outputs.

This unmatched flexibility makes it perfect for mobile systems, allowing a single unit to replace racks of DAs.



The UTAH-100 family offers a wide selection of routers in all signal formats in sizes from 8x8 to 32x32 with standard built-in web control and options for built-in or remote control panels, third-party control interfaces, redundant power supplies.

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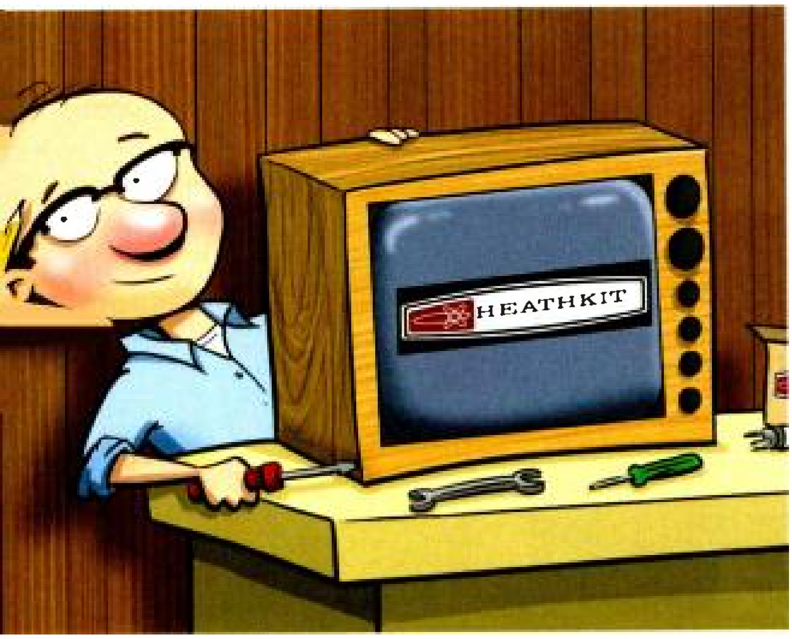
Heathkit closes its doors

I was sad to learn in early May that the venerable company Heathkit had closed its doors. I'll bet there are tens of thousands of *Broadcast Engineering* readers who cut their technology teeth on Heathkit products.

Heathkit, and fellow electronics kit makers like Allied Knight Kit and Lafayette Radio, produced a range of products focused on allowing people to build their own equipment. The kits, at one time, ran the gamut of audio, video, test and measurement, amateur radio, television, and other household items. These companies were responsible for introducing two generations of audiophiles, ham radio operators and general all-around tinkerers to the world of build-your-own electronics.



The premise was that a person could build something themselves, save factory labor, and end up with a higher-performing product. An additional benefit for some was the valuable electronics knowledge learned in the process. For several decades, that manufacturing model held true.

One of the most sophisticated Heathkit products was a color television. In fact, in May 2001, *Broadcast Engineering* reader Doyle Hill wrote me saying his father had purchased a Heathkit GR-2000 25in color TV in 1976, but never assembled it. For years, the kit remained in its original boxes. He asked me to publicize that he would like to give the kit to someone who would be willing to assemble and use it. Reader Ray Carlton took on that challenge, and he assembled the 25-year old television kit by December.

"I wish I could afford a Plexiglas cabinet, so I could admire its innards full-time," Carlton said.

Carlton's comment illustrates the pride kit builders typically felt about their completed projects. Sure, someone could buy a stereo amplifier, but it took time and skill to assemble a Heathkit AA141 amplifier with dual push-pull EL84 tubes in each output channel.

I too assembled a range of electronic kits. I trace my electronic roots to projects including Knight Kit ham radio receivers and transmitters. In addition, I built a wide range of Heathkit test equipment, including a VTVM, tube checker, digital frequency counters, DVM, audio and TV signal sources, and a vectorscope. I still own much of that equipment, and it all still worked at last check.

However, the era of LSIs, multi-layer circuit boards and, most importantly, cheap and efficient foreign labor brought an end to saving money through kit building. Soon, it was cheaper to buy electronics from Radio Shack, Best Buy or dozens of other box houses than to build it yourself.

Additionally, much of today's equipment is software-based. See last month's editorial on this year's NAB exhibition. Although some companies touted new products, those announcements were often little more than software upgrades. The line between a new and upgraded product continues to blur.

While the companies mentioned at the beginning of this column have disappeared, so too have many storied names from inside these pages. Do you remember these firms: Ampex, Bosch, ITC, Leitch, Pluto, RCA or Vital? What other names could you add to this list?

While many *Broadcast Engineering* readers will be sad to learn of Heathkit's demise, we can take solace in that new suppliers and vendors always will spring forth and flower, if even for a brief time, like summer dandelions. BE

Brad Dick

EDITORIAL DIRECTOR

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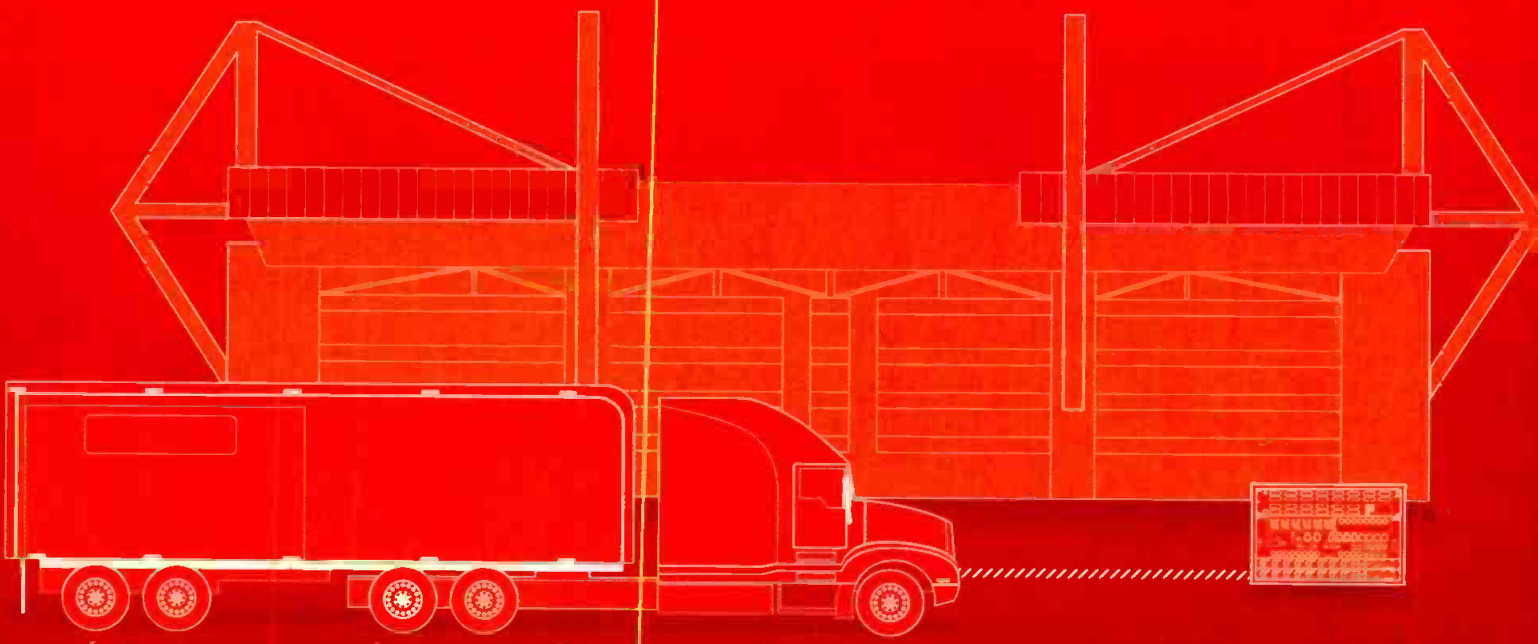

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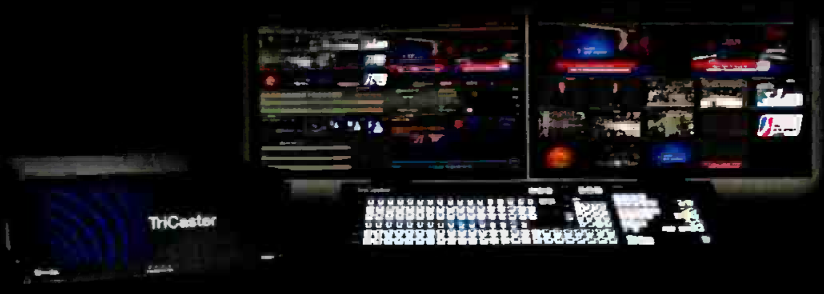

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Router evolution

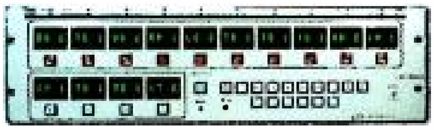
System requirements are keeping pace with changing signals.

BY SCOTT BOSEN

Routing switchers are a common element in a wide variety of television production and distribution systems. They provide an efficient, reliable and economical means of connecting signal source devices to the destinations where the signals are used. As the industry has evolved over recent years, from analog through digital and now to HD and higher-resolution systems, routing systems' operating requirements have undergone a similar evolution.

History

Early routing systems essentially were blocks of single-bus switchers tied together to take advantage of a common set of inputs. Control generally was limited to a row of pushbuttons for each output. As systems grew in size from 30 or 40 inputs all the way to 60 or more, it became impractical to continue adding buttons to the control panels. That is when numeric addressing came into use. Operators keyed a source number on a keypad to select the desired source. With the introduction of addressing, it also became practical to create a control panel that allowed operators to select sources and destinations, giving rise to the variety of multibus and full-matrix control panels designed as central router control points for use in studios and master control rooms.



Early systems were built primarily to take advantage of a common set of inputs.

The next big advance in user interfaces for routing systems came with the introduction of alphanumeric displays that could present source and destination labels to the operator, eliminating the need for the paper "look-up tables" always taped to the rack next to the numeric panels. A control panel with alphanumeric displays made it easy for non-expert operators to control the router, greatly extending the routing system's utility in streamlining the facility's operations.

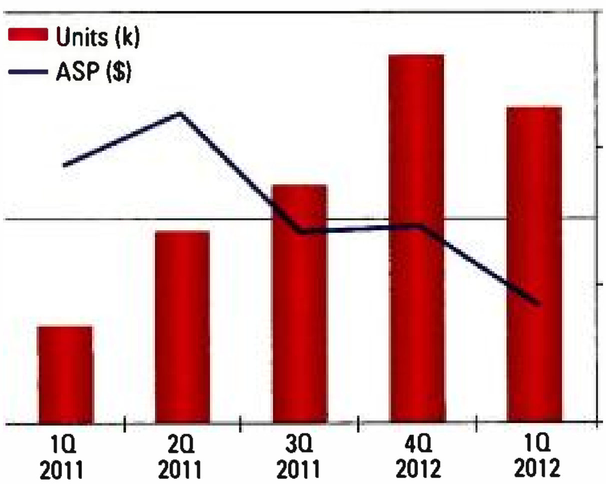
Today's router control systems still largely depend on the operational practices developed in the early days of alphanumeric addressing. Because the control panels had a limited number of keys available, labeling systems were designed around the idea of grouping sources and destinations into "categories." One of the keys in the keypad would access a category, and then a one- or two-digit number would select the desired member of that category. The category-plus-number system made it simple to, for example, select CAM 1 or VTR 22. Then, however, the operator needed to find the old lookup table to figure out that TEST 5 would yield SMPTE color bars. Some systems were able to display a descriptive name after the source was selected, but because the labels on the keys were fixed, users were stuck with a limited set of category names.

This history brings us to the current phase of control-panel evolution — panels with relegendable buttons. The availability of pushbuttons with built-in LCD displays and multicolor illuminations has at last freed us from the restrictions of a limited keypad with fixed labels. Early panels with LCD buttons took advantage of the fact that buttons could easily be

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

World's tablet prices falling

Despite improved product technology and features, competition among tablet makers forced the device's average price down a sizable 21 percent in a single year to $386 last quarter.



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relabeled, allowing the system's administrator to change category names, for example, without the need for removing and relabeling the keycaps on every panel. This feature was a big advance in system flexibility, but the button labels essentially were fixed once the system programming was completed, and the panels were operated in the same way as panels with fixed-label keypads.

LCD button panels allowed for easy relabeling without removing keycaps — a big advance in flexibility.

The latest generation of control panels takes full advantage of the dynamic labeling features of LCD buttons, allowing the panel's buttons and displays to work in a dynamic mode, driven by internal menus in the panel software. This means the category-plus-number labeling system can be left behind at last, replaced by panels that provide unlimited flexibility in grouping sources and destinations into an intuitive and transparent structure for all operators, regardless of their technical training or expertise.

Soft panels

It is becoming increasingly important in today's facilities for the router control system to provide "virtual" control panels — GUI representations of router control panels that can be presented on the screens of computers, phones and tablets that are all part of the broadcast facility.

"Virtual" control panels are important now because they can show on all computer, phone and tablet screens.

A good GUI control panel system will provide a toolbox for designing an unlimited range of on-screen panels, from simple button-per-source panels to panels that support the setup of complex monitor walls. The ability to support multiple operating systems and Internet-browser-based panels can greatly extend the usefulness of the virtual control panel system.

The ability to publish the panels over a network with specific access rights for users or groups of users can also make the system much more useful. Close linkage to the control-system configuration files can make the panel-design process much simpler, allowing the panel to be designed with point-and-click navigation rather than having to type in the source and destination labels as the panel is being laid out.

Advanced control functionality

Modern routing systems are adding a number of features that involve various forms of signal processing with the router. (See Figure 1.) An example of this is embedded signal processing, which allows embedded audio arriving on digital video streams at a router's inputs to be extracted, manipulated and re-embedded at the

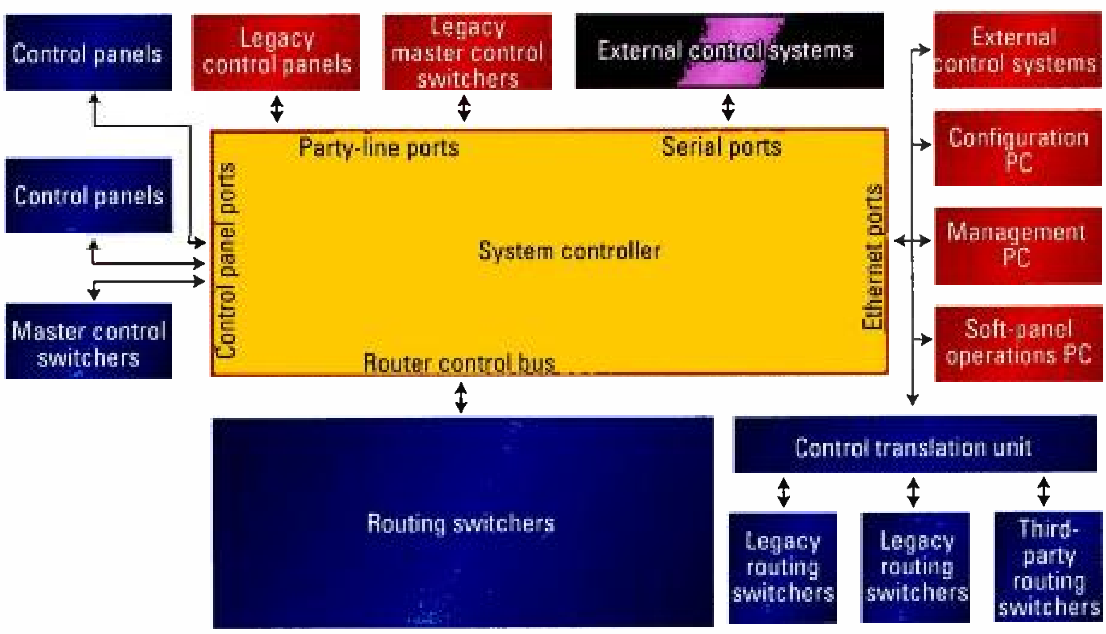

Figure 1. Modern systems have added many features that require various forms of signal processing with the router.

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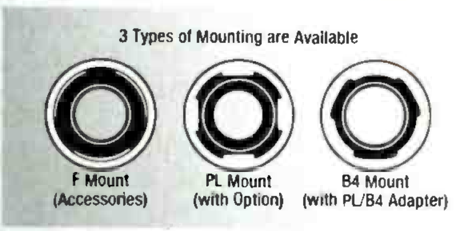

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Continuous Innovation

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outputs. Controlling these functions requires a new approach to the design of the control system and presents a tremendous challenge in designing a user interface intuitive yet powerful enough to take full advantage of this compelling new ability.

At the same time, external control of the router by automation, scheduling systems, editors and production switchers is increasingly important when it comes to integrating the router into the overall system. Having external control requires the ability of the router control system to communicate with external systems

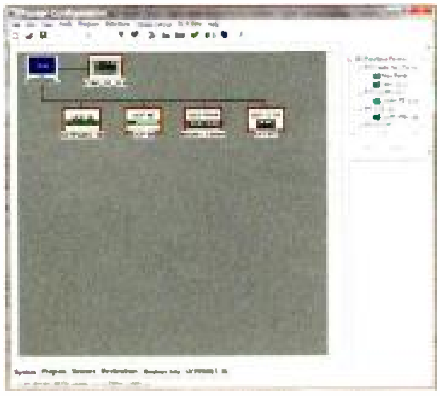

Figure 2. A custom GUI for panel programming can save time during router control system installation.

such as tally management, under-monitor display devices, and — with the expanding use of flat-panel-based monitor walls — the external multiview image processor.

Traditionally, communication from the router control system to these external devices has happened through a simple numeric interface. The router status was sent as a message that output XX was connected to input YY, which meant the external system's programming needed to be reconfigured to match the router's labeling configuration every time the router was updated.

In modern systems, it is possible to download the router's programming information directly to the external device, allowing the complete system to be updated automatically when changes are made to the router's configuration.

System configuration

The most time-consuming part of installing and maintaining a router control system is reprogramming dozens of control panels to reflect the new system configuration. (See Figure 2.) This is where the router control system can make a big contribution by automating repetitive parts of the process. Most systems offer a GUI for panel programming. The best systems allow the GUI to be customized. For example, an operator can create separate "views" of certain parts of the system to reduce on-screen clutter and allow the operator to focus on specific devices.

System monitoring

Once the router system is in operation, the control system must provide a comprehensive toolbox for monitoring its operation. (See Figure 3.) Alarm indicators such as power-supply failure and tempera-

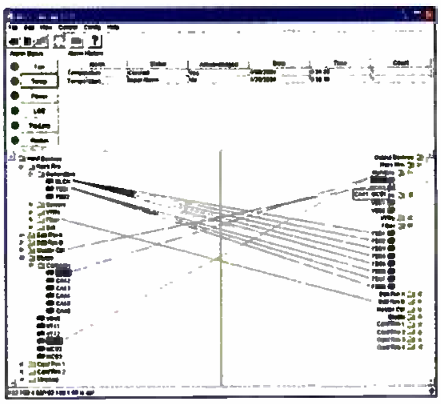

Figure 3. A comprehensive monitoring toolbox is necessary once the router system is operational.

ture alerts must be presented in a clear and easily understandable form to the maintenance crew so that corrective action can be taken to avoid service interruptions.

The monitoring/maintenance utility is also the logical place to provide tools for operational supervision, giving access to high-level functions such as tie-line management, identifying and troubleshooting hardware faults, and releasing locks.

In a growing number of facilities, the routing switcher is tied into an

Control systems will expand to keep up with added functions while making the overall system more efficient. This will streamline workflow.

overall network management system (NMS). These systems monitor the health of the complete facility by receiving messages from the individual subsystems via SNMP communications. The routing system must be able to provide alarm information via SNMP trap messages, and additional functionality, such as loss of signal (LOS) alarms on critical inputs and outputs, can be very useful to the NMS in tracing the root cause of a service interruption through the various devices in the system.

The future

The increasing sophistication of router control systems has kept pace with the amazing growth of routers over the past few years.

Modern systems are infinitely easier to configure, manage and maintain than their predecessors, making it more practical to design systems based on a large, central routing switcher. In the future, we can look for the router to become even more tightly integrated into the facility, providing an expanding range of functionality that traditionally has been handled by dedicated equipment.

Control systems will expand to keep up with these added functions, while making the overall system operation more efficient. All of this will streamline workflow while expanding flexibility. BE

Scott Bosen is the director of marketing for Utah Scientific.

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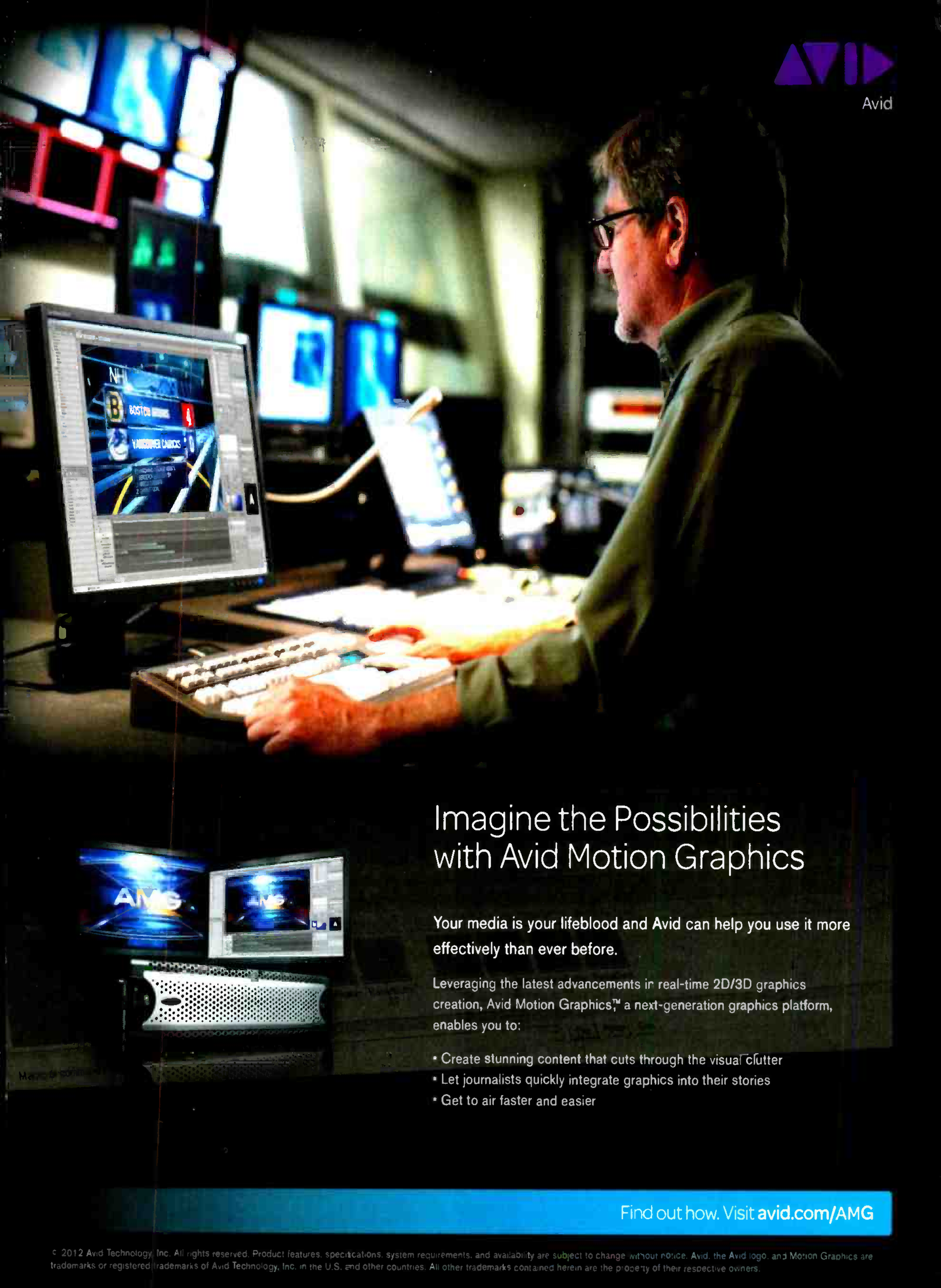

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Channel sharing

The FCC's channel-sharing rules have become effective.

BY HARRY C. MARTIN

The FCC's initial TV channel-sharing rules, adopted in April, went into effect on June 22, according to a notice published in the Federal Register. The new rules are a significant step in the FCC's move towards incentive auctions and TV channel re-packing to accommodate the spectrum needs of wireless broadband proponents. Making room for more broadband wireless service is the No. 1 priority of FCC Chairman Julius Genachowski.

The Federal Register publication also set the deadlines for seeking reconsideration or judicial review of the FCC's channel-sharing Report and Order. The deadline for petitions for reconsideration has passed, but aggrieved parties have until July 23 to ask a court of appeals to review the Report and Order.

Considerations

When channel sharing becomes a reality, it will be subject to the following considerations:

- *Eligibility.* Channel-sharing will be available only to full-power and Class A licensees who participate in the incentive auction process. What TV licensees are eligible for is not clear because most of the key details of the channel sharing procedure are yet to be determined. LPTV and TV translator stations are not eligible. Because they are secondary services, no provision has been made for their existence during or after band-clearing.
- *Voluntariness.* Sharing will be entirely voluntary. The initial channel-sharing rules state that broadcasters may opt in or out of the sharing plan and decide with whom they may want to partner.
- *Single facility/separate licensing.* While stations sharing a single channel will use a single common transmission facility, each will continue to be licensed separately. Each sharing licensee will keep its original call sign, retain all rights of an FCC license and remain subject to the full panoply of FCC rules.
- *Minimum capacity.* The manner in which a given 6MHz channel would be divided by sharing licensees will be left to the licensees, provided each sharing station retains enough capacity to operate at least one full-time SD programming stream.
- *Must carry.* The FCC asserts that the sharing rules will have no effect on stations' cable and satellite carriage rights. Each separately licensed station will be entitled to the same carriage rights as long as it meets all of the usual technical requirements from the shared transmitter location.
- *NCE-Commercial sharing.* Commercial and NCE stations are permitted to share, as long as NCE licensees structure their arrangements to maintain their noncommercial status. Thus, if an NCE licensee now operating on a reserved channel elects to move to a non-reserved channel as part of a channel-sharing arrangement, the NCE station must continue to operate on an NCE basis. The FCC will decide in a separate context whether a commercial station can elect to share a channel that has been reserved for noncommercial use.

Broadcasters may opt in or out of the sharing plan and decide with whom they may want to partner.

White space rules

The FCC's "white space" proceeding may finally be over. In a Third Memorandum Opinion and Order (3rd MO&O) released in April, the agency disposed of a handful of petitions for reconsideration of a 2010 decision that modified technical specs for white-space devices as adopted in 2008. The 3rd MO&O has now been published in the Federal Register, which means the rules as modified became effective on June 18.

Dateline

- On or before Aug. 1, 2012, noncommercial TV and Class A stations in California, North Carolina and South Carolina must file their biennial ownership reports.
- On or before Aug. 1, 2012, television stations, Class A TV, LPTV stations, and TV translators in North Carolina and South Carolina must file their license renewal applications.
- On Aug. 1, 2012, TV and Class A TV stations in Florida, Puerto Rico and the Virgin Islands must begin their pre-filing renewal announcements in anticipation of an Oct. 1, 2012, renewal application filing date.
- On Aug. 1, 2012, television 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: California, Illinois, North Carolina, South Carolina and Wisconsin.

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

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Internet TV systems and coding

Content distribution is heading to the connected world.

BY ALDO CUGNINI

Today's TV viewers want more content from an increasing number of sources, and that means that Internet delivery is a growing phenomenon. With hybrid technologies emerging, it is reasonable to expect that television broadcast will increasingly use the Internet to expand throughput beyond that afforded by a single RF channel. But there are limitations to the Internet that must be understood in order to capitalize on this commodity, and some of those constraints are being overcome by new technologies.

Streaming can now provide a high quality of service

In general, Internet TV is a means to provide streamed video content to a PC, STB or Internet-connected TV, by means of an Internet connection. Internet Protocol Television, or IPTV, refers to a special case where a full-time TV subscriber connection is established by means of a dedicated line (and channel) to the telephone system central office. It is envisioned, however, that many Internet TV viewers will get their content though their Internet connection, and as such, receive OTT video service that shares bandwidth with other Internet traffic.

The simplest way to deliver video over the Internet is to use progressive download, sometimes called "HTTP streaming."

This sharing of bandwidth creates a QoS challenge for Internet TV service: While a terrestrial channel has a fixed bandwidth (i.e., 19.2Mb/s in the U.S.), an Internet TV service must share the bandwidth, both locally (e.g., within a viewer's household) as well as regionally (e.g., with other subscribers). This means the bandwidth available to a receiver can vary continuously over a wide range, and different subscribers may have different levels of guaranteed service, as well. Lowering the video bit rate to the least common denominator would result in poor video quality to everyone; to deal with this, several technologies are available.

Progressive download vs. streaming

The simplest way to deliver video over the Internet is to use progressive download, sometimes called "HTTP streaming." This is simply a bulk download of a video file to the viewer's terminal (i.e., Internet-connected TV, STB, PC, etc.). A temporary copy of the file is stored on the user's device, typically on a hard drive, and playback can start after a sufficient amount of the file has been downloaded. This means that content will always incur a considerable delay before it is available to be viewed, which makes a live service rather difficult to implement. However, because the files are downloaded using TCP, there can be a nearly 100 percent assurance that every single bit was transferred correctly.

True streaming, on the other hand, opens up a handshaking connection between the server and client using a set of Internet protocols to deliver streams, such as Real Time Streaming Protocol (RTSP), Real Time Messaging Protocol (RTMP) and Microsoft Media Services (MMS). A streaming connection delivers a video stream

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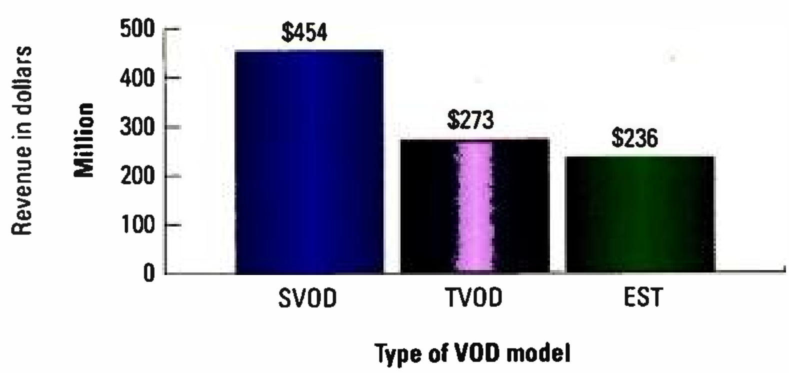
A look at tomorrow's technology

Subscription VOD surpasses other VOD models

In the United States in 2011, revenue from subscription VOD (SVOD) services, which give consumers access to movies in return for a regular, recurring fee, surpassed transactional VOD (TVOD) and electronic sell-through (EST).



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with minimal buffering, allowing a nearly real-time presentation of the source content. In this respect, streaming has an advantage over progressive download, as continuous delivery is the goal, but the associated downside is that corrupted or missing packets are not detected. The consequence is that audio and video can have ongoing glitches when network congestion is experienced.

Adaptive bit rate streaming

To solve the QoS issue, adaptive bit rate (ABR) streaming has been developed. ABR allows each device to determine the quality of its connection and then use that metric to select the best-coded stream from a number of different quality streams. At the server end, a series of encoders encode a set of multiple streams at different bit rates, and these streams are then sliced up into segments or "chunks." An ABR client in the viewer terminal detects the incoming stream bandwidth on the fly and uses this, along with a model based on the device's CPU capability, to select a segment among the various streams.

A special manifest file precedes the first segment, providing the client with a list of URLs from which each segment can be accessed. As each segment is received, the client progresses to the next segment in that stream, or it can jump to a parallel segment in one of the other streams if the channel bandwidth changes because of congestion, etc. In principle, a handful of streams will provide enough granularity so that the viewer does not detect a change in picture quality.

Note that ABR provides high transmission bandwidth efficiency when a unicast transmission (i.e., one-to-one) is used, but it can also work well with multicast and broadcast scenarios depending on how well the Internet infrastructure distributes bandwidth to users. ABR has the potential to deliver an audio/visual experience that we have come to expect from linear transmission: low delay, fast start time and a consistent experience across viewers.

Several manufacturers have developed different solutions for ABR streaming. Adobe HTTP Dynamic Streaming (HDS) uses a format called F4F to deliver Flash videos over RTMP and HTTP. Apple HTTP adaptive Live Streaming (HLS) was developed for the iPhone and iPad, and is implemented using HTTP, H.264 and MPEG-2 Transport Streams, with a manifest file called M3U8. Microsoft Internet Information Services (IIS) Smooth Streaming is used within Silverlight on the Windows 7 phone and incorporates fragmented MP4 (fMP4) encapsulation, again with H.264 for video compression.

With these different enterprise systems, an interoperability problem exists because of proprietary protocols and manifest structures. Multiple ABR systems mean that different devices must either pick and choose which systems to support, leading to service-constrained devices, or must include all at increased cost. This situation has motivated companies and experts around the world to propose a single, standard ABR system.

DASH-ing to the rescue: a universal ABR system

MPEG-DASH (Dynamic Adaptive Streaming over HTTP) is a newly standardized method for defining Stream Segments and Manifest Files for the purpose of ABR streaming. The specification (ISO-IEC 23009-1) defines a Media Presentation Description (MPD) that formalizes the stream manifest, which includes Segment timing, URLs and media characteristics such as video resolution and bit rates. (See Figure 1.) While compatible Segments can contain any media data — with arbitrary compression — two types of containers are exemplified in the standard: MPEG-4 file format and MPEG-2 Transport Stream.

In going to a standard system, MPEG-DASH is quickly deployable with the existing Internet infrastructure, using widely deployed standard HTTP servers/caches for scalable delivery. Generic encoders can be

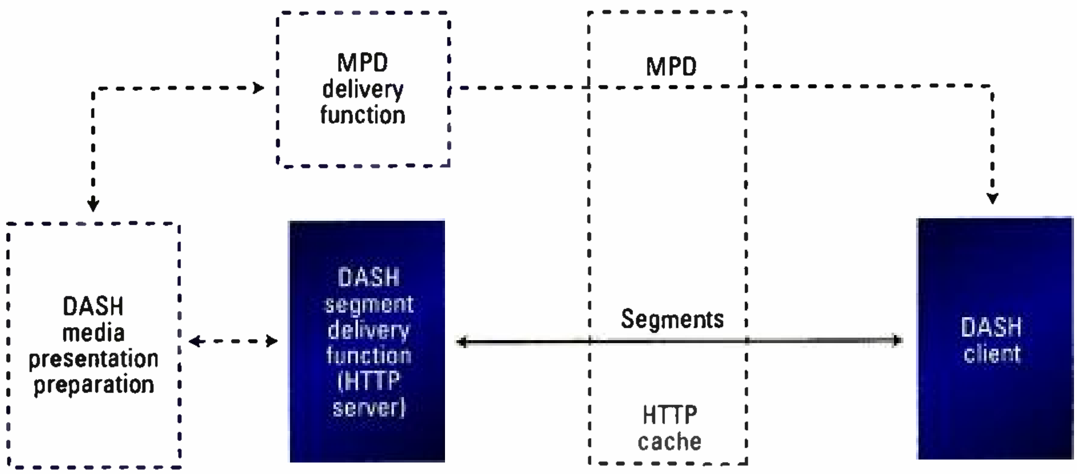

Figure 1. MPEG-DASH defines a standard set of Media Presentation Description and Segment Formats that enable adaptive bit rate IP video streaming.

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reused, with additional descriptive metadata for better client functionality, and legacy manifest files can be converted easily to MPD format, as well as sent in parallel for backward compatibility with low overhead. In addition, existing content and production equipment supporting legacy ABR streaming systems can be used for MPEG-DASH by means of a set of standard Profiles. Apple HLS content can be used with the DASH M2TS Main profile, and Microsoft IIS Smooth Streaming Content is suitable for DASH ISO-BMFF (Base Media File Format) Live profile.

Vendors are now proposing integrated workflow and delivery systems supporting ABR with multiple source formats, protocols and on multiple devices. While encoding latency can be an issue for live streams, MPEG-DASH includes a profile optimized for live encoding that can achieve a latency of a few seconds by encoding and immediate delivery of short Segments.

New technologies and business models are providing broadcasters with the tools to compete.

In addition to delivery of any multimedia content, MPEG-DASH supports a broad range of use cases, including live, VOD, time shifting (nPVR), ad insertion and dynamic update of program. MPEG-DASH also solves the problem of content repurposing to multiple devices with widely ranging capabilities. In principle, an MPEG-DASH-controlled stream can be targeted simultaneously to both large and small screens, as well as fixed and mobile.

Internet quickly becoming viable for long-form content

The once-exclusive realm of RF transmission as providing the highest quality content consumption experience is being challenged by streaming services. But new technologies and business models are providing broadcasters with the tools to compete with new service entities, and that's where content distribution is headed. BE

Aldo Cugnini is a consultant in the digital television industry and a partner in a mobile services company.

Send questions and comments to: aldo.cugnini@penton.com

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Metadata and MXF, part 2

Take out some human elements to improve workflows.

BY BRAD GILMER

Last month in this column, we looked at the importance of metadata to the professional media industry. We talked about different types of metadata (static and dynamic, technical and descriptive), and discussed the importance of the Unique Media IDentifier (UMID) and how it links metadata and content.

This month, we will focus on why metadata is so important, how rekeying of metadata is a common problem in file-based workflows, and how metadata contained in MXF files can reduce rekeying errors. We will also talk about application specifications produced by the Advanced Media Workflow Association (AMWA) that improve MXF metadata interoperability in file-based workflows.

Critical metadata

There are many reasons why metadata is critical to file-based workflows for professional media organizations.

The first, and perhaps most compelling, reason is that files simply won't play properly without the appropriate technical metadata. Files cannot be reliably identified without it, and for post production, in some cases it may be difficult or impossible to reliably determine how video was manipulated compared to the original source content without metadata. Overcranking (changing the frame rate of the source material in post-production) is one example. Linking the content to information contained in databases, business systems and other media applications is impossible without some sort of metadata.

Fast fail is important in professional media applications. Without metadata, an application must do a "deep dive" into the media, meaning that it must actually begin opening the media file to determine whether the application can decode and play back the content. The problem is exacerbated if the content is located remotely. Failing to implement Fast Fail might mean that an entire two-hour movie has to be transferred over a network (a time-consuming process), only to discover that once the transfer is complete, the file cannot be opened by the application.

Metadata can help applications that use indexing information to quickly move to a specific part of the content and begin retrieving it.

Indexing to a specific point, or even knowing where the first frame of video is in a file cannot be accomplished without metadata. Partial restore is an important concept in professional media. Since media files may be large, it can take a long time to retrieve a short section of video from a movie, for example. Metadata can help applications that use indexing information to quickly move to a specific part of the content and begin retrieving the content from that point.

Even the relatively simple task of understanding what the expected structure of a file may be is conveyed with metadata. For example, is the file a simple one containing a single piece of essence (only video without its associated audio)? Is the file similar to a tape, containing a single video track and two or four channels of associated, synchronous audio? Does the file have a complex structure, including multiple pieces of video and audio with different timelines? The differences in these file types can make a huge difference to an application. Remember Fast Fail? It may be that the application is unable to handle anything but the case where the file looks like a video tape.

I know some of you are thinking of the many ways the issues raised above can be overcome without using metadata embedded in the file. Of course, you are correct. But, many of the solutions you may be thinking of are either proprietary or involve overarching media management systems.

I acknowledge that both proprietary solutions and media management systems are commonplace in professional media facilities. However, many users are looking for open, standards-based metadata solutions. Also, many media companies have implemented media management systems that do not fully leverage the benefits of file-based workflow metadata.

Some issues

One of the biggest issues facing media companies is how to efficiently move content to consumers, whether they are watching a TV, using a smartphone or some as-yet unknown device. All of these systems require metadata, along with the content in order to deliver a complete viewing experience. Unfortunately, the pressure on media companies to provide services has outstripped many organizations' ability to properly build, test and commission

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systems to properly populate metadata fields in media applications. This has had some unfortunate results:

- *Human rekeying of metadata* — In this case, metadata for a piece of content already exists in a system, but operators have to manually rekey it because the company has not had time to engineer an automated solution.
- *Manual metadata entry* — Sometimes, metadata exists in a computer-unfriendly form, or in a form that cannot easily be translated from one computer system to another (information coming in by facsimile, for example). In this case, metadata is manually entered from paper or read from one computer terminal on one system and entered into a field on a different computer system.

In both of these cases, which are extremely common, there are three fundamental problems. The first is that these workflows, without question, will introduce errors. The second issue is that the workflow employs humans in a task they are not good at. The third problem is that these manual operations frequently duplicate effort that already was expended elsewhere within the organization.

An additional problem is that because we have humans doing something they are intrinsically not good at (manually copying numbers from one screen to another, for example), errors will continue to happen for as long as the workflow is in place, regardless of a worker's competence or training level. Additionally, errors in file-based workflows are costly to media organizations, both in error visibility to the general public and in terms of lost revenue as a result of the errors. (See Figure 1.)

Because we have humans doing something they are intrinsically not good at, errors will continue as long as the workflow is in place.

Improving reliability

Given the critical nature of metadata to our workflows, and given the serious nature of the difficulties manual systems create, user organizations are passionate about addressing these issues. Unfortunately, the reality is that many times it is easier to hire another person and train him or her to do the manual operation, rather than undertake what usually appears as a huge, multi-year, multi-million dollar media system project. That said, multiple current solutions exist for users and manufacturers to make improvements to their systems now:

- *Use MXF* — MXF has become the standard for open, interoperable professional media interchange. The entire industry will be helped as more companies continue to move to a standardized file format for media interchange.
- *Use application specifications* — The AMWA has created application specifications specifically designed to improve file-based interoperability in particular use cases. Using these specifications will increase the likelihood of successful integrations, and will reduce the variability found in "wild west" MXF files.
- *Use shims* — Many AMWA Application Specifications include the concept of a shim. Think of a shim as a tape delivery specification. In the days of tape, many organizations specified the tape formats they would expect,

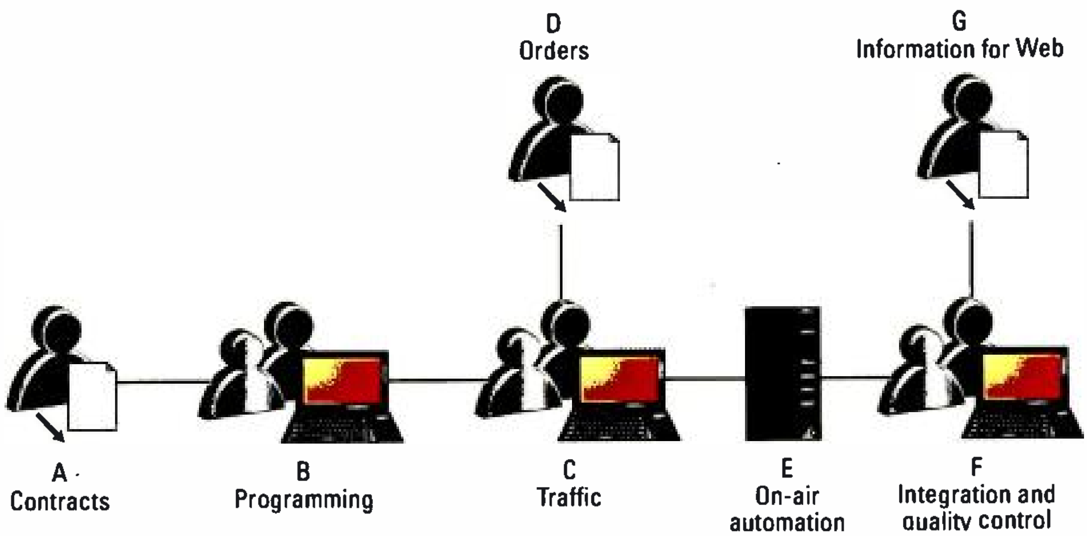

Figure 1. This shows a hypothetical workflow involving manual intervention. A contract is created with a media supplier to air a program (A). The information from the contract is manually entered into a program planning system (B). Program information is viewed and updated in traffic (C). Additional information comes to traffic from the commercial order area (D) to be manually entered. The on-air automation system (E) receives information from traffic, but it is further manually edited in integration and QC (F). Sometimes, information is manually edited again as web distribution information is added (G).

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the video format (e.g. NTSC), the audio format (stereo, or mono on both channels, for example), and how and where timecode should be coded. A shim in the file-based world performs a similar function. Many application specifications allow variability within a range — for example, the application specification AS-03 for finished SD program delivery allows MPEG-2 compression at rates between 5Mb/s and 50Mb/s. But, it may be that you only want to accept 15Mb/s at your facility. A user-specified shim allows

Look at workflows and determine where metadata embedded in a file can reduce rekeying and eliminate errors.

you to set your own specifics, as well as other "shim-able" AS-03 parameters.

- *Use UMIDs properly* — Last month, I talked about the UMID, and how it should be used. Proper use of UMIDs allows implementers to build systems that reliably deliver correct content efficiently.
- *Look for MXF metadata import opportunities* — Look carefully at workflows and determine where metadata embedded in a file can reduce rekeying and eliminate errors.

Summary

Last month, we talked about different types of metadata and the importance of unique identifiers in file-based workflows. This month, we have examined issues surrounding metadata re-entry and introduction of errors, and we have looked at ways to reduce errors and increase interoperability using open, standards-based formats. We also talked about the business drivers that are spurring media companies to move forward with file-based workflows. Metadata is the key to unlocking the true power and savings of this new technology. **BE**

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

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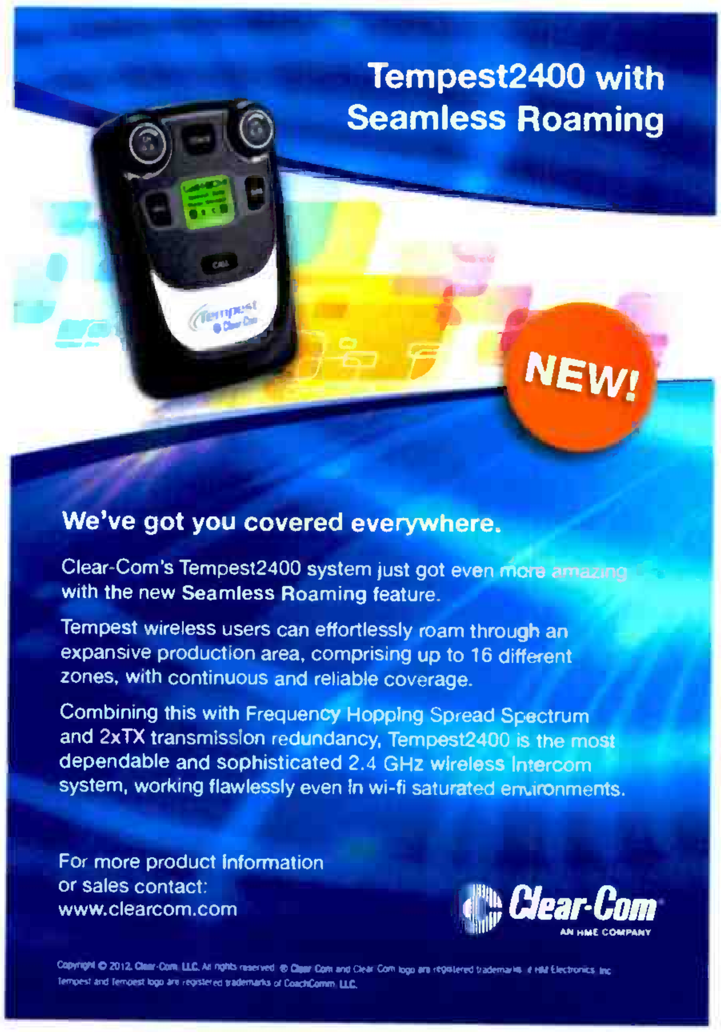

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Intercom design

Digital and matrix-based systems rule today's trends.

BY CHRISTIAN DIEHL

Today's intercom systems are quite different from those installed only a decade ago. What may have been an analog partyline system in the 1990s has evolved into digital partyline and matrix-based solutions. Additionally, today's high-speed, high-technology and sometimes high-risk productions demand ever more sophisticated and complex communications. Directors, TDs and crews must have reliable, portable and flexible intercoms. This article presents an overview on current intercom requirements and design trends while offering tips for technology selection.

Contemporary intercom systems must be able to handle different scenarios, including OB settings like this one inside a Touring Video OB truck.

Beyond the intercom

The demands placed on contemporary intercoms are as diverse as the installations where they are used. Scenarios include large production facilities with hundreds of users (maybe even with connections to remote production sites), as well as small studios or temporary OB systems with constantly changing configurations.

Besides a system's scalability for allowing the maximum usage for a large range of users, the amount of possible integration with facility technology is pivotal to an intercom system's ergonomics. Here, integration refers to the mixing of various signal types as well as various technologies and protocols.

Regarding the signal side of today's intercom systems, communication is more than just a simple link between two people. In addition to voice, analog and digital audio signals, data and control signals also need to be interfaced and managed. How an intercom system handles different signal types and integrates them is an extremely accurate indicator of its usefulness.

Integration can be understood in two different ways. One aspect is the kind of signal that can be handled. The other aspect relates to the interfacing side — how the system transmits the combined signals, and what transmission protocol is used.

In today's landscape, newer intercoms rely on digital audio for communication. This makes it easy to combine that audio with an AES3 and MADI-centric communications infrastructure. This allows facility designers to integrate equipment like digital audio routers seamlessly with the intercom system. Incorporating these signals into the matrix offers several advantages.

Relying on non-proprietary standards like AES3 and MADI opens the door to facility design options.

First, digital itself brings a lot of flexibility to the facility design, especially when it comes to integrating other equipment into the communications infrastructure. Second, relying on non-proprietary standards like AES3 and MADI opens the door to many options in facility design. Finally, a data-centric system enables the support of additional features such as embedded general purpose input outputs (GPIOs).

More than point-to-point

Modern broadcast and production environments often require the use of a variety of tools, such as analog and digital professional radios, partyline systems and wireless handsets.

The way an intercom system handles these outside signals is crucial to the overall systems' flexibility. And, any new intercom platform should also be able to interface with other broadcast equipment to facilitate workflows and, for example, integrate production signals like program feeds.

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For handling connections over large distances, say, between a production facility and a remote studio, VoIP connections are a good solution. Session Initiated Protocol (SIP)-based technology supports the EBU Tech 3347 standard, which allows for connections to remote systems and integrates them into a single infrastructure. The only downside to using VoIP technology is that it does not provide real-time communication. However, broadcast applications are more concerned with connectivity rather than minimal latency (perhaps a few tens of milliseconds) that may occur with VoIP.

Audio/video bridging

A current intercom trend is to leverage the same technology used to deliver content for communication. Audio/video bridging (AVB) is an Ethernet-based technology that allows the use of a single infrastructure to transport multiple types of signals over the same network backbone. AVB permits both data communication and content audio to travel over an AVB-compliant network.

AVB makes use of several IEEE standards, including the following: IEEE 802.1AS: Timing and Synchronization for Time-Sensitive Applications (gPTP); IEEE 802.1Qat: Stream Reservation Protocol (SRP); IEEE 802.1Qav: Forwarding and Queuing for Time-Sensitive Streams (FQTSS); and IEEE 802.1BA: Audio Video Bridging Systems.

A key component in these standards is IEEE 802.1Qat, which provides a mechanism for bandwidth reservation. Contrary to common QoS schemes, 802.201Qat provides a reliable mechanism of reserving bandwidth for each audio or video stream. (See Figure 1.)

Any potential hazard regarding network overload is avoided through bandwidth management, which means identifying and denying streams that might exceed a network's capacity. It is also possible to reserve a portion of the available bandwidth for non-AVB traffic. This allows AVB devices to share the same cabling and infrastructure with non-AVB devices like network monitoring or control systems.

A protocol for device discovery, enumeration, connection management and control is currently undergoing the final phase of standardization and is due to be released soon. This protocol, IEEE 1722.1, will eliminates the need for dedicated cabling for intercoms, thereby reducing cabling costs.

Despite the potential for overall increased network complexity, the time required to set up communication networks will be reduced because only one network needs to be installed. Furthermore, AVB offers the possibility to use hardware from multiple manufacturers together on a single network.

The IEEE 1722.1 protocol will allow for easy integration of AVB into a broadcast workflow and facilitate interoperability between different manufacturers' devices.

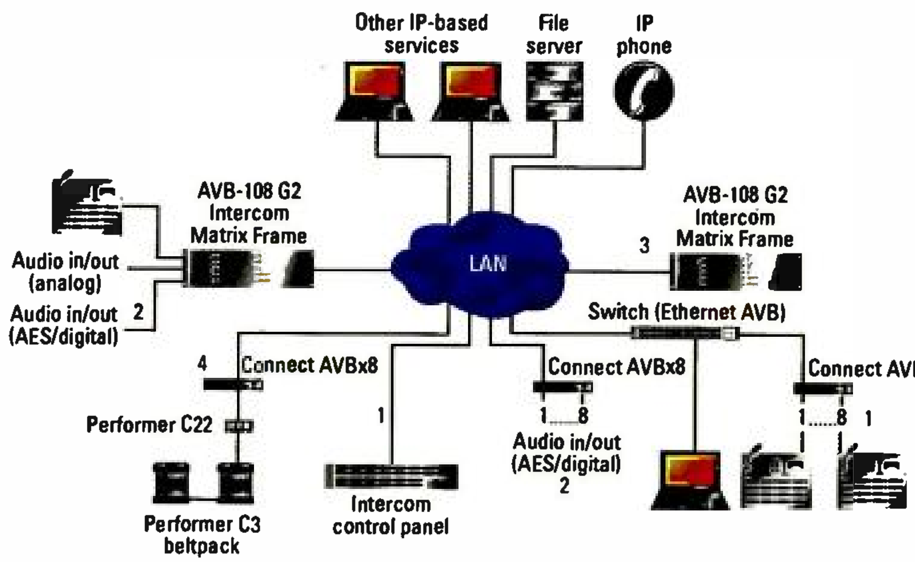

Figure 1. This shows a block diagram of an AVB-based network. In addition to providing full intercom features, the network can intermix multiple vendors, control a range of non-intercom equipment and protect program content channels via IEEE 802.1Qat.

allow for easy integration of AVB into a broadcast workflow and facilitate interoperability between devices of different manufacturers.

This capability means new options for intercom and infrastructure design. The flexibility will permit control panels to be added at any point in the system just by connecting them to an Ethernet port. AVB effectively

This design approach means simpler intercom installation, with expanded features, operating on a unified network. The real plus is that both communications and content can safely reside on a single and reliable IP network. BE

Christian Diehl is product manager, intercoms, Riedel Communications.

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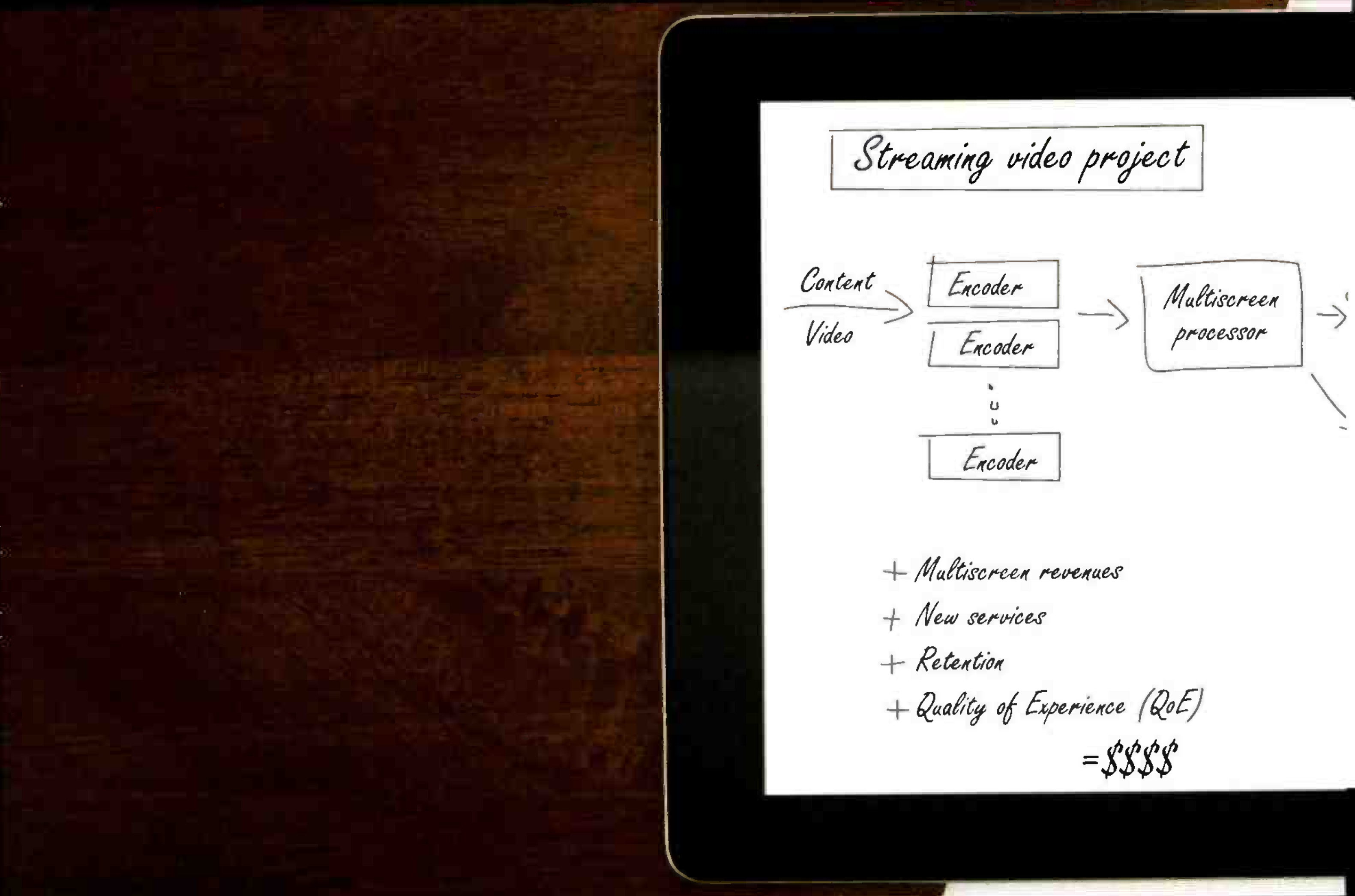

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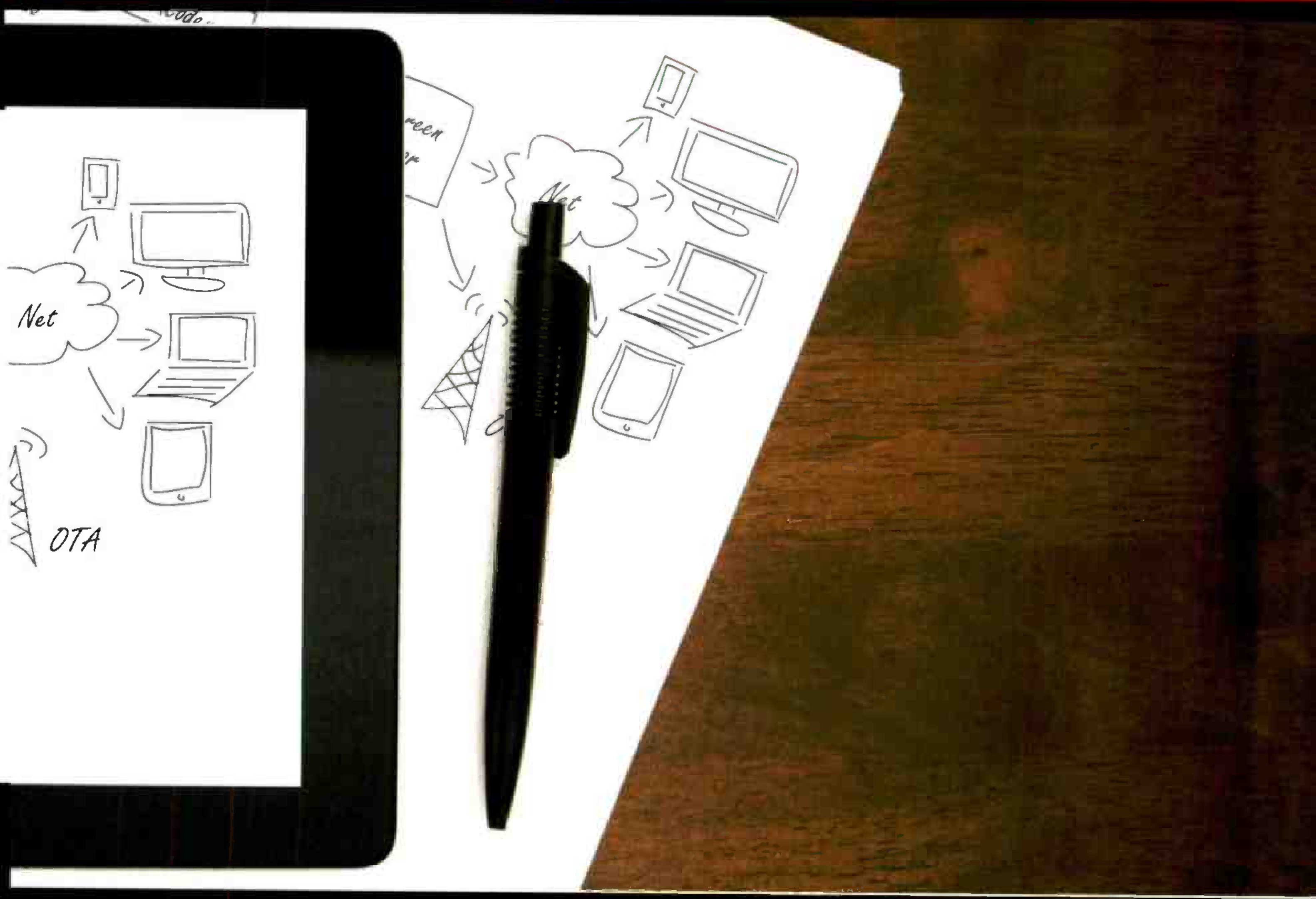

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Lights-out automation and new revenue opportunities

BY STAN MOOTE

A "lights-out" automation system can increase advertising opportunities with multiple playlists.

It sometimes seems that the broadcast industry is in full retreat from an onslaught of IP, file-based VOD and OTT services. At the same time, technology that enables so-called "lights-out operation" of playback facilities hardly indicates there will be a boom in the broadcast labor force. Consider these two factors together, and it's easy to envision a future where a "broadcaster" is a lone 17-year-old serving as both on-air talent and the entire engineering department.

> A good disaster recovery (DR) system backs up the complete chain, enabling quick and clean changeovers. Ideally, it will rarely be used, making it the perfect vehicle for running 90 percent operational secondary and tertiary services — all new revenue opportunities.

But what if we viewed change not as the dismal beginning of the end, but rather as opportunity? After all, the toppling of barriers between broadcast and IP is not a one-way street, and the very tools we're implementing to make our operations more efficient can also be used to cost-effectively venture into new ways of delivering media.

In addition, local broadcasters possess a number of advantages over start-up service providers in the quest to profit in today's overcrowded media market. The draw of a trusted brand is potent, and local TV station viewer loyalty should not be underestimated.

The macroeconomics of lights-out

So let's start at the beginning: What exactly is required to go lights-out?

For playout, basic lights-out operations require an automation system driving transmission servers, the basic functions of station router, master control switcher, graphics/branding and logo inserter, along with various processing functions for up/down/aspect conversions, audio mixing and mixing alerts. New technology for QA-ing server files eliminates the need for previewing. (Note: So-called station-in-a-box systems also contain many of these basic functions.)

Adding an asset management system aids with automatic server ingest, preloading of graphics and building playlists. The loop between playout, traffic and billing needs to be tightly controlled to ensure ads are played and billed out. Having a tight, interoperable system design with quality monitoring tools can basically eliminate makegoods.

Speaking of makegoods, an essential part of a lights-out operation is a robust disaster recovery (DR) system. A good DR system backs up the complete chain, not just one device at a time, hence enabling quick and clean changeovers. Ideally, a DR system will rarely be used, making it the perfect vehicle for running 90 percent operational secondary and tertiary services — all new revenue opportunities.

The typical objective of implementing this kind of file-based, streamlined workflow is to automate tasks previously performed by operators to save time and money. But the same

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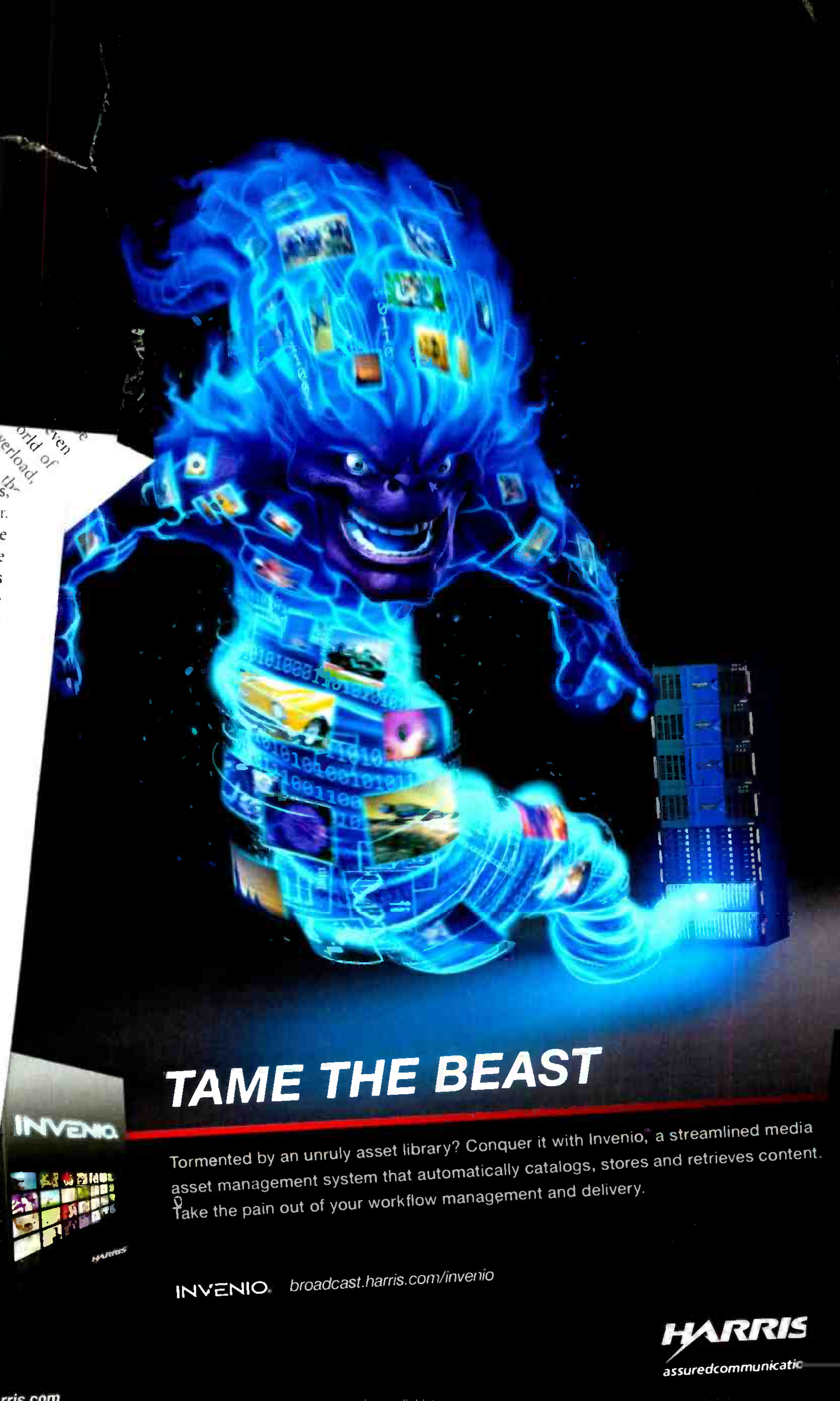

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tools that enable lights-out operation can also enable the creation of different output versions at little or no extra cost. In many cases, the same content can be used with different playlists, and different playlists mean more advertising opportunities.

With more and more consumers "cutting the cord" and watching various types of media from their Internet connections, having more channels on your digital multiplex is an ideal way to boost your product and services through the use of local advertising.

Consider a lights-out playout operation with full backup. (See Figure 1.) Two channels are 100 percent backed up, while two additional channels will be "bumped" in the case of a failure. Distribution of these extra channels can be in many formats, including OTA extra channels, mobile, OTT, Web streaming and closed-circuit targeted advertising or narrow-casting.

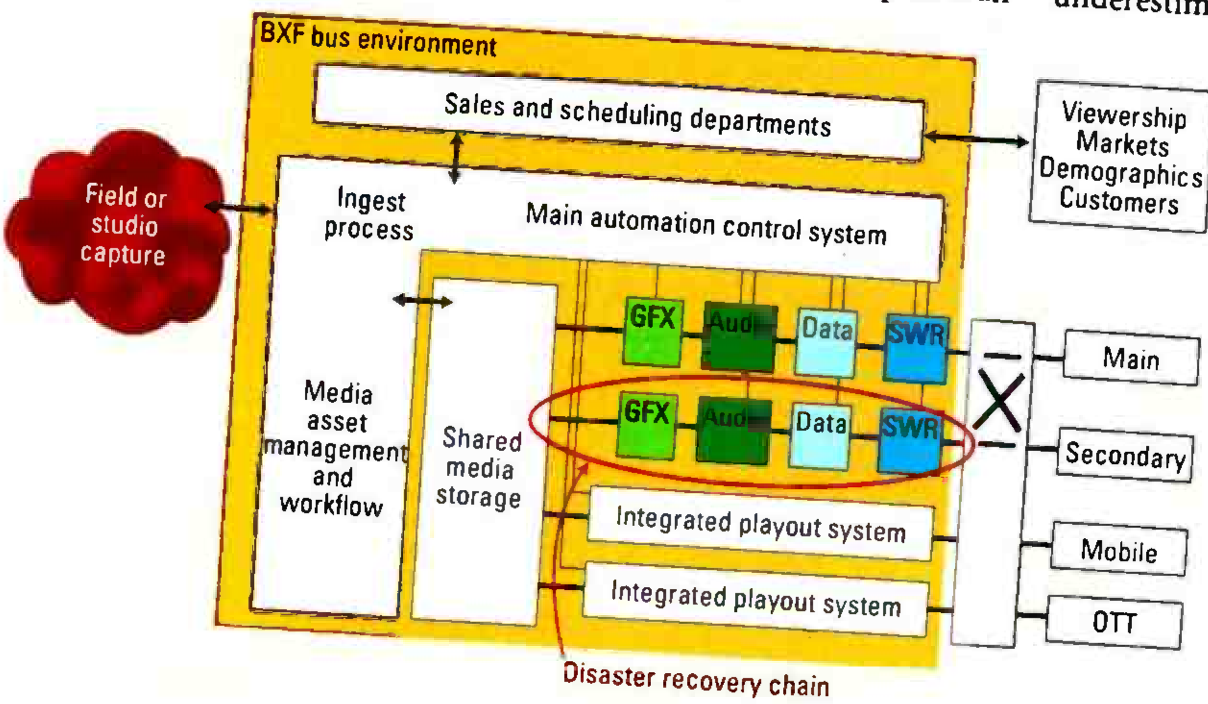

Figure 1. Use the disaster recovery chain to play out new revenue-making services.

The power of television should never be underestimated, and local television even more so. In a world of information overload, local stations have the advantage of being trusted brands for news, sports and weather.

Linear TV's advantage in a nonlinear world

Key to the creation of new jobs is considering how and where secondary and tertiary channels are presented to customers, how the brand of the local TV station is used to draw viewers to these channels, and how the broadcaster can set about creating revenue opportunities from new sources.

The techniques wide brands can b call-letter stations t and advertising oppo broadcasters bring a n advantages to the conges

Brand loyalty

The power of television s underestimated, and local t more so. I information local stations advantage of trusted brands f sports and w Sure, people look Web, but even th local TV station's often preferred pursuit of trustw information.

One reason is s that consumers become accustom the brand over years of famili Consumers also k that television is regulated, which adds a islative layer of trust. In addition, televi news organizations have earned a reputa for professional integrity, which attracts maintains viewership. Hence, any strean video branded with a local station logo h certain strength that no start-up OTT serv provider can rival.

Locally produced content

Content rights are always a challenge, so t best way to fill secondary channels is to pr duce original content. Here again, TV broa casters have advantages. First, they are alrea producing content on a regular basis. Secon they have an established platform they can us to direct an audience to their other services.

To take this further, think back to the 1960s when local stations produced many live shows. Later, we moved to taped productions, but all still done at the local TV station. Other than news, sports, weather and perhaps some local cooking segments, most of these local shows are all but gone. Amateurs are filling the gap by producing themselves and using the Internet for distribution, and in many cases, the quality of these programs is horrible. Local

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he skills to produce high- only the motivation to try een lost. Local broadcasters unity to take this back.

ertising

ack to basics, what pays the bills? of local television, it is advertising. sinesses that advertise on television ice a greater awareness in the commu- hich typically relates to business growth least to steady revenue. The trick is to re out how to provide more slots for local and take advantage of various emerging ethods of targeted advertising.

Additionally, broadcasters can use the downtime at the station's "lights-out" studio and remote crew to help shoot and produce local spots. We used to see this done live decades ago, but it was expensive when using tape and linear techniques. With newer technologies, these types of activities are no longer cost prohibitive.

So where are the jobs?

Let's consider a concrete scenario in our new lights-out, nonlinear world.

A local community college wants to advertise a newly launched course. A spot can be aired on linear TV by a local station that is operating lights out, automated and with very low staffing levels. But once the spot is aired, how do viewers obtain additional information? The parents might use the phone to request a prospectus be sent to them through the mail, but the kids will head to their bedrooms for a rich-media experience to fill them in on the details.

Who better to create, manage and deliver that media experience than the people who know everything about how media works? Who better to create that service than the pros who edit, shoot and produce? Who better to sell that service than those who know the local advertising market? And who better to take advantage of the need for "trust" in media in the current explosion of content production, delivery mechanisms and garage brands?

The local broadcaster with the new jobs these projects created, that's who.

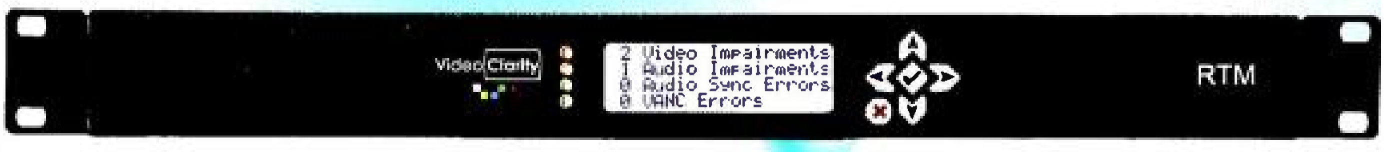
Conclusion

There's no doubt that the media business is changing, but it certainly isn't shrinking. With all the visual media being produced and consumed these days, the "YouTube Generation" is creating an environment where trust and brand have become massively important.

Local broadcasters have invested years of diligent work to earn the solid brand loyalty they now enjoy. It's time to reap the benefits by leveraging your call-letter brand assets to create new revenue opportunities.

Stan Moote is vice president of business development, Harris Broadcast.

Discover Your Actual On-Air Quality And Performance



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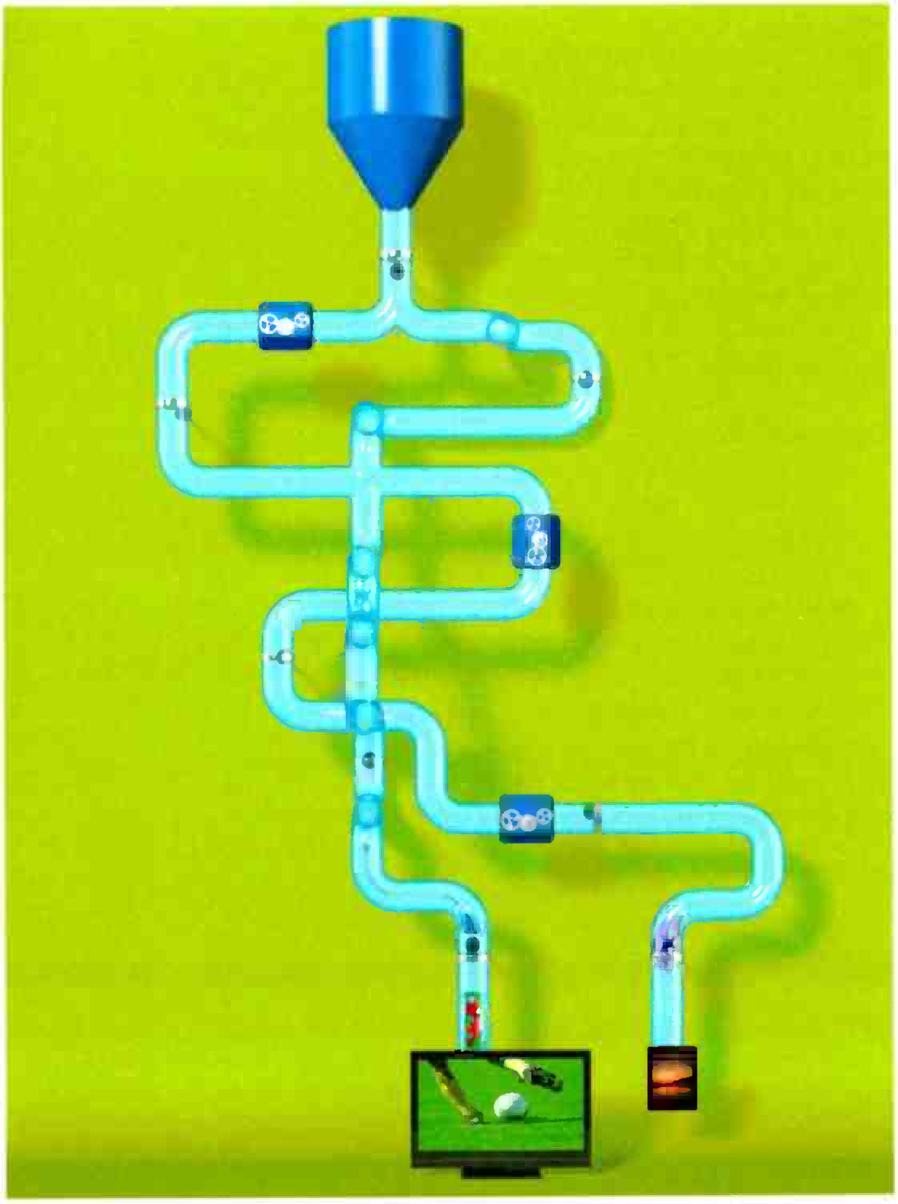
Supporting TV Everywhere

BY NEIL MAYCOCK



A sophisticated and automated media workflow is required to meet the demands of TV Everywhere.

The fantastic increase in online and mobile content consumption, in addition to traditional TV viewing, is driving a greater number and variety of media companies to take on the challenge of multiplatform content creation and delivery to outlets such as Netflix and iTunes. Traditional broadcast workflows do not economically scale to address the demands of this new delivery model, which requires processing and management of a much greater volume of content and metadata, as well as the ability to address the different format requirements associated with each consumption platform.

As a result of this shift, media businesses a considering new workflows and new approach es in managing them. Among these approache has been the extension of automation back up the media supply chain, from its conventional role in master control into content production processes. This article will examine this changing role of automation, the more complicated workflows it now supports, fundamental considerations in implementing a more comprehensive process automation, and finally, the added business benefits that can be derived by using automation to facilitate efficient multiplatform content creation and delivery.

Broadening the scope of automation

The recent focus on broadcast automation has been directed primarily toward the introduction of IT-based technologies and the commercial and operational savings they bring. The demands of "TV Everywhere," however, present a second dynamic that is fundamentally redefining what we understand by the term "automation." To help media businesses maximize their resources and meet the demands of TV Everywhere cost-effectively, automation as we have known it — providing real-time, frame-accurate control over servers, switchers, graphics devices and such — is now extending outside of the master control environment to enable more sophisticated automation of media workflows throughout the entire broadcast operation.

Workflow has been a buzzword in the file-based domain for a number of years, and many of the solutions in this area have targeted the movement of digitized assets. The preparation and delivery of content to multiple platforms, however, demands greater workflow sophistication because it brings into play the manipulation and analysis of these digital media assets and their associated metadata through a combination of manual and automated processes. Responding to the significant rise in workflow complexity in a hybrid (manual/automated) environment, automation vendors are offering a new generation of solutions with much greater utility

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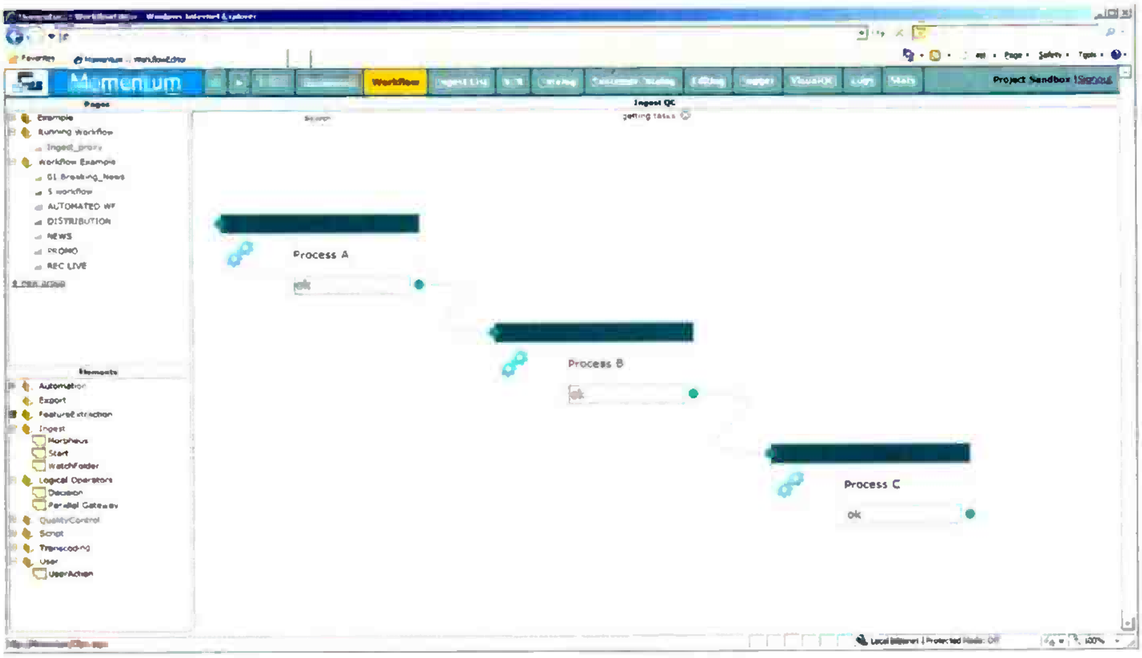

Figure 1. Shown here is the uncomplicated flow of media in the unusual case that no variations in processing are required, and not a single issue arises as this processing is performed.

in facilitating the handling, performance and tracking of upstream processes.

Addressing workflow complexity

Workflow, in its simplest form, is easy to comprehend. It is a sequence of tasks or operations performed on a piece of media. In the management of multiplatform content creation and delivery, however, a simple and linear A-to-B-to-C sequence is rarely sufficient. Figure 1 demonstrates the uncomplicated flow of media in the unusual case that no variations in processing are required, and not a single issue arises as this processing is performed.

Figure 2 illustrates a more realistic flow in which key manual and automated processes — ranging from quality control to format checking to closed-captions validation — depend on one another and often link back on themselves. With all of these possibilities, real-world workflows need to be implemented with conditional logic that allows downstream operations to be determined by the results of upstream operations, or by the metadata associated with an asset. Multiple paths, various points of entry and exit, and differing final outcomes all are a given.

The accurate documentation of an operation's current workflows, including manual and automated tasks, is a good starting point in designing and implementing an optimized workflow solution. The effort pays dividends by helping not only to identify a more streamlined flow of content from beginning to end, but also to highlight areas in which greater efficiencies could be realized with the aid of greater automation. Ideally, this information frees the business to eliminate cumbersome old ways of working rather than maintain workflow elements that undermine the advantages an automated system can yield.

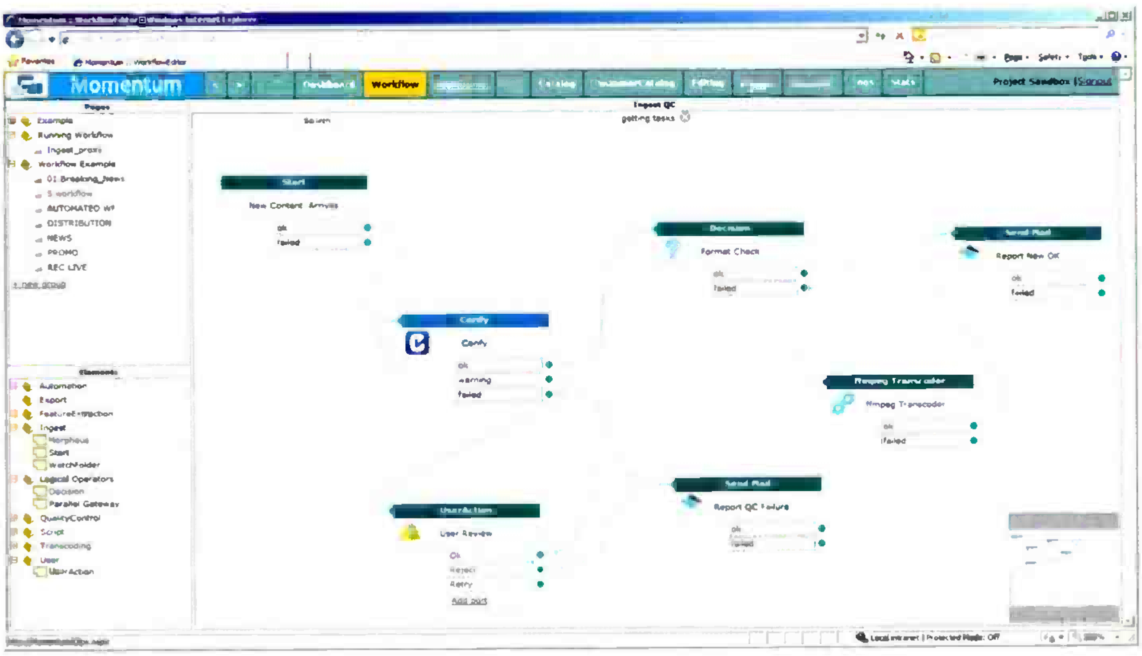

Figure 2. Shown here is a realistic workflow in which key manual and automated processes depend on one another and often link back on themselves.

Selecting a workflow solution

In the selection of a workflow management system, it is important to ensure that the system's inherent capabilities are distinctly understood from capabilities that can be implemented through bespoke code or scripting by the supplier. Because about the only thing that is guaranteed in the digital media industry is change, it is also critical that any workflow system implementation is adaptable

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and can accommodate the changing needs of the business. The maintenance and ongoing adaptation of bespoke solutions can quickly become a costly burden.

The media company itself should be able to maintain the skill set necessary to adapt and optimize workflows throughout the life of the automation system. Rather than require custom coding for every alteration of the workflow, the system should facilitate these changes through flexible graphical interfaces for workflow design and management. More specifically, in dealing with a complex workflow, it is essential that users can describe a high level of sophistication to the system. The extent to which the user can refine the system has a direct impact on the system's total cost of ownership, as the ongoing running costs must be factored into any return on investment business case for a workflow automation project.

Other important criteria to consider are those associated with integration of the workflow management solution with other systems in place. For instance, if the operation is running a business planning system, consider how it can integrate with the workflow solution so that workflows can be automatically instigated by the planning system. Additionally, status of the workflow execution should be reported back to the planning system. The second integration challenge is interfacing all relevant media processing infrastructure, which is typically implemented via device-specific APIs or even simple watch folders.

Addressing both aspects of the integration challenge is a standardization initiative called Framework for Interoperable Media Service (FIMS). A task force has been set up jointly by the Advanced Media Workflow Association (AMWA) and the European Broadcast Union (EBU), and the aim of this task force is to develop a common approach to integrate hardware and software components in modern digital media production facilities. While not yet a ratified standard, FIMS will ease the integration of systems that comply to it in the future.

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Gaining business intelligence

Full integration of the workflow automation system into a business depends on the effective incorporation of the manual tasks carried out by operational staff with the automated tasks carried out by machines. Within a workflow, it should be possible to define manual tasks and assign them to an individual or to a specific group of operators. The system then can present users with clear "to do" lists and track not only who carries out an operation, but also when and how long it took to complete that operation.

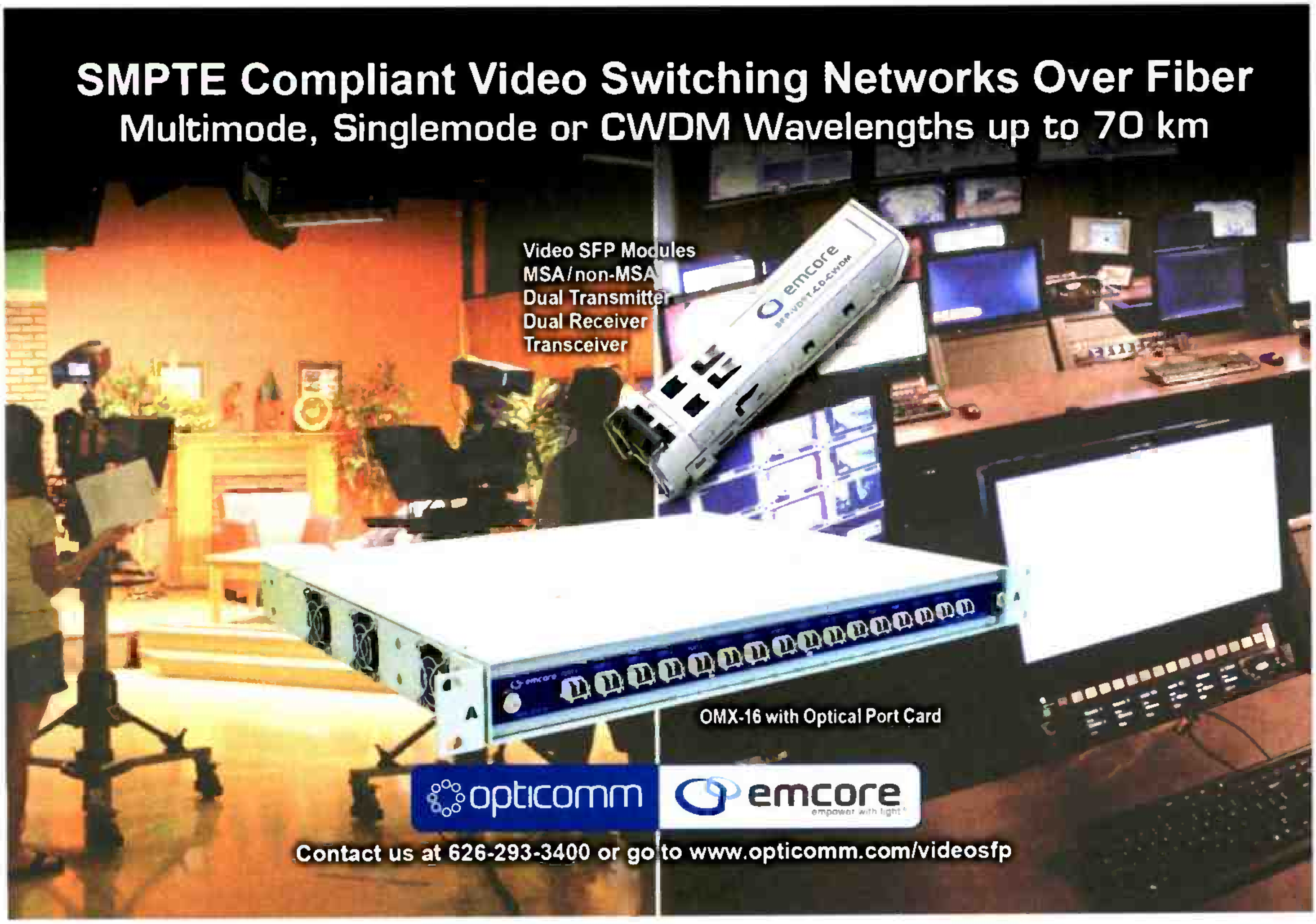
The intelligence of the automation system is beneficial in several ways. In addition to enabling manual modification or interaction with workflows, superior systems incorporate a level of intelligence that helps to optimize the use of resources. For instance, in managing a group of devices (such as transcoders), some automation systems are able to facilitate efficiencies (such as load balancing) by allocating tasks to the appropriate devices.

Another key advantage of automating workflow is that the system can capture operational performance metrics that provide great insight into how the business is performing and the capacity within it. If the right data, such as how long a task took to execute, is captured by the workflow system, then the business can not only carry out historic reporting, but also model potential future demands on a system and estimate whether or not there is sufficient capacity to meet the demand or launch additional services.

Empowering content providers

By empowering the content provider to orchestrate, manage and control sophisticated content production processes, and by providing a high level of control and flexibility without the need for complicated customization, workflow automation makes content more accessible, supports more efficient allocation of resources and aids the business in reducing its overall operational costs. All of these benefits are significant enablers as media companies take on the challenge of multiplatform content delivery.

Neil Maycock is chief architect at Snell.



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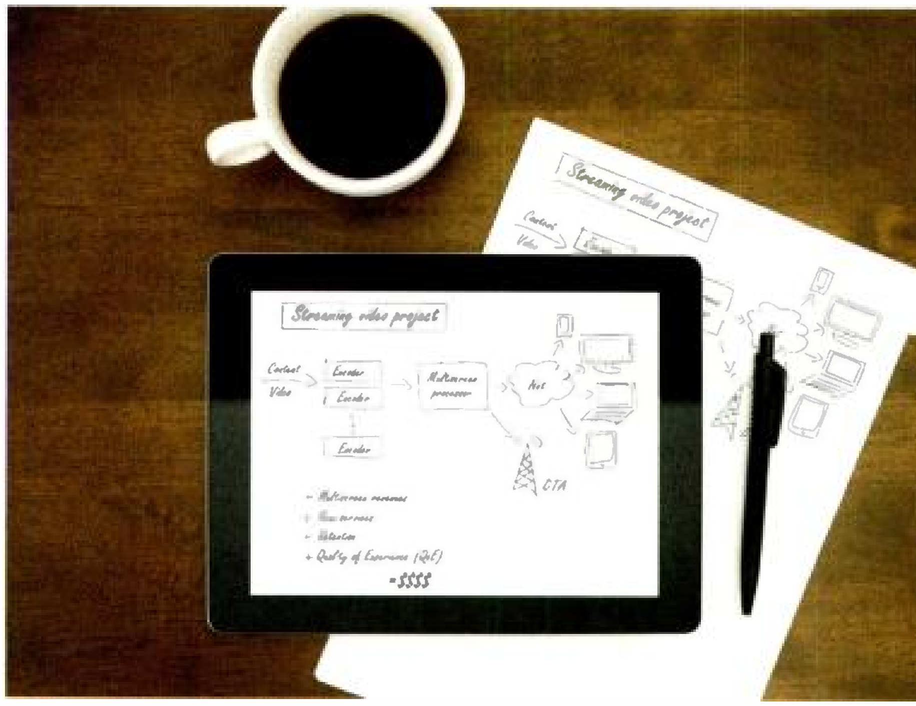
Netting quality in the video stream

BY JEREMY BENNINGTON

The streaming video era is upon us. The advent of streaming video technology is not only changing how traditional TV delivery is accomplished, it also is transforming business models, subscriber experience and content availability. It is creating a "video renaissance" for the broadcasting industry.

Why is streaming video technology transformative? What challenges does it solve? What problems may it create? What can I do about it? There are many questions, but one thing is for certain: We must find ways of enabling content to be consumed on not just the TV, but other devices and locations. Streaming video technologies make that possible and cost-effective.



The streaming video project now has many variables, but the monetary equation's root is video quality.

Industry transformer

Streaming video technology has not only enabled almost anyone to provide any type of content directly to the subscriber, it has given the ability to change how we view the subscriber.

Historically, the video industry developed business models around a "television household." This lumped all individuals in the home into a single group, even though each had distinct viewing preferences, habits and purchasing power. Also, it was hard to break down the TV household because individuals shared televisions. Similarly, early in the streaming video era, content was primarily delivered to a PC. It, too, was a shared device, although typically used by one individual at a time.

As broadband speeds increased, new streaming technologies were invented. Quality increased, and new devices like tablets and smartphones became commonplace in the home. The TV household was finally broken down to represent individuals, all having their own device. At this point, this evolution enabled the industry to provide specific content to each individual in the home, parallel to communal viewing on the TV and PC. Furthermore, advancements with game consoles, new set-top boxes and Smart TVs have enabled streaming video content on the television. As an industry, we can now technically provide content to any device in most homes. Moreover, we can provide content to individuals or the household.

With these new capabilities, broadcasters, video service providers and content owners can tailor content and business models to each individual next to traditional video business models. As we build these new individualistic models, it assumes that we can gather information about how video is being consumed, the quality of the viewing experience and how it impacts subscriber behavior.

Intentional quality reduction

One of the biggest challenges streaming video solves is the ability to provide content to any device over nearly any network. One of the biggest problems created when streaming video is the intentional and unintentional reduction of quality due to limited network or device capabilities. In many cases, the cause and effect on the subscriber is unknown. This unknown must be measured in order to better understand what drives user behavior and how service can improve.

Not only do we need to measure and understand streaming service quality provided to the

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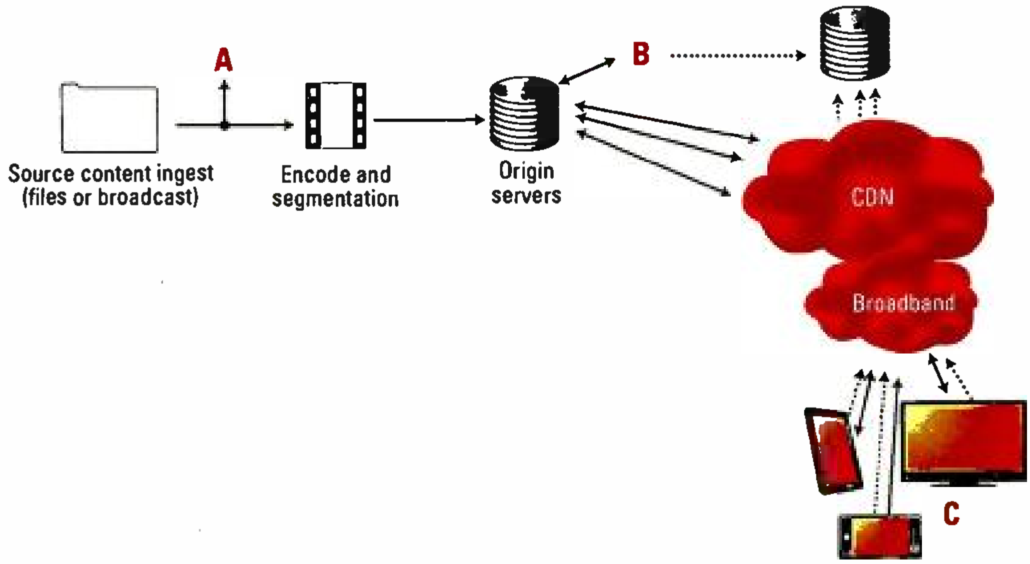

Figure 1: One of the most critical places to apply PQM monitoring is prior to encoding and packaging of content (point A).

end user, we also need to ensure sourced video is high quality. If the source's quality isn't measured, then it is junk in and junk out, no matter how the video is encoded and sent over the streaming video network.

Solutions

Various operators, suppliers and standards bodies are working on different aspects of how to address these issues. The ATIS Internet Interoperability Forum is working on a standard to correlate end-user quality and source quality in a streaming video network. Complementary to that, the SCTE is working on video artifact definitions and measurement guidelines. The following two resolutions below are based on these developing standards, and can also be accomplished using various vendor implementations.

Resolution 1: Junk in, junk out — In any video network, it is critical to measure video quality at the origination. For a cable TV, satellite TV or IPTV operator, the source would be the incoming feed from a programmer before it is re-encoded for transmission over their networks. For a broadcaster, this might be the national feed being sent out from post production, or it could be the incoming feed from a remote. For a local affiliate, this might be the national feed received and the retransmit with local ads and content. The "junk in, junk out" issue arises anywhere video content is handed off to another party or is being re-encoded.

For instance, you could be monitoring video at a headend that has been encoded and re-encoded several times by other parts of the video distribution. Network and MPEG layers are typically error-free; however, the impairments are in the content itself due to prior encoding. Only perceptual quality monitoring (PQM) can identify visual artifacts within the content itself and determine video quality. PQM can identify video artifacts like: blockiness, blurriness, jerkiness, black screen, frozen screen, colorfulness, scene complexity, motion complexity, ringing and several other visual artifacts, regardless of cause. Definitions of these artifacts can be found in the SCTE HMS177 draft standard. Most tools that detect these artifacts can also use them to compute a mean opinion score (MOS). A MOS is a 1 (bad) – 5 (perfect) score of the overall video quality representing how an average viewer would rate video's quality. Using the artifacts and MOS score, you will know at each point in the video transmission path if junk in results in junk out.

One of the most critical places to apply PQM monitoring is at the point prior to encoding and packaging of content for a streaming video service. Monitoring at point "A" provides a quality baseline for the service. (See Figure 1.) The same PQM monitoring is then applied for each of the bit rates at point "B" and compared to their counterpoints from point "A." From the comparison, the measurable degradation can be calculated. If the degradation is significant, or the quality was poor at the source, then the content should be halted or at least an alarm sent to operations. We can then catalog the quality for each bit rate and segment in a database for correlation with each view. (Measurement at point "B" in Figure 1 can be before or after the origin server, but before the CDN.)

Resolution 2: End-user quality of experience correlation and potential impacts — From the first resolution, we know the baseline quality of video prior to encoding and packaging for a streaming video service. We also know the quality of each bit rate by segment, so we know how much degradation is imposed when the

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content is encoded to a lower bit rate. Using this information and telemetry from the streaming video client, the quality for each subscriber can be calculated, per service, and then correlated with user behavior.

The bandwidth and network quality for each subscriber may change over time, and the client will adapt to the conditions by requesting different bit rates and using various other techniques. Calculating each subscriber's quality is straightforward when using the new MPEG DASH standard on a client. (If another client like HLS or Smooth-Streaming is used, the client metrics telemetry reporting may not exist, or it may be proprietary.) The MPEG DASH standard includes an option to provide telemetry and metrics that include what segment was requested, when it played and a reason if it didn't. Using this information from point "C" in Figure 1, we can look up the quality measured back at point "B" for each segment that was played. Then, the user's quality can be calculated over the entire viewing period. (See Figure 2.)

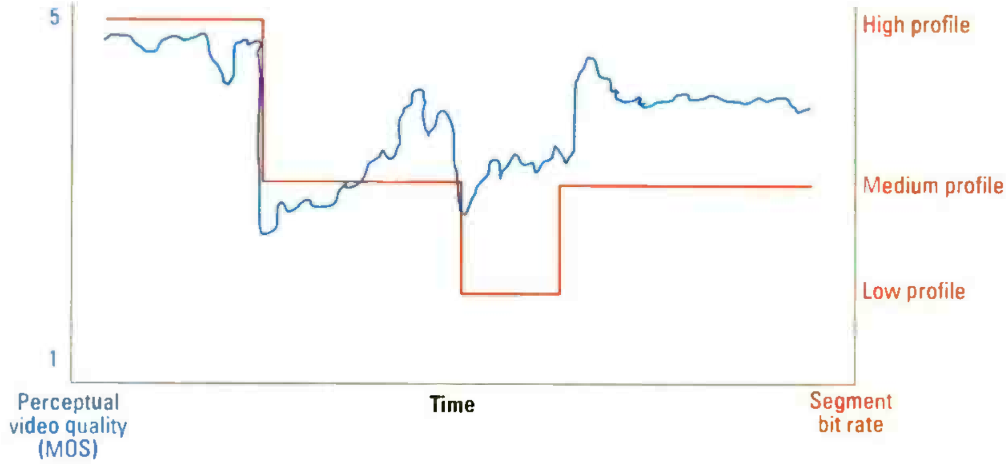

Figure 2. The MPEG DASH standard gives the option to provide telemetry and metrics at a specific point. This information is used to calculate a user's experience over an entire viewing period.

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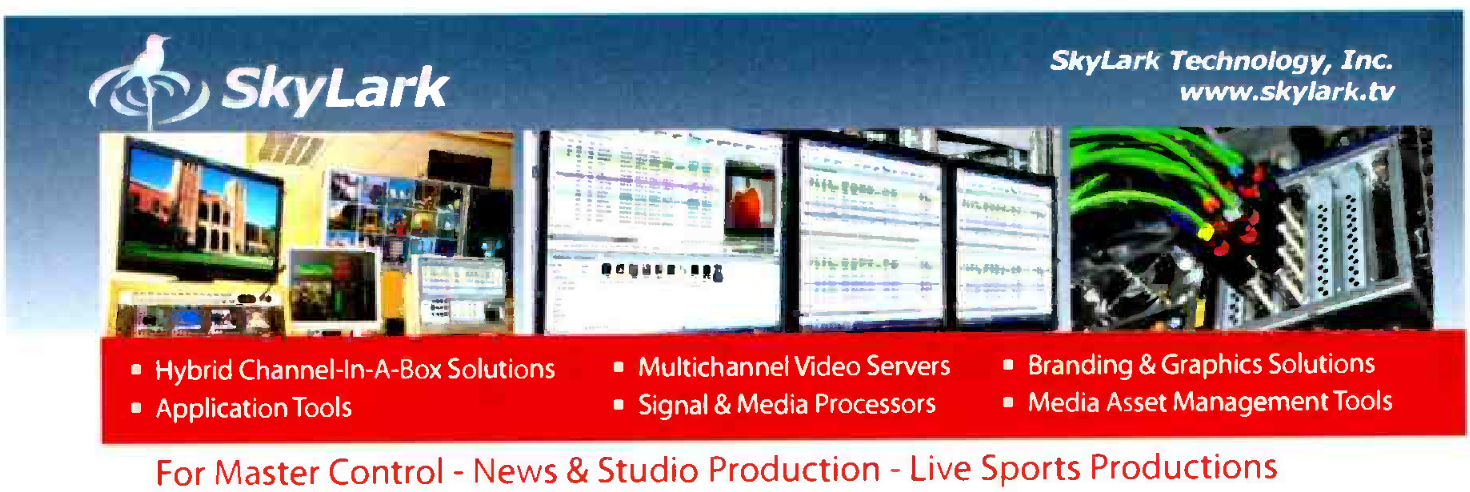
In addition to calculating each subscriber's video quality, the average viewing quality across all subscribers is calculable as we gather this data from all the clients. From this data, it can be better understood how each subscriber is receiving streaming video service — not just from a bandwidth perspective, as many companies currently look at, but from a true perceived video quality perspective. This is critical as one looks over not just a single video viewing period, movie or clip, but over a longer time period. If users are experiencing high video quality consistently, they are more likely to use the service. If they have consistently low quality, they will have a different behavior, and yet another different behavior if it is inconsistent. The quality information can also be correlated with the percentage of video completion for a fixed video asset (like a TV episode, user generated clip or movie, for example) to understand the potential cause and effect on users. (See Table 1.) Similar conclusions can be generated for the length of someone watching a live broadcast or streaming channel.

Video quality	Percentage viewed	Cause and effect
Consistent very good - perfect	75%-100%	People love this content.
Consistent very good - perfect	25%-75%	People may like this content.
Consistent very good - perfect	1%-25%	People do not like this content.
Consistent poor - good	$75%-100%	People really love this content, but I am not providing very good quality.
Consistent poor - good	25%-75%	People like this content, but they might love it if the quality was better.
Consistent poor - good	1$-25%	People may like this content, but I cannot determine that because I am not delivering a good enough quality.
Variable quality	75%-100%	People really love this content, but I am not providing very good quality.
Variable quality	25%-75%	People like this content, but they might love it if the quality was better and consistent.
Variable quality	1%-25%	People got ticked off and stopped watching; they might like the content if I provided better quality.
Started good quality than decreased	N/A	People got ticked off and stopped watching; they might like the content if I provided better quality.

Table 1: This shows the potential cause-and-effect range based on quality and percentage viewed.



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Without correlating the video quality with the percentage viewed, it is difficult to understand what drives user behavior, keeping in mind that quality may not always be correlated with the bit rate since some content is harder to encode than others and may change throughout a program, asset or movie. For instance, if you were streaming a channel, the video quality decreased because the complexity of the content increased (i.e., going from a newsroom to a sports event). And, even though the bit rates remained the same, knowing the subscribers stopped watching it would be an important data point. Why did they stop? They didn't stop watching because of the type of content; they may have wanted to watch the sporting event, but the degraded quality convinced them otherwise.

Conclusion

Streaming video is enabling a video renaissance where we, as an industry, are able to provide endless types of content to almost any device, anytime, anywhere and do so economically. However, in the process of becoming so flexible, the quality of video becomes much more variable than in our traditional HD/SD to a TV model. Understanding the quality of provided video is critical to any video service provider, be it traditional or streaming. In a streaming video service, it becomes critical to understand the cause and effect on subscriber behavior. From that, we can understand what content is liked more compared to others, and why that is the case. From there, more emphasis can be placed on those video assets for monetization.

Jeremy Bennington is senior vice president of strategic development, Cheetah Technologies.

Understanding the quality of provided video is critical to any video service provider. In a streaming service, it becomes critical to understand the cause and effect on subscriber behavior. From there, more emphasis can be placed on monetization.

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When IP is not "that IP"

BY DUNCAN POTTER

Video servers capable of using their video awareness and proximity to the client to create a virtual session enable the operator to report the actual quality of experience.

There is a world of difference between IP in managed and unmanaged networks, and it's not just the IP stack that's different. The business of on demand TV and video is probably more accurately described as monetizing content. There are really only three basic methods of monetizing content: subscriptions, pay-per-view and advertising. While these three methods may appear similar, there are additional elements and challenges that engineers may overlook when it comes to actual video delivery.

> Adaptive streaming is a hybrid delivery method that is based on HTTP progressive download. It was first widely used in NBC's production of the Summer 2008 Olympics in Beijing.

Requirements for successful video delivery

The first key delivery requirement that engineers must address is the prerequisite to maintain a certain quality of experience (QoE). Here, both subscribers and content producers expect a high degree of QoE, in part, because today's display systems highlight every image impairment.

A second requirement is that usage data must be relayed back to an analytics system. Content owners want to know much more than just how many viewers were served. They want to know about the quality of those streams.

Let's look more closely at the delivery architecture by breaking it down into three main layers: the monetization layer (analytics, transaction and billing systems, campaign and offer management), the management layer (managing and maintaining the flow of content through the system — packaging, workflow and content protection) and the delivery layer (actual transmission of content to the consumer).

Within cable and IPTV platforms, the production and collection of delivery data within the system are straightforward because all of the system components are directly under the control of the operator. However, with the transition from a managed IP environment to the public Internet (as in the case of OTT or multiscreen environments), there are some specific new challenges that must be addressed.

The "sessionless" issue

These new environments often rely on variable bit-rate delivery, one controlled by the client. Called HTTP-based adaptive bit rate (ABR) streaming, it is a process that adjusts the quality of delivered content based on changing network conditions with the goal of ensuring the best possible viewer experience.

HTTP-based adaptive streaming is a hybrid delivery method that resembles IP streaming but is based on an HTTP progressive download. The technology was first widely used in NBC's production of the Summer 2008 Olympics in Beijing. Examples of ABR streaming include: IIS Smooth Streaming (used with Microsoft Silverlight), Apple Live Streaming and Adobe Flash Dynamic. Even though these technologies use different formats and encryption schemes, they all rely on HTTP. The media is downloaded as a long series of small progressive downloads, rather than one big progressive download.

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In a typical adaptive streaming implementation, the content is chopped into many short segments, called chunks, and then encoded to the desired delivery format. Chunks are typically 2 seconds to 10 seconds long. The video codec creates each chunk by cutting at a GOP boundary, starting with a key frame. This allows each chunk to later be decoded independently of other chunks. In effect, this means that there is no direct "session," unlike RTSP that is traditionally used in managed network environments such as IPTV or cable.

The encoded chunks are hosted on an HTTP Web server. A client requests the chunks from the Web server in a linear fashion and downloads them using a plain HTTP progressive download. As the chunks are downloaded to the client, the client plays back the sequence of chunks in linear order. Because the chunks are carefully encoded without any gaps or overlaps between them, the chunks play back as a seamless video.

The "adaptive" part of the system comes into play when the video/audio source is encoded at multiple bit rates, generating multiple chunks each at a different bit rate. (See Figure 1.)

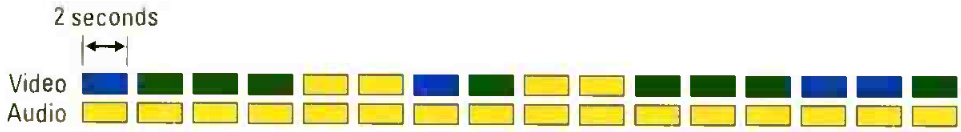
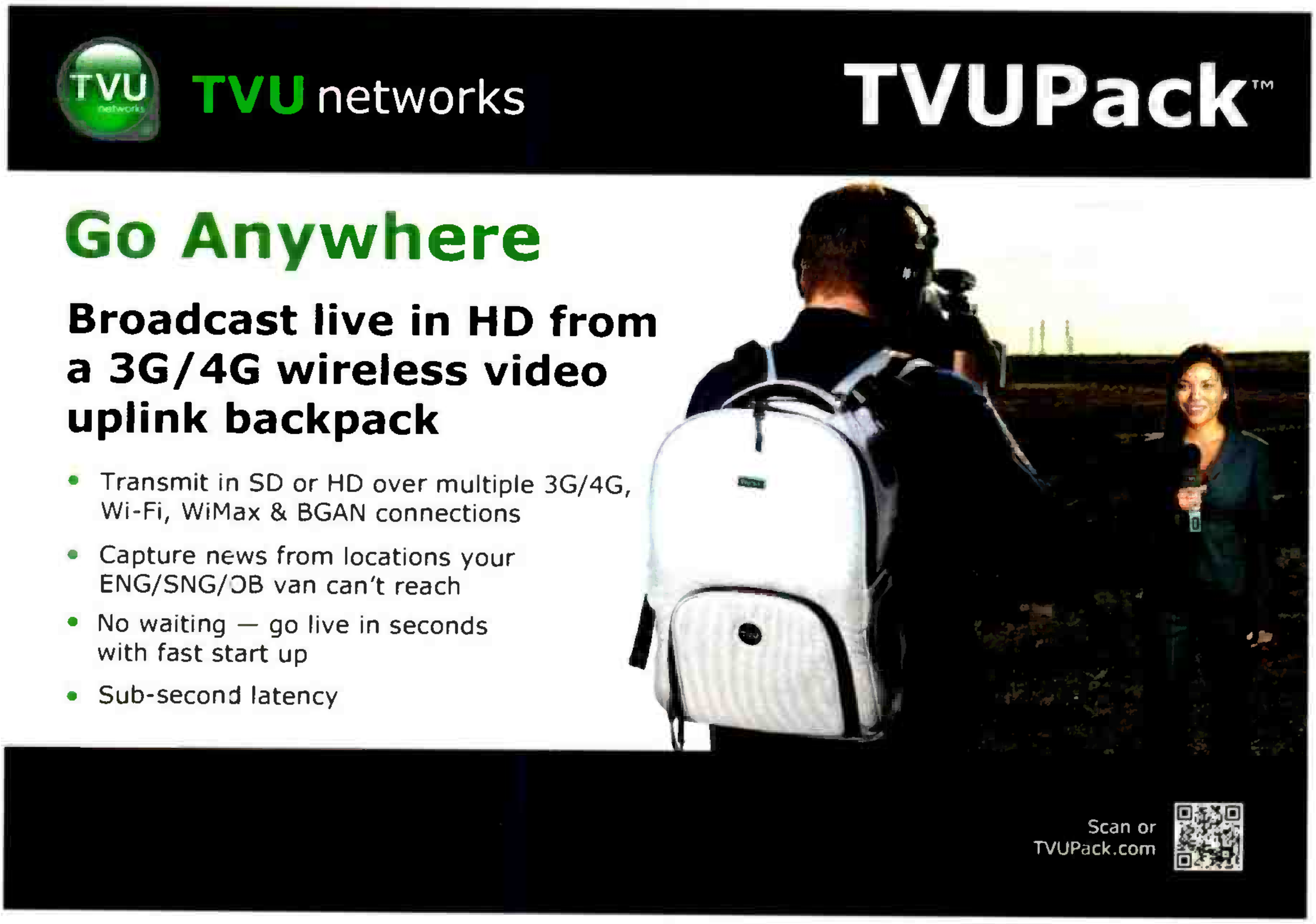


Figure 1. Adaptive streaming requires the video be cut into small segments and then encoded into various bit rates prior to transmission.

In the figure, the top row represents the video, with different colors denoting various bit rates. This bit-rate schema is generally defined at the time of encoding, although there are some new technology advancements that are able to perform this on a more dynamic and distributed basis. Even so, these schemes do not alleviate this issue of monitoring and reporting.



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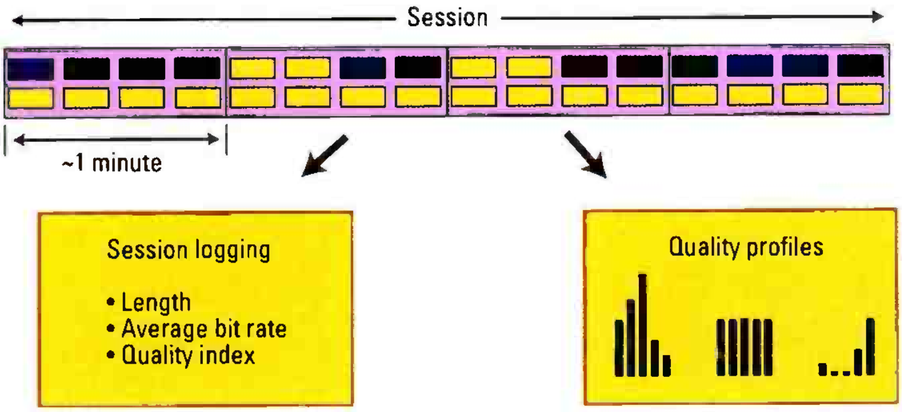

Figure 2. Content owners often require session reports that include specific quality profiles. This requires CDNs to not only measure certain parameters like bit rate, but tie the data to entire programs and customer QoE, not just data fragments.

Because Web servers usually deliver data as fast as network bandwidth allows them to, the client can estimate available bandwidth and decide to download larger or smaller chunks ahead of time.

These techniques add complexity to the delivery process because they require the video to be cached and transmitted as close to the viewer as possible. Now the number of components in each delivered stream becomes fluid rather than fixed.

With this basic understanding, a potential problem becomes fairly clear. If there is no real session associated with the communication, and the operator has deployed distributed network caches to maximize bandwidth usage, how does the operator report the QoE of a specific session or even the quality of video that has been delivered to a specific client over a certain time period?

Possible solutions

There are at least two potential answers to this issue. First, implement a log-based monitoring system that pulls the log files from all possible locations, especially from the video servers, and attempt to build an effective correlation between individual files being transmitted and the client that is viewing those files. This method is attractive because it is fairly simple but does require an enormous amount of server horsepower for the analysis and correlation. In the most simplistic of examples, a 90-minute soccer match encoded at five different bit rates would create 13,500 files.

The second solution relies on the edge servers to play an active role in aggregating the information. The main requirement in this system is that the video servers be capable of using their video awareness and proximity to the client to create a virtual session. This enables the operator to report the actual QoE, or at least the bit rate being consumed by the client, in a way that is meaningful to the content provider.

Once a session concept has been introduced, it is then possible to report usage data tied to sessions and content, instead of fragments. Parameters of interest could include session length, average bit rate and engagement. (See Figure 2.)

Engagement is typically measured as session length versus asset length, i.e., it shows how much of the content that was actually watched. This type of measurement requires the system to understand what an asset is and that it has a certain length. Just knowing what fragments that have been delivered is not sufficient.

As viewership on tablets, OTT and even mobile devices increases, ABR delivery will become even more important. Engineers will need to better understand how to deploy distributed systems that embrace cost-effective video delivery while preserving the all-important QoE and data reporting. Whether being implemented as an operator CDN or an extension of the existing IPTV infrastructure, monetization, QoE and data reporting are likely to remain key areas of focus over the next few years.

Duncan Potter is chief marketing officer and vice president of operations, Edgeware.

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HVS fundamentals

Knowledge of the Human Visual System is essential to understand how future equipment might be specified for improved performance.

BY JOHN WATKINSON

On an evolutionary scale, film and television have a vanishingly short history. This means the senses of humans and other creatures evolved for some other reason than to watch screens. That reason is simple: survival. A creature with slightly more effective senses has a better chance of avoiding being eaten, finding food and finding a mate; therefore, we expect surviving species to have been selected for effective senses, which is indeed the case.

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Reality vs. illusion

While I intend to concentrate here on the Human Visual System (HVS), it is worth noting in passing that all of the senses combine to create a model in our minds of what is around us. We call it reality, whereas it is only an illusion due to that part of our environment that our senses permit us to detect. If our senses were different, if we had the hearing of a dog and the vision of an eagle, our reality would be different. There is a spread of performance of senses between humans, and it changes with age and can be impaired by various substances. You might define reality as the remaining illusion due to a shortage of alcohol. There is no one reality, and many things must remain forever subjective.

For example, I have lost count of the number of times I have been informed that I must be uncomfortable on account of what I am wearing or the way I am sitting and so on. Some advice is then proffered as to how I could improve my comfort. People who act that way have yet to learn that their own reality may not reflect everyone else's and have a way to go in personal growth.

For a further example, a significant number of people have essentially no stereoscopic vision, and others are color blind to different extents. But because that is their reality, they don't know that they lack those abilities unless by chance they are tested. It follows that the average person viewing a TV screen will see more than some and less than others. Consequently, simply assessing quality by looking at the picture is likely to be unsatisfactory because someone else may see things that you missed. The regular use of objective quality measurements overcomes that problem.

HVS components

The HVS has some superficial similarity to a camera. Figure 1 shows that it has a lens, an iris and a sensor, but that is where the similarity ends. To make progress in understanding the HVS and in how to use a TV camera, it is vital to understand that in most respects, the two are completely different. The reality allowed to a TV camera by its sensing ability is different to the human sensation; therefore, the well-worn saying "the camera never lies" is one of the greatest fallacies I have ever come across. The fact is the camera always lies, and part of the art of the videographer is to keep it honest, or at least keep it to the story you are trying to tell.

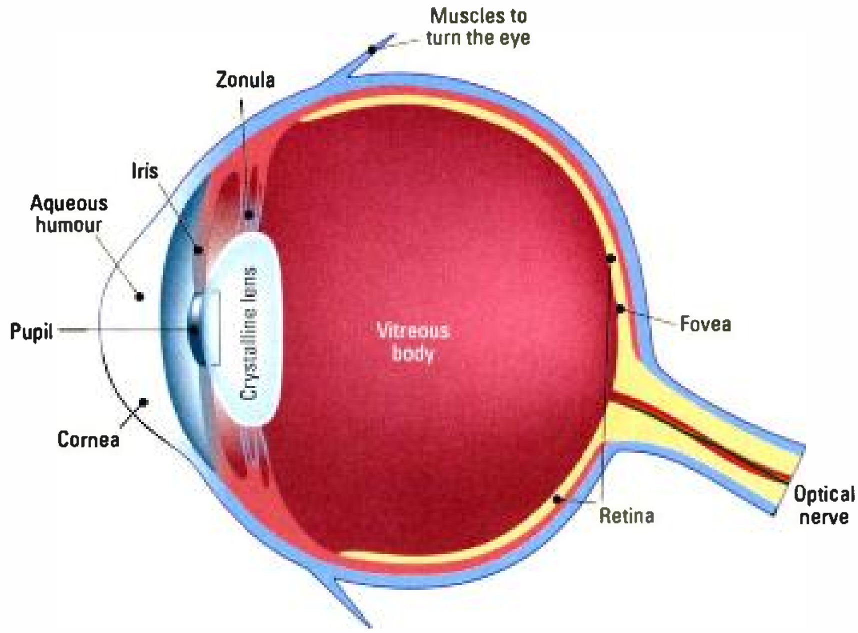

Figure 1. Shown here is the Human Visual System.

The fact is the camera always lies, and part of the art of the videographer is to keep it honest, or at least keep it to the story you are trying to tell.

Human vision is extremely indirect, so what we call vision is not the image on the retina, but something that has been subject to what we might describe as extensive post-production. Essentially human vision comes from a kind of three-dimensional frame store, which contains a model of our surroundings. We are also in the model, so we can reach out and grasp things like focus rings and battery packs.

The reason for this arrangement is that it allows a huge field of view, around 180 degrees horizontally. I once attended a conference where another presenter had calculated the bandwidth needed to replicate the field of view of human vision with the same acuity, color gamut and the same temporal response. The result was, if I remember correctly, in the terabit per second region. Clearly, the HVS cannot and does not transmit terabits per second between the eyes and the brain, so it must be more subtle, and that is where the frame store comes in.

Self-evidently, the frame store only needs to be updated if anything changes. This alone allows a colossal reduction in bandwidth from the eye. The second bandwidth

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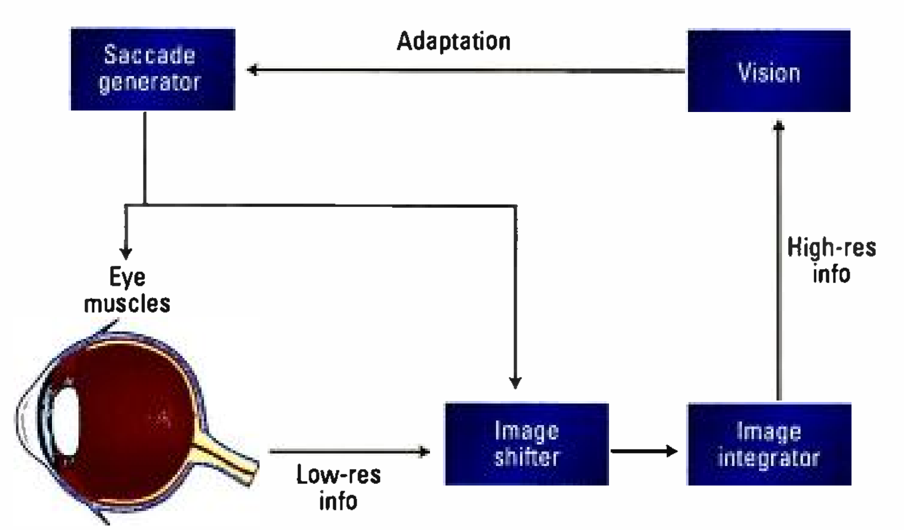

Figure 2. Saccadic motion is the involuntary constant minute oscillation of the eyeball.

reduction measure is that the acuity of the eye is not uniform. Best acuity is only present in a small central circular area known as the fovea. Obviously, the eye then needs to swivel so that it can rapidly place the item of interest on the fovea. It will do so if anything is detected by any sense that suggests something has changed in the environment.

The cause might include a sound, a vibration, a change in radiant heat or touch sensed by the skin, or something detected by the peripheral vision. Because the primary purpose of peripheral vision is to alert the senses to a change in the environment, the response rate of peripheral vision is higher than foveal vision. Try looking away from a TV set so it appears right at the edge of your field of view, and you will see it flickering. You will also experience a strong urge to look at it, which stops the flickering. This is one of the mechanisms behind TV addiction.

The retina is covered in what are effectively pixels, although they are officially called rods and cones. The density of the pixels is low in the peripheral vision area and higher in the fovea. Only the fovea has color pixels. Peripheral vision sees in monochrome, and the sensation of color comes from the frame store. But color video will have to wait for another time. Interestingly, the density of pixels in the fovea is much less than we would find in a TV camera of similar acuity. In other words, the HVS appears to violate sampling theory. In fact, it doesn't because something else is going on, known as saccadic motion.

Saccadic motion

Saccadic motion is the involuntary constant minute oscillation of the eyeball. It has the result of shifting a given pixel to a large number of different locations so that over time, a high-resolution image can be built up from all the measurements made in various places.

The HVS causes the eye motion, and then cancels the resultant image shift in a kind of DVE, with the result that the pixels shift. The system can be seen in Figure 2. The HVS then integrates a sharp image by adding a number of images over time with the pixels in multiple locations. Clearly this takes time, and it is one of the reasons for persistence of vision and the reduced visibility of flicker in the fovea.

In normal circumstances, our eyes never stop moving, and this is just as well because our vision is AC-coupled, and we can only perceive changes. One reason for this is that evolution resulted in the retina being back to front, with the light-sensitive layer underneath the blood vessels and nerves. The raw retinal image is like looking through a bowl of pasta. However, by keeping the eye moving, we can average out the shadows of the blood vessels and get the image. Only the good images can update the frame store, so we never see the pasta.

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The delay caused by the image processing is quite significant, so what we see is behind real time. However, if you move your hands together, you feel them touch at the same time as you see them touch because the HVS has shifted the position of our hands in the image to where it should be because it knows they are moving and how fast. The same mechanism allows you to catch a ball.

The delay caused by the image processing is quite significant, so what we see is behind real time.

Another interesting difference between our eyes and a camera is that if a camera is panned very rapidly, the image smears out unrecognizably. When our eyes move rapidly from one point of interest to another, we don't see image smear, nor do we see darkness. What happens is that the eyes are essentially switched off when they move rapidly but we continue to see what is in our frame store. Magicians know this and can do things without the audience seeing because they elicit a rapid eye shift during the action they want to conceal. You can try looking at one of your eyes in a mirror, and then switching your gaze to the other eye. You will never see your own eyes move.

It should not be necessary to point out that a typical camera has only one eye, whereas many creatures, apart from the mythical Cyclops, have two eyes. The HVS merges the information from both eyes, such that we believe we are looking at life from a viewpoint half way between our eyes. Stereoscopy warrants an article of its own, so I won't go into it further here. BE

John Watkinson is a high-technology consultant and author of several books on video technology.

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Medway

Marquis Broadcast's software tool kit represents an effective way to manage metadata capture and transfer.

BY CHRIS STEELE

These days, increasing volumes of content are being repurposed for Internet distribution. In mid-January, the FCC issued the implementation schedule and standards for web captioning based on the 21st Century Communications and Video Accessibility Act of 2010. This means captioned content must retain closed captions when broadcast on the Internet.

Because closed captions have been used over many years, archives of captioned content in multiple formats currently exist, and the challenge is to convert this material into web content with the closed captions intact. Further issues are presented if the programs need to be edited or shortened, or the commercials need to be removed prior to web broadcast.

The platform

Marquis Broadcast's Medway is a software tool kit that delivers a seamless integration between broadcast content applications. In some installations, it provides simple media transfer and conversion services between Avid or Apple Final Cut Pro 7 edit environments and broadcast servers. (See Figure 1.) In large-scale installations, it acts as the central hub, providing multiple, simultaneous, and high-volume media and metadata integration services across best-of-breed systems from multiple vendors.

In this instance, the solution allows media destined for the Internet and the captions associated with it to be edited at the same time, enabling easy conversion of material without caption loss. Such a workflow reduces the amount of manual operation as there is no requirement to re-edit the whole closed-caption sequence separately. The cost-efficient workflow ensures editors can get the process right in one process execution.

The process

Medway transfers both essence and metadata, wrapped in an MXF file, enabling the entire production process to be maintained in a digital environment. Media can be rewrapped and transcoded during errors and significantly improving output quality.

The solution creates a unified working environment for broadcast ingest, post-production editing and transmission playout. Acting as a central hub for the facility, Medway transfers media and associated metadata at faster than real-time speeds over standard data networks. Where the workflow involves a mixture of media formats, transcoding is automatic.

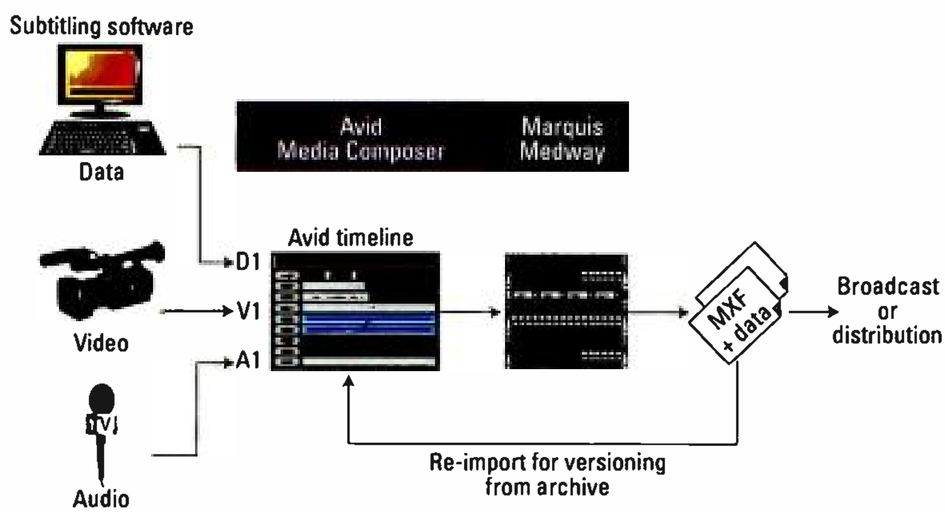

Figure 1. In this installation, Medway provides simple media transfer and conversion services between the Avid edit environment and broadcast server.

> **Medway allows media destined for the Internet and the captions associated with it to be edited at the same time, enabling easy conversion of material without caption loss.**

transfer wherever necessary to ensure minimal production delay. The need to produce interim files, or go out to tape, is totally removed, minimizing the chance for operational

Metadata is gathered from the NLE workstation and augmented, either by the user based upon local rules for that particular type of transfer or from MAMs or servers. By allowing

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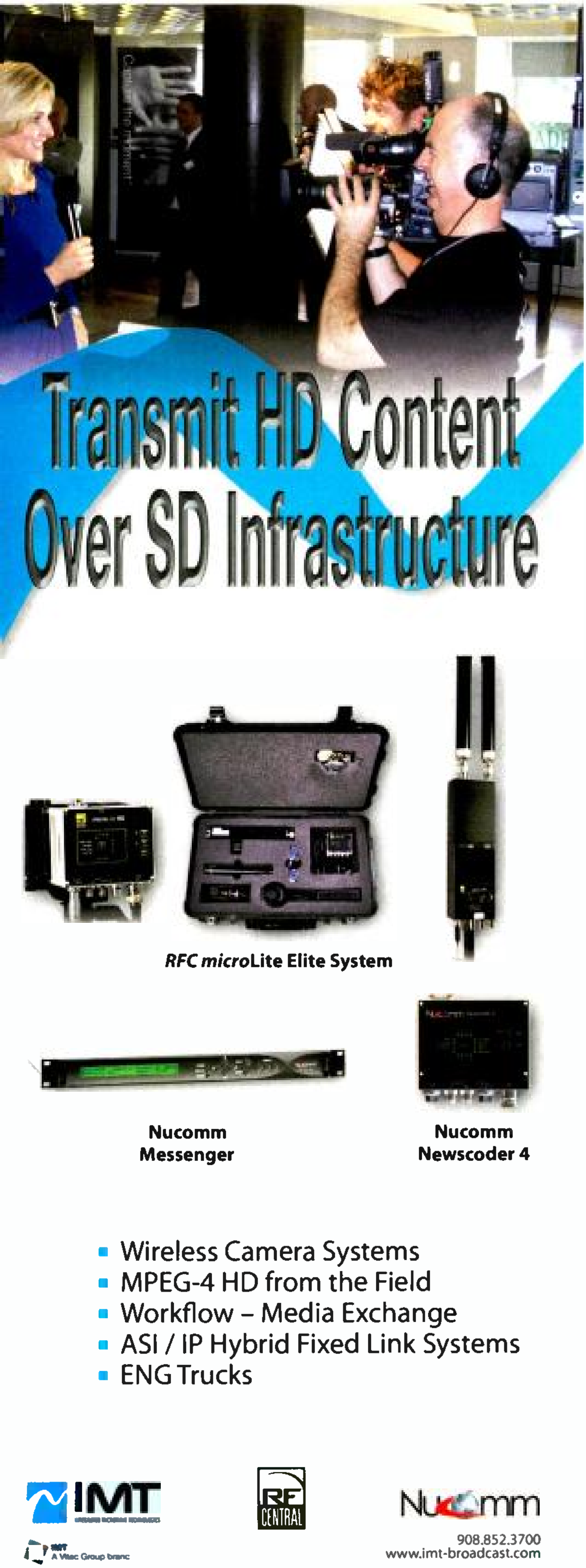

metadata to be managed and moved with its associated media, Medway enhances media tracking by ensuring media can never be lost. This maximizes the return on expensive assets.

In relation to closed captioning, the solution ensures the captions appear on the data track after the content has been ingested in Avid. By associating the closed captions with the media, both can be transferred simultaneously through an intuitive drag-and-drop interface. Both can then be edited within an Avid system. The closed captioning is transferred from the MXF data track to the data track for editing, and then back to the MXF data track for transfer, playout or archive. The recreated MXF file still retains the closed captioning, even after editing.

The platform supports full integration to MAMs and automation systems.

For web content, HD material might be converted to a lower resolution by a variety of third-party applications. Linking in this way allows the closed captioning to be edited at the same time as the conversion to SD takes place.

Managing file formats

Complex digital workflows can be hampered by expensive and repetitive operations brought on by file incompatibilities. With the move to file-based production workflows and recent legislative changes, Medway represents an effective way to manage metadata capture and transfer.

This solution supports moving essence and captioning data to and from editing and delivery to storage, archive and playout servers. The platform also supports full integration to MAMs and automation systems. Because Medway efficiently scales, it works well in installations ranging from a simple and straightforward workflow to more complex and advanced workflows. **BE**

Chris Steele is product manager for Marquis Broadcast.

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EVS' C-Cast

The second-screen system enables new revenue opportunities for broadcasters.

BY JOHANN SCHREURS

Television viewers no longer limit themselves to a single screen. Instead, today's audiences multitask over Twitter, Facebook and other social media sites as they consume their media. Rather than risk losing those viewers, broadcasters can now provide original premium content to consumers via their second screens, including camera angles and highlights not seen in primary broadcasts. With the proper tools, the large amount of content on servers that is often wasted and unused can be monetized and delivered in near real time to viewers' connected devices.

Delivering the additional content to viewers on second-screen media platforms relies on the descriptive metadata associated with event footage.

The system creates a second-screen timeline of events being produced into which external elements — such as ads, stats or surveys — can be inserted, enabling a high degree of interactivity and facilitating cause-and-effect programming. With an open architecture based on APIs, broadcasters can build their own Web application interfaces and charge subscribers for the service, and/or have sponsorship and merchandising on the consumer application.

The integrated engine suite is designed to make any multicamera content, as well as archives, highlights or third-party content, instantly available to Web-connected devices. The system is not an application, but rather the intelligence behind it, allowing customers to generate exclusive content on their own application interface. (See Figure 1.)

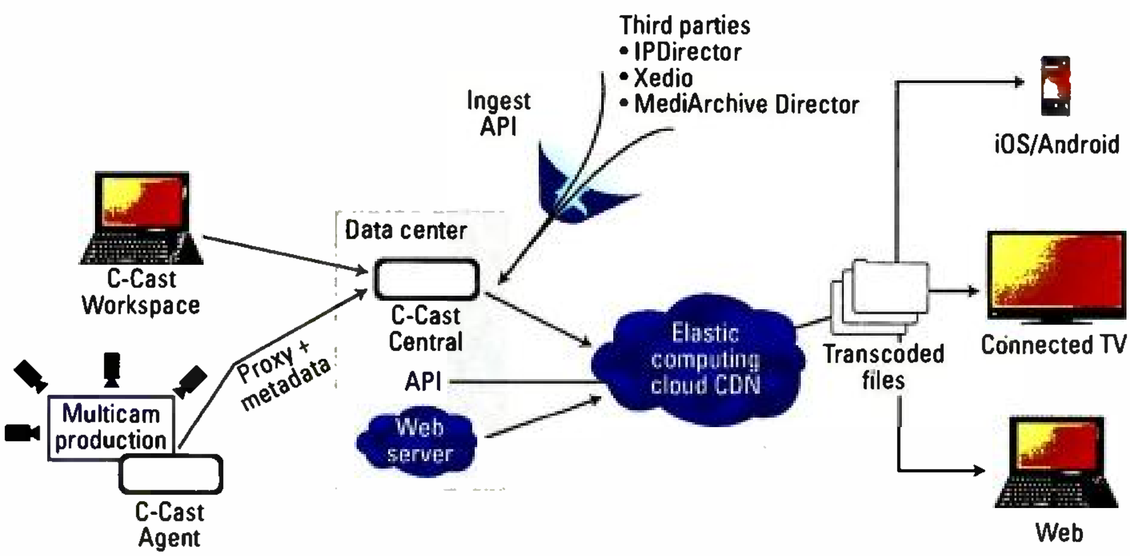

Figure 1. EVS' C-Cast interfaces with the company's multicamera production system to make content that might otherwise go unwatched available to second-screen devices, providing another potential revenue source for broadcasters. The system also provides support for adding external elements, such as ads, stats or surveys, from third-party systems.

With an open architecture based on APIs, broadcasters can build their own Web application interfaces and charge subscribers for the service.

Integrated system

The EVS C-Cast provides a set of integrated tools to support the development of content for these new screens in any live EVS multicamera production infrastructure, such as in OB facilities and TV studios.

Any clips or highlights created during live productions can be made instantly available to Web app subscribers. The company's synchronized multicamera-angle recording allows the system to automatically process unseen footage or any clip

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created on the company's servers for these other screens. During live operations, descriptive metadata as well as third-party stats can be integrated into the system database and associated with video clips and highlights, which are made available to the user in near real time.

More than 70 percent of tablet owners now watch sports on their TV sets while simultaneously consulting their Web-connected device as a second screen.

Components

The complete workflow is composed of standard equipment, including XT/XS series servers and IPDirector.

Installed at a production venue (OB van, studio or broadcast site), the C-Cast Agent server connects to the network, retrieves content and transfers it to C-Cast Central.

Installed at a datacenter and managed by the broadcaster, C-Cast Central assembles the content from one or several C-Cast Agent servers. It manages content, ensures delivery and directs availability via APIs. C-Cast Central is scalable to unlimited productions and applications, and includes the administration back office, CDN management, content syndication management and an API for second-screen applications. A viewer application manages viewers' interactions on their devices. Both the viewer application and the Web server are usually provided by a Web service provider but can be supplied by EVS in a project management mode.

EVS' C-Cast system makes any clips or highlights created during live productions instantly available to Web app subscribers. The company's synchronized multicamera-angle recording allows the system to automatically process unseen footage or any clip created on the company's servers for these other screens.

New revenue opportunities

More than 70 percent of tablet owners now watch sports on their TV sets while simultaneously consulting their Web-connected device as a second screen. C-Cast enables broadcasters to take advantage of this social media engagement in ways that mean increased revenue opportunities. **BE**

Johann Schreurs is general manager, new media broadcast, EVS.

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Surround everywhere

Surround sound doesn't have to be lost on a stereo transmission path.

BY J. TODD BAKER

When the lights dim in a theater, or we flip on our A/V receivers at home, we take for granted that we're going to hear great surround sound. But, many people don't realize that you can get this same great experience with spatial rendering over headphones as well. This has opened up a world of possibility for audio on portable devices. Transmitting surround sound to cinemas and home theaters is fairly straightforward.

Whether it is a D-Cinema, broadcast or streaming environment or discussion, bandwidth constraints for audio are virtually nonexistent. But, how do we get the same mix to the bandwidth-constrained world of mobile devices?

Most audio for mobile devices, whether streamed as audio only or associated with video, is transmitted at 128Kb/s and below, if we're lucky. Sometimes, it can be as low as 32Kb/s. Surround codecs cannot fit down such narrow pipes. Even if larger pipes were occasionally available, adaptive streaming concerns could force the content from a surround capable codec (192Kb/s+) into a stereo codec. This would cause a major shift in the audio image. Matrix formats, such as SRS 5.1 found in Microsoft's Expression Encoder, enable content providers to stream surround over any stereo codec. Devices with spatial rendering will create a theatrical experience over headphones.

Matrix format

Prior to the advent of discrete surround codecs, nearly all broadcast and theatrical surround was delivered by a matrixed surround format. By taking the surround content from the mixing room and summing the channels in a specific manner during the downmix to stereo, difference information is preserved between the channels that cue the decoder where to extract the objects during playback for surround. In the absence of a decoder, matrix-encoded signals playback as stereo. When a decoder is present, in a home theater, multi-speaker renderer, or in TVs and mobile devices, with two-speaker spatial renderer, the surround mix is restored.

Downmixing

Before discrete surround codecs, nearly all surround content was mastered and archived in a matrix format. This same master was used for delivery to theaters or broadcast providers. Since it was a stereo compatible, Left total/Right total (Lt/Rt) master, the mix was preserved all the way to the final destination. Where mono delivery was required, a standard mono sum of the two channels delivered mono compatibility.

With the emergence of discrete surround codecs for theatrical and broadcast mixes, most facilities delivered both a 6-channel (5.1) and stereo-compatible mix, matrixed (Lt/Rt) or standard stereo (Left only/Right only – Lo/Ro). With the transition to HDTV in the U.S. complete, many mixes are only created in 5.1, leaving it up to the end-point of the codec (TV, for example) to handle any downmixing.

Within Expression Encoder, this downmix technique is moved upstream to the content ingest workflow in order to allow for a stereo compatible surround mix. The principle is the same as the one used in the early era of surround from broadcast and cinema. The SRS 5.1 tools provide streaming content providers the ability to ingest 5.1 audio into their Expression Encoder workflow. Utilizing the batching tools provided in Expression Encoder, multiple profiles can be created to export various file types.

Where higher audio bandwidths are available, discrete codecs can be used. When compressing for stereo codecs, the user can enable SRS 5.1 encoding to downmix a stereo-compatible matrix. Any of the stereo codecs supported by Expression Encoder can carry the resulting output.

Since a matrix format is stereo compatible, it is also supported within Silverlight-enabled players and browsers. Listeners can decode SRS 5.1 for playback over 5.1 speaker systems, using an AVR, or over two-speaker or headphone rendering on virtual surround enabled TVs and mobile devices.

When 5.1 discrete codecs took over the air, many people abandoned matrix formats. But, with the emergence of streaming content to mobile devices, the need for a stereo-compatible surround format has resurfaced. When rendering surround over headphones, the benefits of discrete codecs are lost. Matrix formats provide these renderers with the information they need to present a cinematic experience on any mobile device, regardless of the limitations of today's mobile bandwidth constraints. BE

J. Todd Baker is director of technology, SRS Labs.

AUDIO TECHNOLOGY UPDATE
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Facility remote monitoring

Media-aware systems can help when centralizing.

BY JOHN LUFF

Parsing words carefully can sometimes lead to interesting results. This topic could cover monitoring over a large distance, or it could cover gathering information about systems within one facility. Then again, it could mean monitoring many facilities from one location. It seems to me that in the context of our changing industry, it needs to cover all three.

Increasingly, broadcasters are involved in one of many variants of centralized operations. That is often meant to construe centralized master control, though it could easily mean traffic, promotions or even a common transmitter facility for a region (as in Sutro Tower in San Francisco or Mount Wilson in Southern California). When viewed from the vantage point of the central facility, remote monitoring often means gathering information on the status of the remote facility and, most importantly, displaying it in a way that operators can quickly get a sense of the health of the remote location. Today, that means several kinds of information.

Video switching provider The Switch uses Skyline DataMiner, an SNMP fault reporting system with SLA correction, for remote monitoring. The Switch monitors each of its locations from its network operations center in New York City.

SNMP

For a centralized master control, it is important to access data about hardware as well as credible video to understand the end result of any potential failures noted by remote sensing. For instance, an SNMP monitoring system might report a failure in a video server, but what is more valuable to know is what the video and audio outputs look and sound like. By using a combination of IT-based remote sensing and return of confidence feeds as compressed audio and video, we can gain a much better view of the status.

SNMP is a great tool and is integrated into the monitoring systems delivered by a number of manufacturers in our "space." SNMP has three elements. Devices must have resident capabilities to respond to requests from a local SNMP monitoring system. The final element is a system that generates requests and aggregates responses into a practical user interface. There are a number of SNMP management software packages that can be used both for IT- and broadcast-centric hardware.

In our industry, it is often more convenient to buy the monitoring software along with modular equipment (DAs, conversion hardware, etc.). This can have two major benefits. First, there can be tight coupling between fault reporting and fault repair with control over a router, perhaps switching to a backup in the event of a failure of a particular circuit. Second, by merging signal transport hardware and the monitoring system into a closely coupled system, it is easy to get reports from each piece of modular conversion and distribution hardware about the health of the signal.

Consolidation

Of course there are other benefits to merging the facility monitoring into a small number of components. It becomes easy to have a single interface that is used to both monitor and control devices. This can permit operators to make adjustments when things are not quite perfect, like perhaps swapping audio tracks to remain on the air with a usable signal. Carrying it one step further, it is easy to see how a graphical user interface could, for instance, turn a defective device from green to red when a fault occurs, and with a simple mouse click permit the operator to bring up details about the fault. This could of course include pictures and sound to a larger monitor to permit quality evaluation.

The need to do that is easy to understand. An MPEG quality analysis system might sense the presence of excess macroblocking, causing an alarm. But it may be the best picture you have available due to rain fade in a satellite circuit, or even a faulty recording. Switching to a backup without seeing

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the defect might not be a good idea. Another example might be audio silence, which might simply be a dramatic effect the producer intended. Having monitoring systems that are more media aware can thus allow better fault finding and smoother operation than multipurpose IT-centric systems. But, of course, the opposite is also true.

IT hardware

Today, we live in an increasingly hybridized world where purpose-built video and audio hardware has to interface well with IT-centric hardware. For example, we now find station-in-a-box systems for master control that are entirely IT-based, except for interface cards for live feeds. Monitoring such systems, along with video servers, transmitter remote controls and lots of other examples can be done with video industry packages that have SNMP capability. But in a large installation, there may well be more IT than video in the future, so finding a happy medium is critical if we consider growth of a system over the long term.

We should think about the topology of a monitoring system carefully. If a monitoring system has to operate over a WAN connection, one should carefully consider what happens if the interconnection goes down. If the monitoring system is critical, as in the case of a centralized master control facility remaining in contact with the remote locations, then a backup interconnection method needs to be determined. Both MTBF and mean time to repair (MTTR) will affect the decisions about provisioning backup interconnect bandwidth. It would not suffice to leave the receiving end of a central master control operating in hysteresis for a long period of time. A VPN over the Internet might allow at least thumbnails and SNMP traffic to continue even if higher quality video would be impractical.

The other side

I always suggest to clients that the remotely monitored facility have at least some routing that can be controlled from the other end, at the NOC. This allows the remote operator to switch a monitoring circuit between all potential points in the system over which they have monitoring and control, which is lot more cost-effective than increasing the number of "probes" and return video/audio circuits. We could learn a lot from NASA, which has been remotely monitoring and controlling rovers on Mars for years with a system latency measured in minutes, not milliseconds. **BE**

John Luff is a digital television consultant.

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

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FOR-A — FT-ONE

4K super slow-motion camera records up to 1000fps; images are captured as uncompressed raw data on the system's internal (RAM) memory, which has a recording capacity of 8.5 seconds; this data is then stored on one of two hot-swappable SSD cartridges; each cartridge can store 75 seconds of full 4K resolution images, enabling up to 150 seconds with a maximum of two SSD cartridges.

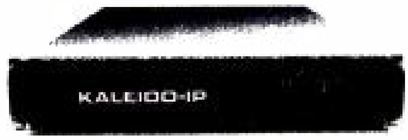
www.for-a.com

Broadpeak — BkA100

Video delivery analytics system is designed to streamline an operator's CDN; enables operators to access key information located in the video streaming servers; provides the operator's support team with critical system monitoring information, the operations department with capacity planning details and marketing with the analytical results essential for building an effective marketing campaign; identifies important metrics, as well as the raw data necessary to compute them, and then provides a shared view of the material that can be accessed simultaneously by a virtually unlimited number of users.

www.broadpeak.tv

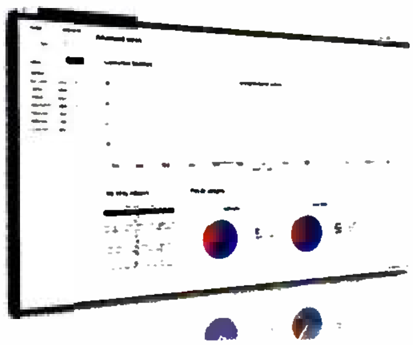
Miranda — Kaleido IP X100



IP multiviewer is designed as a cost-effective solution for smaller applications; housed in a 1RU chassis; can handle monitoring of up to 24 SD or eight HD video programs; for subscriber delivery applications, the unit, when combined with the iControl Headend monitoring solution, provides remote signal visualization and probing capabilities that dramatically reduce mean time to repair; handles both MPEG-2 and H.264 (HD/SD) MPEG transport streams.

www.miranda.com

Broadcast Pix — Multiscreen support



New multiscreen support for the 1 M/E Granite and Mica Video Control Centers; now, three "programs" can be generated using the system's program output and two enhanced PowerAux outputs, and each can be controlled by a separate panel or Soft Panel; the multiscreen technology is ideal for driving three image magnification screens, as each enjoys patented technology to maintain one frame of constant delay for continual lip sync throughout a presentation.

www.broadcastpix.com

PESA — easyPORT series

At the heart of the "throw down" multi-format converter boxes is PESA's compact, four-port utility switch, which incorporates standard SFP-type pluggable module card cages; card cages can be populated to fit practically any combination of input and output signals, including HDMI/DVI, 3G-SDI, ASI, NTSC/PAL and IP-to-ASI conversion; an internal switch fabric allows users to select which input goes to which output; the module also can be set as a distribution module, allowing any single input to be transmitted to up to four outputs.

www.pesa.com

Leader Instruments — OP43

Optional audio card for the LV5770 multi-monitor incorporates loudness measurement, lip-sync timing analysis and surround-sound monitoring; this doubles the total number of audio capabilities currently available for the LV5770, which already include 16-channel AES/EBU embedded audio input/output, Dolby Audio evaluation and decode, and 8-channel discreet or embedded digital-to-analog signal conversion.

www.LeaderAmerica.com

Triveni Digital — StreamScope MT-40 4.7

New release includes mobile DTV analysis capabilities; gives users the ability to monitor multiple terrestrial and mobile transport streams simultaneously and in real-time from any location across the network using a single integrated product; provides the same level of analysis for mobile transport streams as it does for terrestrial DTV; enables broadcasters to view EPG and ESG data sets and program guides, as well as verify ATSC, MPEG, A-78, SCTE and ATSC M/H standards and protocols.

www.trivenidigital.com

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Litepanels — Luma

Daylight balanced on-camera light draws only 12W of power while providing the equivalent daylight illumination of a 50W HMI; weighs only 10oz; features full spectrum soft light output with visually accurate color temperatures; can be dimmed from 100 percent to 0 with no color shift; is flicker-free at any frame rate or shutter angle; has a conveniently located on-fixture dimming knob; can be powered with six AA batteries (standard or rechargeable), an AC adapter or off the D-Tap of a professional camera battery pack.

www.litepanels.com

Harmonic — Iris 2.0

Video quality monitoring and analytics software features an enhanced graphical user interface and integration with several leading monitoring systems; enables service providers to monitor and analyze their use of Harmonic broadcast encoders in real time, using the data to help optimize bandwidth and video quality; can handle any codec and format; can process and monitor up to 250 services in 1RU.

www.harmonicinc.com

Wohler — WST-708

Real-time, single-card-based standards converter enables on-the-fly conversion of WST/OP-47 to CEA-608/CEA-708 captioning standards; features two 3G/HD/SD video channels; allows for direct bridging and transcoding of captions/encoded subtitles without the need for additional hardware or offline conversion processing; provides transcoded data out of serial and/or Ethernet ports for logging, closed-caption file regeneration, direct connection to an ATSC encoder and use with the SMPTE Grand Alliance protocol.

www.wohler.com

Emotion Systems — eFF

Audio media anlaysis tool has been updated with the addition of MXF support, as well as multiple language UI support; automatically resolves audio loudness errors in file-based media to ensure compliance with the latest international standards; analyzes file-based media by using accurate modelling of VU and PPM meters, and loudness detetection parameters (ATSC A/85, EBU R128 and ITU-R BS.1770); operates in faster than real time.

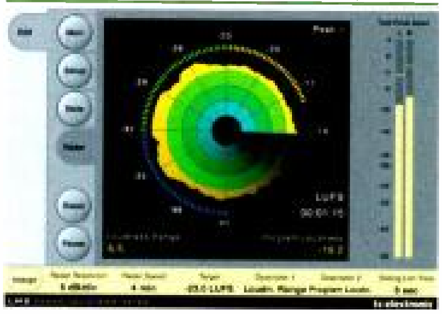
www.emotion-systems.com

Roland Systems Group — iPad control

iPad application controls M-480 digital mixing console; using wireless LAN to connect, users are able to adjust mixing parameters on stage or around the room, away from the M-480 positioned at the front of the house; by connecting the company's Wireless Connect USB adapter to the console's USB port, the M-480 can appear on a wireless network, enabling the iPad to connect and control the console.

www.rolandsystemsgroup.com

TC Electronic — LM2 plug-in



Features the company's Radar Display, which provides a quick — yet detailed — overview of the loudness landscape of any stereo audio signal; main radar view shows loudness history, while the outer ring displays momentary short-term loudness; true-peak levels are shown in real-time on the right side of the user interface; two versatile descriptors can be set to reflect a variety of parameters, such as loudness range and program loudness.

www.tcelectronic.com

Strategy & Technology — Second-screen synchronization

System provides seamless operation of synchronized second-screen applications — viewed on smartphones or tablets — for cable, terrestrial and satellite platforms; can be deployed alongside any and all television devices and set-top boxes, regardless of the STB capabilities; enables broadcasters to synchronize their second-screen applications with both editorial and advertising content, independent of the content's final distribution and delivery technology.

www.s-and-t.com

TSL — TallyMan VP (Virtual Panel)

Software-based control platform with touch screen is designed to simplify control of multipe router I/Os; removes the need to install individual hardware panels each time a router is added, expanded or upgraded; can interface with any third-party router, vision mixer or multiviewer; ideal for news operations, sporting events and remote headends; allows users to switch equipment on and off remotely.

www.tsl.co.uk

ikan — MR7

High-definition field monitor features built-in H.264 recording abilities for instant playback, optional wireless transmitter and handheld rig; users can view 2K footage via 3G-SDI in HD with a 170-degree viewing angle, as well as confirm the recorded audio for each take with an internal headphone jack; waveform and vectorscope features enable users to analyze camera's image for color accuracy and intensity on-the-fly.

www.ikancorp.com

Vinten Radamec — ICE

Intelligent Control Engineering (ICE) technology has been incorporated into the new FH-145 and FHR-145 heads; platform provides a motion control system and drive train within the heads designed to deliver both the fastest and the slowest broadcast-quality movement; can drive a wide range of full-servo broadcast lenses using analog, digital or hybrid control mode; harnesses IP technology, allowing control from either the VRC or LCS systems over a standard Ethernet infrastructure.

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Group Publisher: Wayne Madden, wayne.madden@penton.com
Sr. Marketing Manager: Kim Davidson, kim.davidson@penton.com
Director, Online Sales: Angie Gates, angie.gates@penton.com
Production Coordinator: Curtis Jansen, curtis.jansen@penton.com
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249 West 17th Street
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Corporate vs. production IT

There is a difference.

BY ANTHONY R. GARGANO

There is an old saying that goes something like: With age comes wisdom. Actually, with age comes age — plus a lot of experience.

When I started in this industry, the great broadcast equipment companies were mainly American, with a few Europeans also thrown into the mix. That was when equipment was all about analog hardware, a business where one of the critical keys to success was manufacturing prowess. Then, Japanese influence brought high-quality, low-cost manufacturing combined with innovative designs, slick, intuitive user controls and ease of operation. Soon, the likes of RCA and Ampex were history, and upstarts Sony and Panasonic entered their broadcast heydays.

A digital Trojan horse

Unwittingly, the Japanese companies also sowed the seeds of their own downfall. As they developed even more technologically advanced products, they eventually introduced digital technology and formats. Digital technology proved to be a Trojan horse that allowed marketplace leadership to move back across the oceans and allow a mostly new crop of North American and European companies to again take the preeminent marketplace position.

Digital technology introduced a new competence into the mix: software development. At the time, the distinctive competence of those market-leading Japanese companies was in manufacturing. It wasn't long, however, before some hardware functionality gave way to instruction sets embedded into upgradable firmware and software. Software development, where North America and Europe excelled, became the key driver.

The new driver opened opportunity for many new companies to not only enter the market, but to become highly successful in the newly-found enterprise. A common misconception at the time was that the Japanese could not develop software because of logic flow differences between Occidental and Oriental thought processes.

While some still maintain the erred thought, the reality then was that upgradable, software-defined products were an anathema to both a business infrastructure heavily invested in people and capital equipment assets necessary for high-volume manufacturing, and to a box-sale business strategy dependent upon sales of new and replacement boxes. So, rather than leveraging and advantaging the seeds of the technology they introduced, the Japanese companies went into denial and created their own version of Steve Jobs' "reality distortion field" in a doomed attempt to protect their manufacturing investment.

As digital technology evolved, it enabled a new realm of software-defined architecture, from products and applications to systems and infrastructure. Coupled with this, and thanks to Mr. Moore's Law, ever-increasing computing power took products from non-real time, to real time and even faster video processing. Once real time and faster-than-real-time proved viable, files and the new broadcast and production construct of file-based workflows and systems architecture took off.

With downsizing and staff consolidations a problem during this period, the technology revolution's speed left traditional video engineering staffs scrambling through a decade of playing catch-up, setting up the perfect storm.

With an attitude of, "Gee, it's just a file; we know how to handle files," enter corporate IT. Thus, the advent of file-based systems led to the entry of corporate IT — where trouble desk response delays and staring at hourglass icons were completely acceptable — into video network domains where a pause in data flow meant a dark screen.

While data streams and networks may be common denominators, deliverables, service level requirements and systems architectures are hugely different between production and corporate IT. Today's production facilities and broadcast networks continually seek, to greater advantage, efficiencies and capabilities that file-based video networks can deliver. And, therein lies a danger.

In this era of outsourcing, consultants and internal IT department involvement, a thorough understanding of production IT in relation to corporate IT is essential to ensuring success of these expanding and complex projects.

Follow-up footnote

Regular readers may recall my December 2011 column on Emmy award-winning ABC Network engineer Steve Mendelsohn. I am sad to report Steve has lost his valiant struggle against pancreatic cancer. But, a fighter to the end, he bested doctors' prognostications by a year. **BE**

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

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

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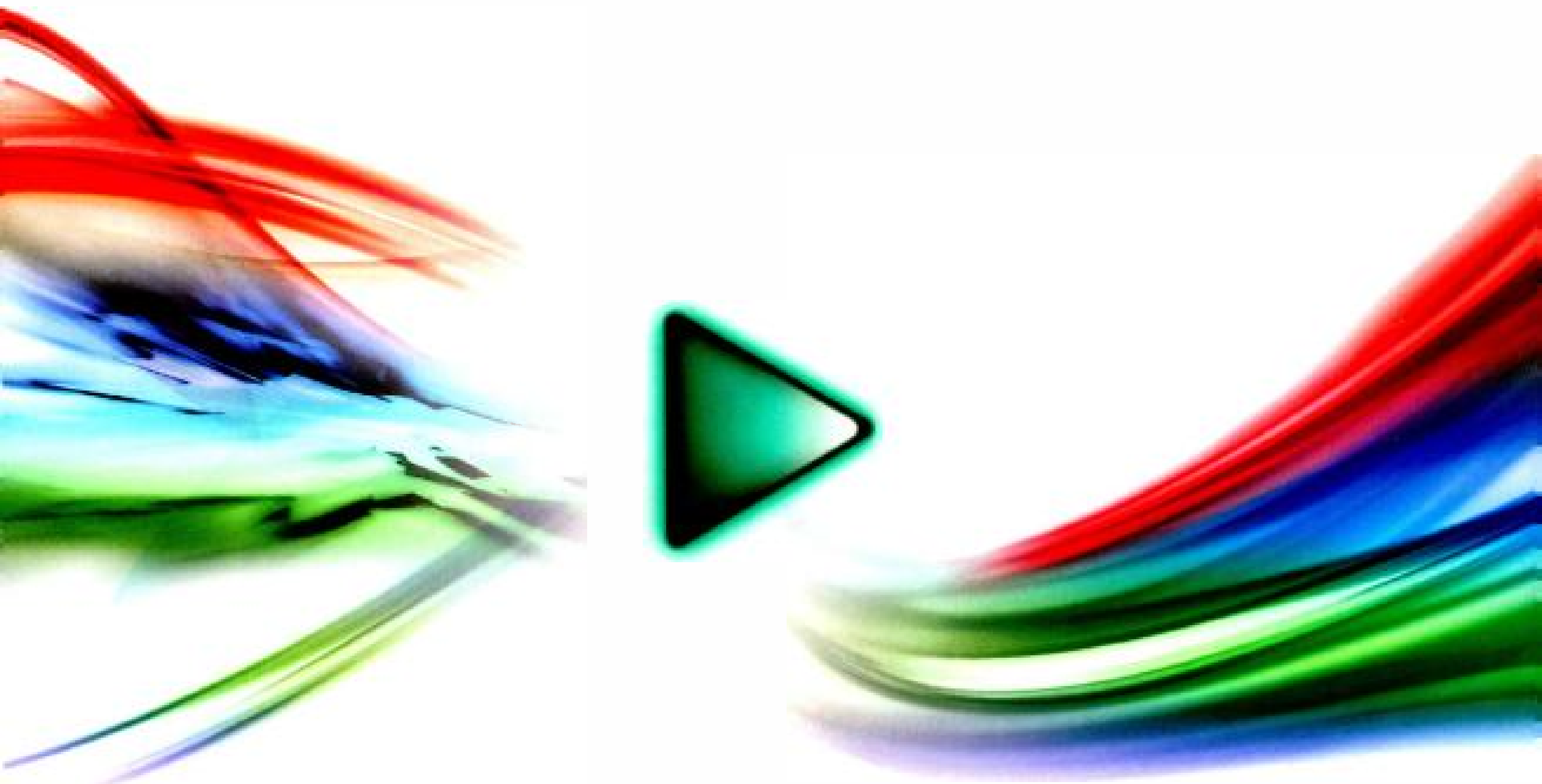

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• **PlayBox UK** +44 1707 66 44 44 • **PlayBox Bulgaria** +359 2 9703050 • **PlayBox Romania** +4 031106 5115 • **PlayBox Turkey** +90 216 3379402
• **PlayBox Turkey** +90 216 3379402 • **PlayBox Germany** +49 7251 302 0445 • **PlayBox Adria** +381 113117286 • **PlayBox Albania** +355 44 80 45 52
• **PlayBox Albania** +355 44 80 45 52 • **PlayBox USA** +1 404 424 9283 • **PlayBox Asia Pacific** +603 7954 3400 • **PlayBox India** +91 9811913333
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