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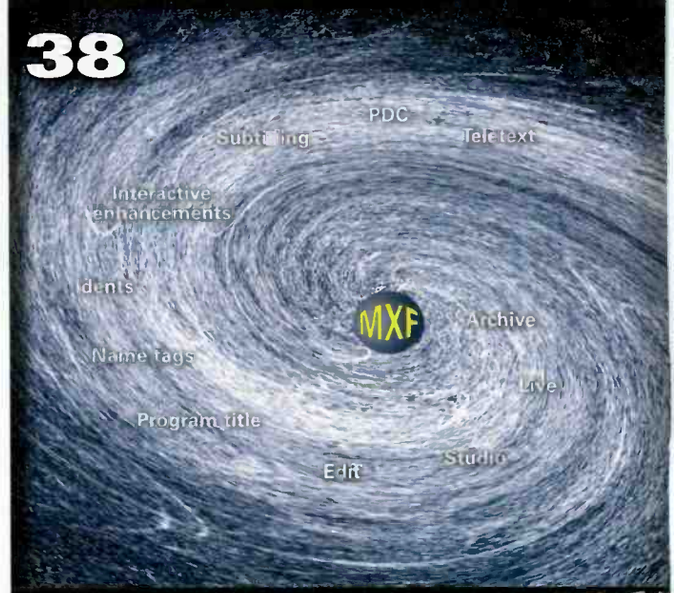
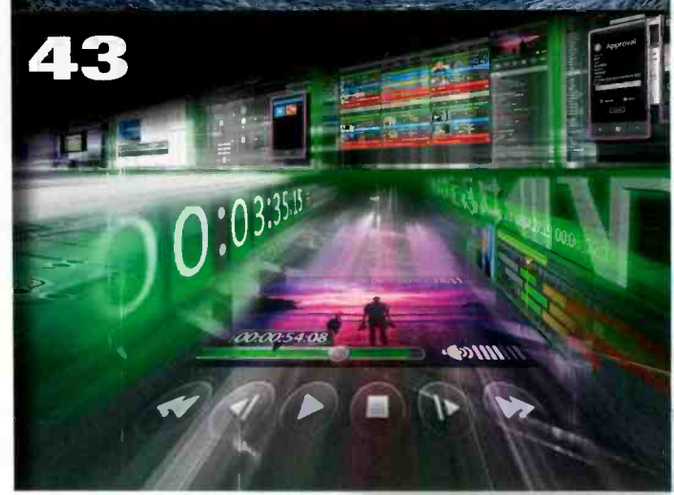
According to key players in the broadcast engineering community, implementing efficient, cost-effective production and distribution workflows is critical to long-term survival.





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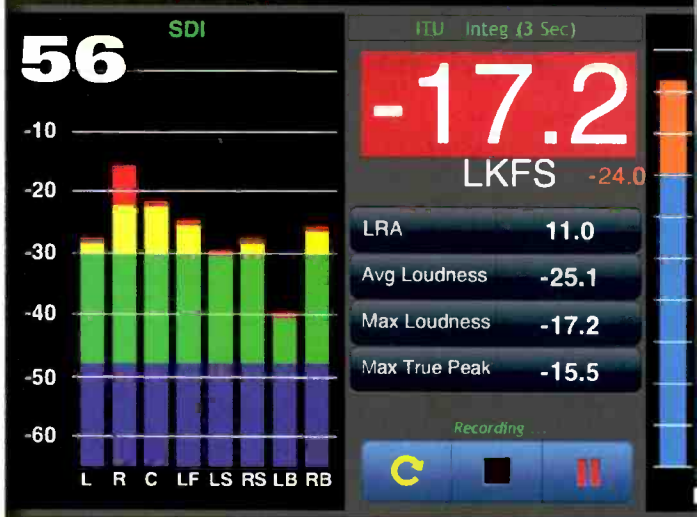

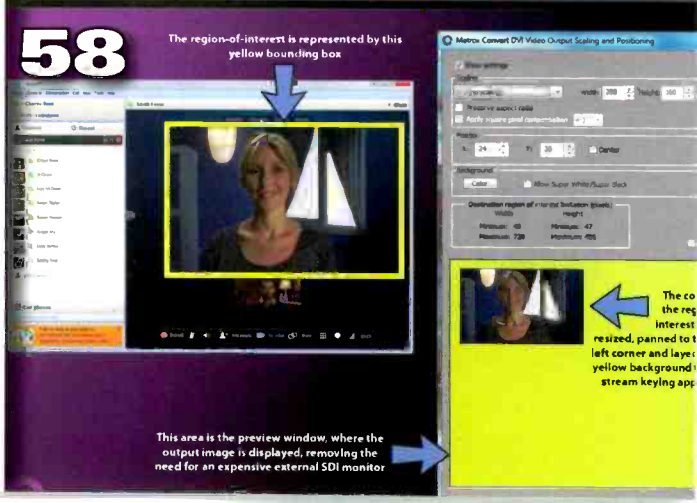

JUST THE FACTS!

The FCC approved the assignment of Qualcomm's D and E Block licenses in the lower 700MHz band to AT&T subject to some restrictions. The order grants a petition from the companies to allow AT&T to purchase 6MHz of unpaired 700MHz spectrum nationwide and an additional 6MHz of unpaired 700MHz spectrum in New York, Boston, Philadelphia, Los Angeles and San Francisco for $1.925 billion. The transaction will enable AT&T to repurpose the spectrum for broadband services. According to AT&T, the company will use carrier aggregation technology to bond the unpaired spectrum with paired spectrum it already holds. The new spectrum will add increased capacity to AT&T's LTE network once the LTE Advanced standards are released.

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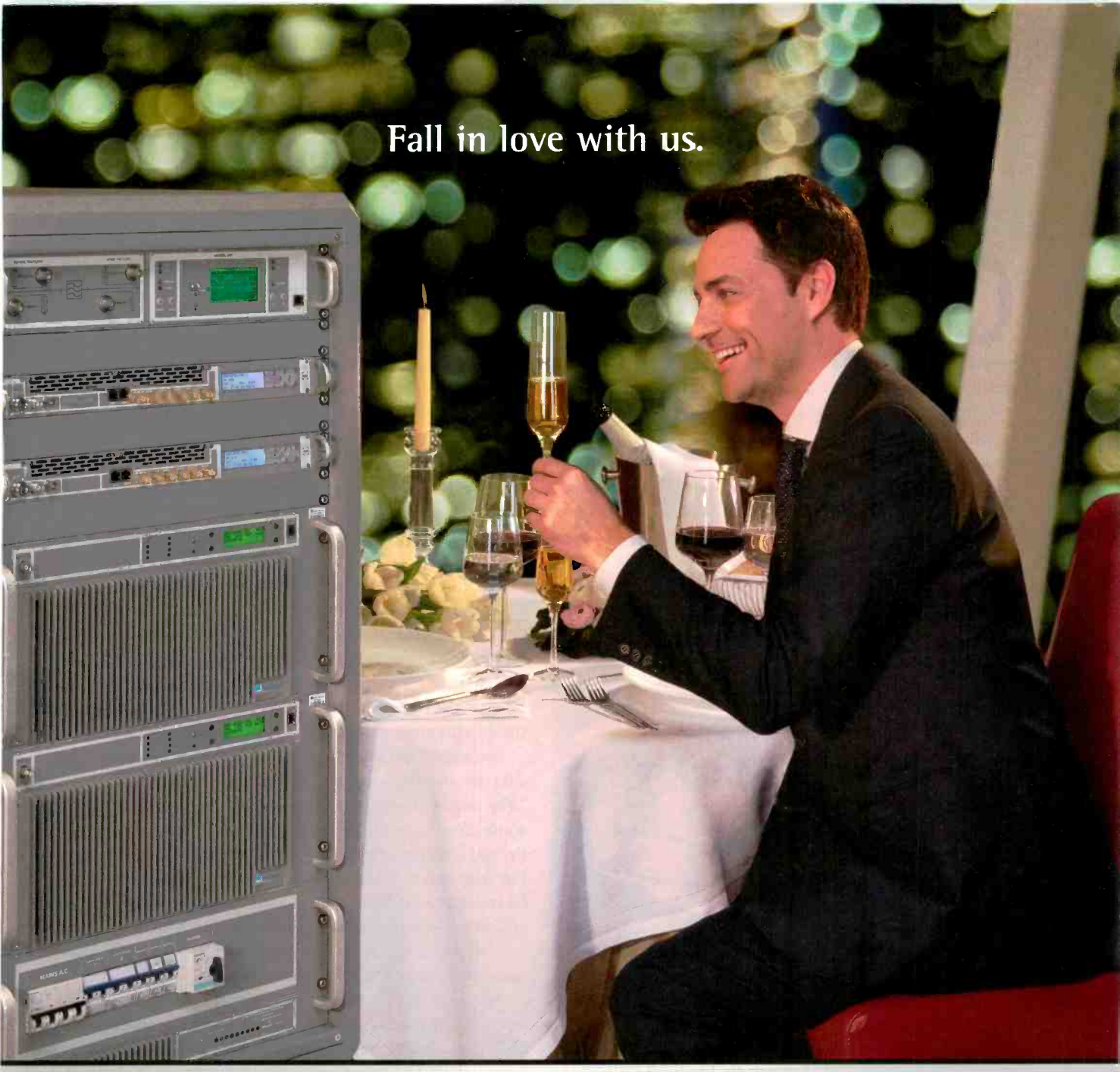

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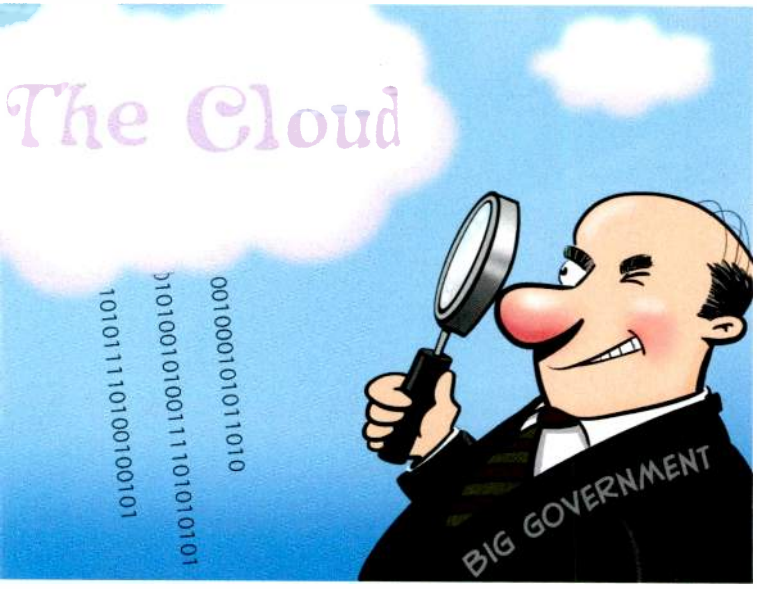
The leaky cloud

Cloud storage was certainly a hot button for 2011 and will be equally as hot this year. Though there has not been widespread adoption of storage or software as a service (SaaS) by either broadcasters or content producers, they still search for less-costly storage and application alternatives. It seems worth a bit of time to examine some of the issues to consider when the general manager says, "Let's move to the cloud."

At first, the cloud sounds like the perfect solution for storing content and providing easy access to applications. The cloud is ubiquitous. Users can access, modify and store



their work from any location. All they need is a small client or browser. Requiring little investment in local software or hardware, what's not to love about such a solution?

Here are some things to consider before moving your valuable content to someone else's servers.

One adjective describes broadcasters, and that is reliable. So, a first question to toss back at the GM might be: How reliable is the cloud service? Let us look at a couple of eye-popping examples of recent cloud failures.

Last April, Amazon's EC2 Elastic Computer Cloud service crashed, causing widespread outages. News services, including *The New York Times* and dozens of other companies, effectively went dark for as long as 24 hours.

Jason Glassberg, co-founder of security company Casaba, called the issue "a big ol' black eye" for Amazon. "Reliability is probably the No. 1 concern with cloud services," he said.

A research vice president in the Technology and Service Providers group at Gartner, Lydia Leong said, "There are a lot of moving parts in cloud IaaS [Infrastructure as a Service]. Any one of them going wrong can bork your entire site/application."

Amazon is not the only high-profile cloud vendor to suffer outages. Microsoft's Office 365 and Windows Live servers did the same when they died in August and again in September. Google's Apps for the [cloud] domain and Gmail also have seen several large-scale crashes. Considering those issues, what about security?

Once your content is moved to someone else's servers, you lose absolute control over that data and who has access. In fact, your content may not even be stored in the United States.

Microsoft 365's terms of service (TOS) say, "As a general rule, customer data will not be transferred to datacenters outside that region. There are, however, some limited circumstances where customer data might be accessed by Microsoft personnel or subcontractors from outside the specified region (e.g., for technical support, troubleshooting, or in response to a valid legal subpoena."

You might not even be notified if a vendor moves your data to another country. Again, from Microsoft's TOS, "The requirements of providing the service may mean that some data is moved to or accessed by Microsoft personnel or subcontractors outside the primary storage region. For instance, to address latency, routing data may need to be copied to different data centers in different regions. In addition, personnel who have the most technical expertise to troubleshoot service problems may be located in locations other than the primary location."

Ask who has access to your content without permission. Will you be notified if your data is given to the cops/FBI? Can cloud vendors disclose your data without your permission? The answer is probably.

In Microsoft's TOS for the 365 product, the Q&A section says, "In a limited number of circumstances, Microsoft may need to disclose data without your prior consent, including as needed to satisfy legal requirements."

Given such legal and technical concerns, how willing are you to put your content in someone else's hands? Is there a cloud in your future? BE

Brad Dick

EDITORIAL DIRECTOR

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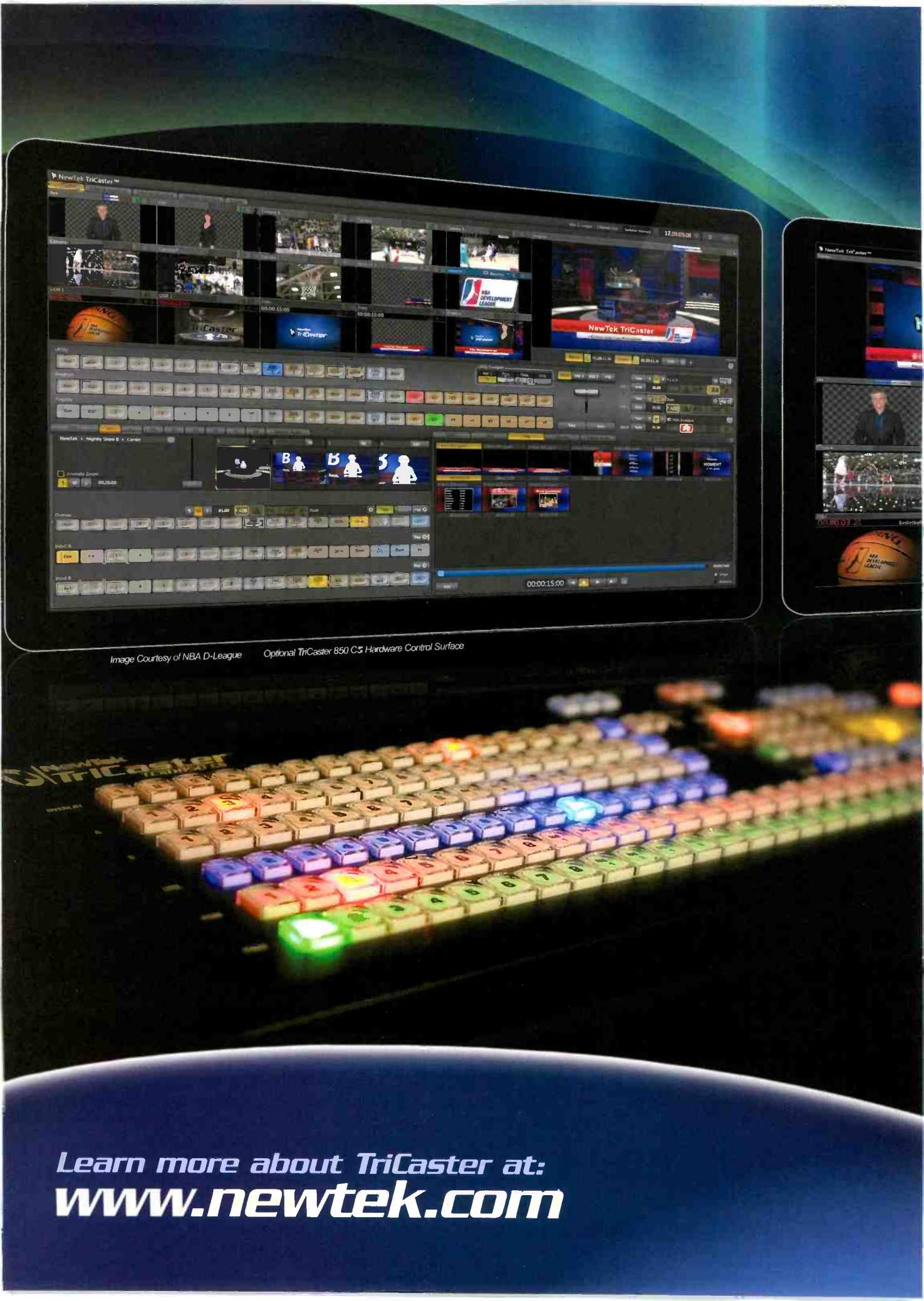

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4K2K, part 2

Large-sensor camcorders evolved from DSLRs.

BY STEVE MULLEN

Last month, in the first part of this series, we discussed how the 4K2K format offers an intermediate step on the way to Ultra High HD. In this final part, we'll cover what videographers can expect from large-sensor camcorders.

When Canon announced its EOS C300 camcorder, which has a 4K2K sensor but does not record 4K2K video, the company also announced it was developing a DSLR that will record 4K2K video. Although it may seem a bit strange that a camcorder designed to employ high-quality cinema lenses is limited to full HD video recording yet a still camera will be able to record 4K2K video, it's not strange given the history of DSLRs.

When large CCD and CMOS chips replaced an SLR's 35mm film, the next logical step was to place an LCD on the digital camera so one could review shots in the field. The next logical step was a "live view" mode that allowed one to view what was being recorded. It was only a small step to compress live view images and record them as video.

Large-sensor digital camcorders have evolved from DSLRs. It is primarily a marketing decision whether to release digital motion picture technology in a still camera package, a camcorder package or both. However, one clear advantage of a camcorder package is space for a mic jack (even XLRs), a headphone jack and manual audio controls.

The Panasonic AF100 uses a Micro Four Thirds sensor, which has a 1.33:1 aspect ratio and a frame size of 17.3mm x 13mm.

When a potential buyer who is in the process of learning about 4K2K production and post production encounters the same technology in two different packages, it may prove confusing.

When a videographer shoots with a still camera, he or she will find expected camcorder functions missing. For example, every professional camcorder has some form of ND filtration; DSLRs do not. Likewise, when a videographer shoots with a camcorder whose internals are primarily those of a DSLR, he or she may encounter missing functions. For example, some large-sensor camcorders do not have internal ND filtration.

Mirrorless cameras such as the Panasonic GH2 use contrast detection autofocus.

A primary differentiator of DSLRs and traditional camcorders is their optical system. This is true for current HD and future 4K2K products.

Frame size

While video cameras have frame sizes that relate directly to sensor size, such as 2/3in, DSLR frame size relates to 35mm film — in particular, 35mm still film. When shooting 35mm slide or negative film, each 36mm x 24mm image is placed with perforations above and below the frame.

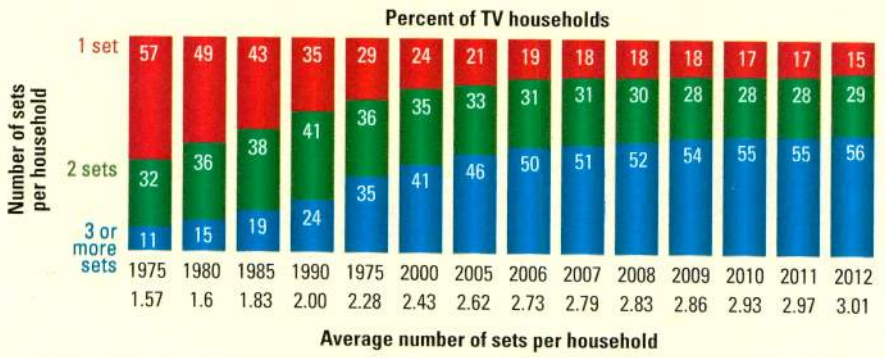
DSLRs with 36mm x 24mm sensors are called full-frame cameras. The Canon EOS-1D X, announced for March 2012, employs an 18-megapixel 28.7mm x 19.1mm sensor. Canon calls it an APS-H sensor.

There are small variations in APS

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

TV set ownership declines

Nielsen estimates that while the number of TV households in the U.S. with at least one TV set is currently about 115.9 million, that number will decline to 114.7 million in 2012.



Source: Nielsen 2012 "Television Audience Report" www.nielsen.com

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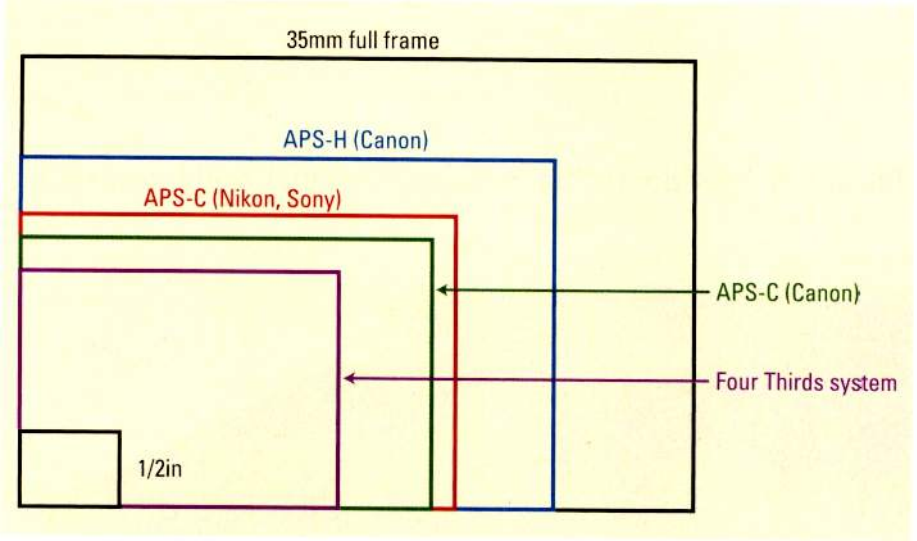

Figure 1. Shown here is a frame size chart.

frame size: Canon APS-C (22.2mm x 14.8mm), and Nikon/Sony-C (23.4mm x 15.6mm). Both full-frame and APS sensors, when taking photos, have a 3:2 (1.50:1) aspect ratio. Panasonic uses a slightly smaller sensor for its AF100 camcorder and GH2 still camera called Micro Four Thirds (M43), which has a 1.33:1 aspect ratio and a frame size of 17.3mm x 13mm. (See Figure 1.)

Sensors smaller than a full-frame sensor reduce the potential minimum DOF. Minimum DOF, of course, is a function of the maximum aperture size. A large-sensor camera does not directly provide a shallow DOF.

When a lens designed for a full-frame camera is mounted on a camera with a smaller sensor, the lens' focal length is multiplied by the lens crop factor. (Crop factor equals the ratio of a 35mm frame's 43.3mm diagonal to the diagonal of the image sensor.) A Sony APS-C camera, for example, has a crop factor of 1.5. A 50mm "normal" lens becomes a 75mm tele lens.

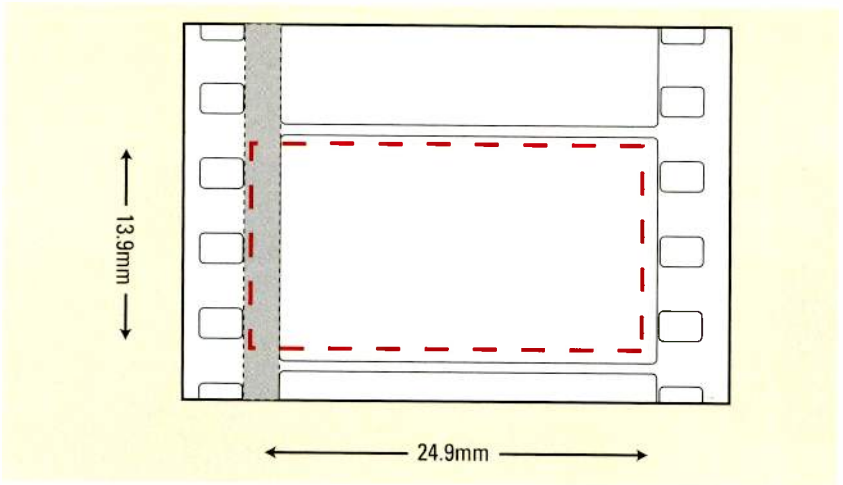

Figure 2. A 24.9mm x 13.9mm Super 35 frame has a native aspect ratio of 1.79:1 — a perfect match to 1.78 (16:9) HD.

When shooting video, a 16:9 window on the sensor is employed. This has three ramifications. First, the viewfinder image will shrink when switching a DSLR to video mode. (This shift can be minimized by shooting 16:9 photos.) Second, the number of pixels read out will be reduced, which is a positive. Third, the lens crop factor will slightly increase. For example, when a Sony APS-C camera is switched to video mode, the crop factor increases to 1.8, thus a 50mm lens acts as a 90mm lens.

The earliest 35mm movie film had a 22mm x 18mm image, with perforations on the sides of each frame. In 1929, the Academy ratio was established. It has a 21mm x 15mm image that has a 1.37:1 aspect ratio. To obtain wide-screen, but not anamorphic, images, a Super 35 frame can be employed.

A 24.9mm x 13.9mm Super 35 frame has a native aspect ratio of 1.79:1 — a perfect match to 1.78 (16:9) HD. (See Figure 2.) It also matches Quad-HD (3840 x 2160 pixels) and almost matches 4K2K, which is 4096 x 2160 pixels — a 1.90:1 aspect ratio. Not surprisingly, frame sizes that come from cinema cameras do not require the use of a 16:9 window when shooting video.

Lens zoom system

While the videographer likely knows that DSLR lenses do not have power zoom, he or she may not know that photo lenses have other issues. For example, the zoom ring may have high friction because of the need to significantly extend the lens when zooming. Pressure exerted to start a zoom while shooting can easily cause a visible disturbance.

Pressure used to extend a DSLR lens at the beginning of a zoom can cause a visible disturbance.

Better Sony lenses, such as A-mount lenses that use micro ball bearings, may cause noise that will be picked up by an on-camera mic.

AF system

Photographers are used to trusting auto-focus — even on action shots where the shooter is following a moving subject. When a DSLR's mirror is in the 45-degree-position in order for the shooter to see the

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subject, AF is possible. (See Figure 3.) A portion of the image passes through a semitransparent area of the mirror, reflects off a small mirror mounted on the back of the mirror and is cast

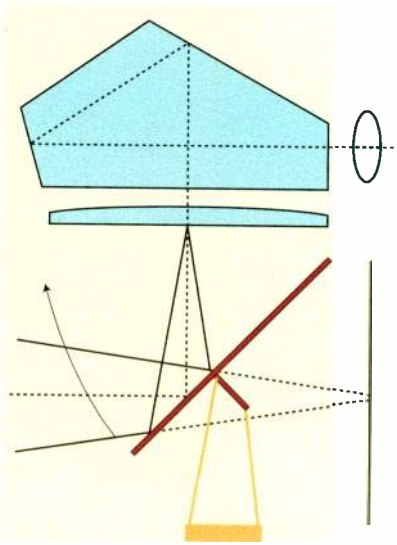

Figure 3. A phase detection AF system uses a series of mirrors, a small sensor at the bottom of the camera and a processor to calculate precise focus.

onto a small sensor at the bottom of the camera. The sensor, in conjunction with a processor, sends commands to the lens' AF motor to move to a position calculated to be correct for precise focus. This system is called phase detection AF.

DSLRs employ a different AF system when shooting video because the mirror must be continuously up. The processor, therefore, obtains information from the CMOS image sensor, which is why it is called contrast detection AF.

Mirrorless cameras such as the Panasonic GH2 and Sony NEX-5N must use contrast detection AF. (Strictly speaking, digital cameras without a mirror do not have a reflex system and, therefore, are not DSLRs.)

Contrast detection AF systems work by having a microprocessor rapidly command the lens servomotor to step forward and backward by a tiny amount. The processor notes whether contrast increases or decreases. If contrast increases, then current focus is not perfect. Therefore, stepping forward and backward continues. When there is no change in contrast, the current focus is the best possible.

Contrast detection tends to be slower than phase detection and becomes slower at low light levels. And, unless the lens is designed to be quiet, AF noise may be recorded.

Aperture system

Photography lenses are designed to click into key f-stops: f/2.8, f/4, f/5.6, f/8, f/11, f/16 and f/22. Cinema and video lenses are designed so the aperture changes in a continuous manner. One solution is to use camera lenses designed by the camera's manufacturer for video shooting. The other solution is to use cinema lenses.

ND capability

To obtain a shallow DOF with a large-chip camera under bright light — at the slow shutter speed required for the correct amount of video motion blur — an ND is a must. (ND filtration also will be required to keep the aperture under f/11 to minimize diffraction.) When a camcorder does not have a built-in filter, a shooter has three choices: mount the camera on rails on which a matte box is mounted, attach one of several ND filters to the lens or employ a vario-ND filter.

Lens mount type

Both cameras and camcorders that employ large sensors use a lens mount designed to work with their brand of lenses. For example, Sony's NEX family — including the FS100 and VG20 camcorders — uses Sony's E-mount. Sony markets the LA-EA2 adaptor, which enables the use of Sony and Minolta A-mount lenses. The LA-EA2 has a translucent mirror system that provides phase detection AF to many A-mount lenses.

For most interchangeable lens cameras, third-party adaptors are available. These enable you to use your favorite photo lenses on a new camera or camcorder. For example, a Sony NEX camera can use Nikon F, Canon 5D, Leica M, Leica R, Pentax, Konica Minolta MD, Olympus and Contax/Yashica

The Sony LA-EA2 adaptor provides phase detection AF to many A-mount lenses.

lenses by using an E-mount adaptor.

Only a few adaptors, such as the LA-EA2, provide electrical signals to a lens. Without electrical connections, in-lens optical stabilization, AF and aperture control cannot function.

Without electrical connections, no information from the lens is received by the camera. Therefore, modern photo lenses that send the aperture ring's setting to the AE system cannot do so.

Solutions to these issues include working with still camera and cinema lenses in a fully manual way (which may be a camera operator's first choice) or using a manufacturer's lenses that have electrical contacts.

Bringing it home

No matter whether you shoot with a still camera or camcorder, images from the sensor must be compressed and recorded. Currently, two codecs are used for recording 4K2K: the Sony F65RAW (16-bit RAW) codec to a docking SRMaster field recorder that records to SRMemory cards or the RED R3D wavelet codec to a REDMAG solid-state drive.

Future 4K2K codec options include H.264 (as a single stream or as four HD streams) and 4K2K versions of current HD formats. BE

Steve Mullen is the owner of Digital Video Consulting.

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Program reporting revisited

FCC plans to seek more detail on programming efforts.

BY HARRY C. MARTIN

The commission is proposing a new enhanced disclosure form (Form 355) for television stations. The 2007 version of this form, which was never implemented, required detailed quarterly reporting of all TV programming in multiple categories such as national news, local news, local civic affairs, local electoral affairs, local programming, public service announcements and several others. Additional information about such things as closed captioning, video description and emergency advisories was also required.

Program categories revised

The commission, which now acknowledges that the 2007 Form 355 was overly burdensome, proposes to reduce program reporting to three categories: (1) local news, (2) local civic/governmental affairs and (3) local electoral affairs, using the following definitions:

- *Local news*: Locally produced programming that reports on issues about, or pertaining to, a licensee's local community of license.
- *Local civic/governmental affairs:* Coverage of government meetings, legislative sessions, conferences featuring elected officials, substantive discussions of civic issues of interest to local communities or groups, and interviews with or statements by governmental officials and policy experts on issues of importance to the community.
- *Local electoral affairs*: Candidate-centered discourse focusing on the local, state and federal races for offices to be elected by a constituency within the licensee's broadcast area. Local electoral affairs programming includes broadcasts of candidate debates, interviews or statements, as well as substantive discussions of ballot measures that will be put before the voters in a forthcoming election.

Format of reports

The commission does not propose a specific form for the report. Instead, it refers broadcasters to a proposed form posted on the website of the Public Interest Coalition (PIPAC), which has been advocating for these reporting requirements. The FCC contemplates that Form 355 information ultimately would be submitted in some machine-readable format that would facilitate computer analysis.

Forms 355 would be filed quarterly and would cover two "composite weeks" from each quarter. The commission would select the component days of each composite week, and then broadcasters would have to use available station records for those dates to prepare their reports.

Content

As to the specific reportable information, the NOI suggests that licensees would have to include a program classification (e.g., local news), title or topic, airdate and time, channel (primary or multicast), whether the programming is first-run, and the length of the segment without commercials.

The FCC wants broadcasters to identify any programming described in the Form 355 that was subject to sponsorship identification requirements and, if so, who sponsored the programming. Broadcasters also would be required to disclose whether any of the reported programming was produced under a shared-services agreement, local marketing agreement, news-sharing agreement, or any other arrangement with another broadcaster or a local newspaper.

In sum

The commission believes that a standardized disclosure form will help enable members of the public to be more involved in ensuring that stations address their needs. In particular, the commission believes that the lack of consistency between various stations' issues/programs lists makes "assessment and comparison" between broadcasters difficult. But the real goal appears to be creation of a commission-maintained database of programming available for slicing, dicing and second-guessing both by the FCC's staff and in the private sector, who could "assess" and "compare" broadcasters' public interest performance. BE

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

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

Dateline

- On or before Feb. 1, 2012, noncommercial TV and Class A stations in Kansas, Nebraska and Oklahoma must file their biennial ownership reports.
- Television stations in D.C., Maryland, Virginia and West Virginia must begin their renewal pre-filing announcements on April 1, 2012.
- By Feb. 1, 2012, TV and Class A TV stations in the following locations must place their 2012 EEO reports in their public files and post them on their websites: Arkansas, Delaware, Kansas, Louisiana, Mississippi, Nebraska, Oklahoma, New Jersey and New York.

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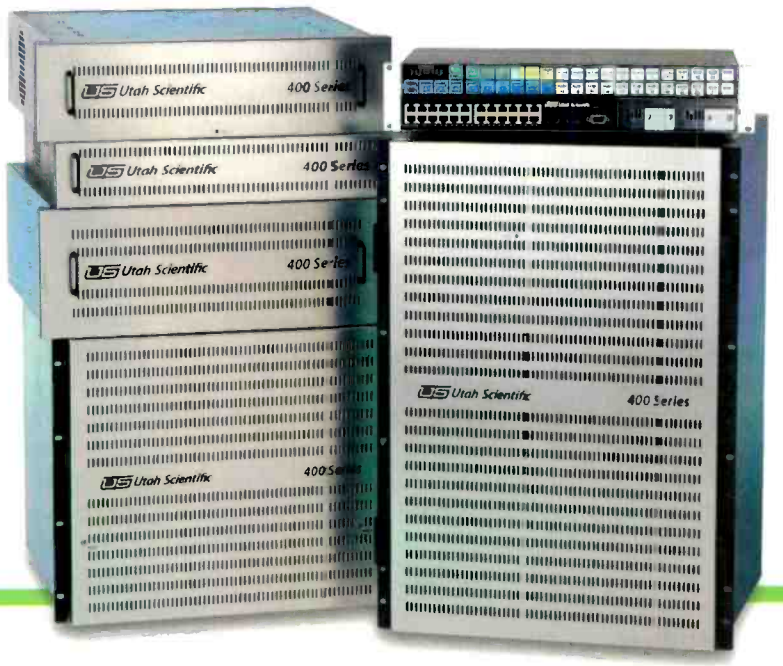

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The road to 3-D

The tools are available to help digital television add a dimension.

BY ALDO CUGNINI

Although 3-D content is widely available in theaters, and 3-D disc players are now on retail shelves, terrestrial digital television has not caught up yet, and a standard supporting 3-D transmission is not yet in the books. Last year, the ATSC concluded a study of 3-D television, with a goal of producing a report on the benefits and limitations of a standard or a set of standards for terrestrial delivery of 3-D television. The report covered various elements of 3-D, including visual sciences and technology. This article will examine various solutions that may become part of a future terrestrial standard for 3-D transmission.

Independent display coding

In one option, the 3-D program can be independent and different from the 2D program. These types of 3-D transmission architectures fall into two large classes: those in which the 3-D program is transmitted alongside a separate, essentially identical, 2D program, and those in which the 2D and 3-D programs are different productions of the same program.

When 3-D and 2D content are coded independently, this can be called *MPEG-2 Dual*; the 2D view is separately coded, plus independent left and right views are coded, all using MPEG-2 coding. Basically, broadcasters are coding three different versions of the same program, and transmitting them in the multiplex. Alternatively, MPEG-2 MVC (Multi-view Coding) can be used for the 3-D program, using inter-view prediction. This latter option uses coding tools, in which one view is coded in a main-profile (MP) base layer, and that layer is used to predict the other view in an enhancement layer with temporal scalability tools. However, MPEG-2 MVP is not expected to offer a significant coding gain over the independent encoding of the two views, owing to the limitations of MPEG-2 coding efficiency.

Frame-compatible 3-D is an architecture in which the left and right views are decimated (usually by a factor of 2) and arranged into a frame-compatible format such as side-by-side or top-and-bottom. These frame-compatible formats fit into a conventional 30Hz frame period, so no additional baseband bandwidth is needed, and conventional baseband video equipment can route the signals. (Of course, the spatial resolution at the home receiver is compromised with respect to a 2D program.) Frame-compatible video can be encoded using a conventional MPEG-2 or H.264 Advanced Video Coding (AVC) codec, but it cannot be displayed on a 2D display, which cannot separate or properly integrate the left and right views. Again, the independent 2D program is separately coded using MPEG-2.

A variation of frame-compatible 3-D is *full-resolution frame-compatible 3-D*, in which the same frame-packing arrangement is used to encode the left and right views, but no sub-sampling is performed. Thus, a higher baseband bandwidth is required at the codec I/O, with an associated decrease in efficiency compared with interview predictive coding. In this format, the 3-D program is most likely coded using AVC, as MPEG-2 could not handle the increased bandwidth,

FRAME GRAB *A look at tomorrow's technology*

Viewing preference for online video

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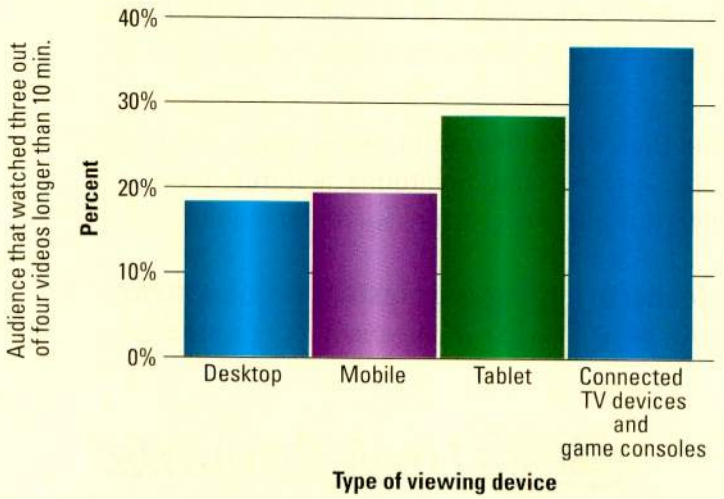

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especially with the 2D program also present in the multiplex.

MVC 3-D is a format in which the left and right views are coded at full resolution, either independently using AVC or jointly using MVC with inter-view prediction. The latter approach can result in a lower bandwidth requirement than independent coding. But it comes with a hardware tradeoff between an architecture supporting two compression streams, and two parallel codecs, versus one more-complex stream.

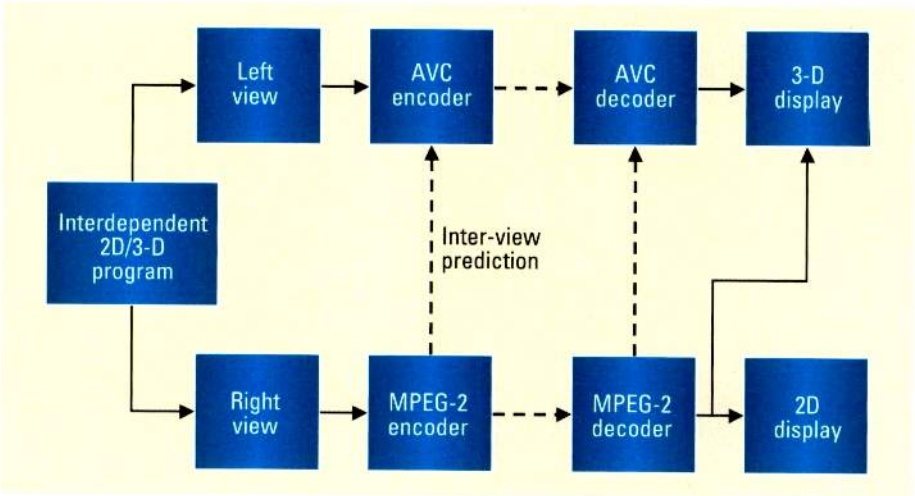

Figure 1. Hybrid shared architecture using inter-view prediction

An alternative to MVC with inter-view prediction is *AVC frame compatible with resolution enhancement*, in which the base layer carries the left and right views in a frame-compatible format, and the enhancement layer carries the "difference information" needed to provide full resolution. This format provides a migration path that would enable 3-D receivers to be built today, using existing AVC tools for the base layer. Later receivers would add full resolution, using AVC tools not yet developed. Those early receivers would thus be compatible with, but not capable of displaying, the future format.

Dependent display coding

The other option is for the 3-D program to be dependent and related to the 2D program. When one view is used as the 2D program, and both views provide the 3-D program, shared coding is an option in which either both views are coded independently, or MVP is used to predict one view from the other. (See Figure 1.)

There is some sensitivity in the production community that this type of coding arrangement constrains the director's ability to shoot the scene because one view is subservient to the other. Nonetheless, it can provide savings in both production budgets and transmission bandwidth.

Again, as with the independent formats, both views can be coded using MPEG-2, or a hybrid system could be utilized that encodes the "default" view using MPEG-2 and the second view with AVC or another advanced codec, such as high-efficiency video coding (HEVC). With this architecture, one consideration deserving careful scrutiny is the fact that the left and right views are coded by different means, a point that applies to other formats as well. The result can be different compression artifacts in the two views, causing some peculiar effects. Demonstrations of hybrid architectures suggest this could be acceptable with further study.

Depth-based coding

An alternative to coding left and right views is the use of a depth map, a grayscale video picture in which the depth of an object in the image is coded by using different intensity levels. The depth map then is coded as an ordinary video stream, using AVC or another advanced codec. Transmission variations include combinations of the techniques discussed previously.

Depth information must be extracted (or synthesized) from original left and right views, or from temporal information derived from moving objects or a moving camera. This 2D-plus-depth-map technology is still in an early stage, so error-free depth information is not yet achievable. In addition, the decoder must re-generate the second view, which adds computational complexity. Nonetheless, the approach has interesting applications, especially for animation and graphics.

Future work

As the solutions studied in the ATSC report must be backwards-compatible with existing MPEG-2 receivers, all the variations considered include a standard 2D-content channel using MPEG-2 coding. But such a constraint likely will be lifted somewhere down the road, when MPEG-2 eventually is made obsolete by AVC and HEVC.

In the meantime, a system can be developed that fits into existing transmission standards, and that means that consumer products could be available in 2013. A full analysis of the pros and cons of each of the discussed approaches can be found in the Planning Team 1 Report on 3-DTV at the ATSC website, *www.atsc.org*. BE

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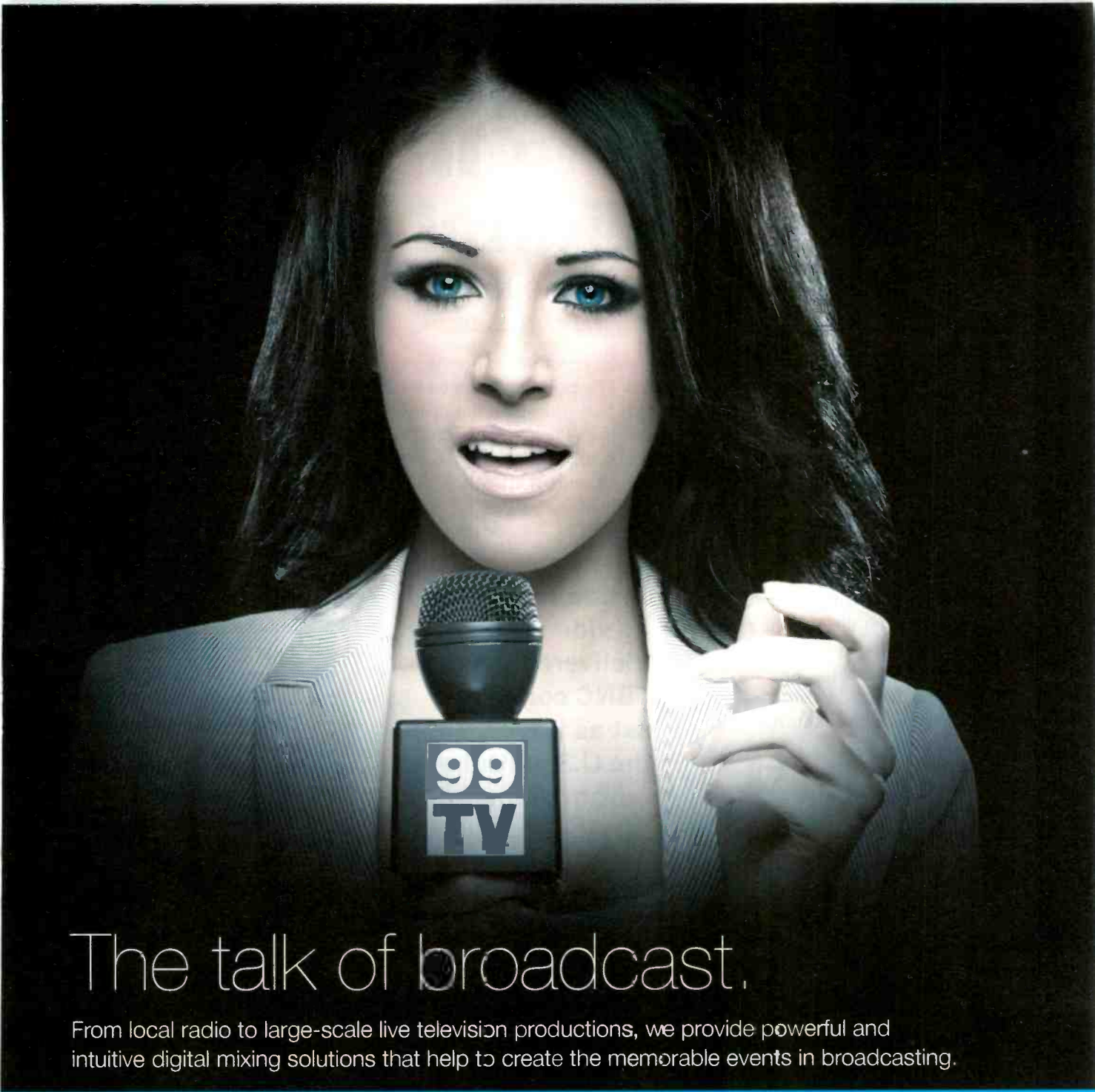
Send questions and comments to: aldo.cugnini@penton.com



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STUDER
by HARMAN

Merging IP and serial digital video

After 50 years, it may be time to retire the BNC connector.

BY BRAD GILMER

Since its inception, video has been running over coaxial cable. In the early days, the PL-259 connector, sometimes known as the UHF connector, was used. Shortly after the conversion to color, the BNC connector became the standard electrical interface for professional video. Since then, the BNC has survived the conversion from analog to digital, and even made it through the explosion of digital video formats. But, after some 50 years, is it time for the professional video industry to start looking at a different interface for video signals?

To put things in perspective, it may help to look back at the history of the BNC and the signals it has carried. A number of video professionals first encountered BNC connectors carrying analog NTSC signals. As the industry progressed, it became clear standards were needed for interfacing professional video signals as digital information rather than as analog voltages. The industry developed the short-lived parallel digital video interface, but advances in technology quickly lead to development of the Serial Digital Interface or SDI. SDI had a number of key design criteria, one of which was that it be carried on a BNC connector. Early on, SDI was "just NTSC on a digital interface." Video was still a 525-line signal presented to the viewer in an interlaced mode at a 29.97Hz frame rate (625 lines and 25Hz for PAL). The interface delivered 720 active pixels per line of horizontal resolution.

With the move to HD, two competing formats, 720p and 1080i, both could be delivered using the BNC connector. At this time, the frame geometry of professional formats exploded. The aspect ratio moved from 4:3 to 16:9. Permissible frame rates expanded from the traditional 29.97Hz and 25Hz to 24Hz, true 30Hz, 50Hz for Europe, and 60Hz for the U.S. The bit depth per pixel (the number of bits assigned to describe the value of each bit in the raster) went from eight bits to 10 bits and then 12 bits. The industry sought to increase image resolution in four axes.

Inside the studio, video is still delivered via the BNC connector, just as it was when the U.S. withdrew from Vietnam.

SMPTE 2022

A number of years ago, the world of SDI and IP technology started coming together in the area of video transport. As terrestrial IT network technology improved, and as transport providers began to be able to guarantee high quality and high availability of IP networks, professional video users began experimenting with IP streaming of professional video feeds. This ultimately led to the creation of the SMPTE 2022 family of standards for the transport of professional video over managed IP networks. While this technology has been successful, it has essentially operated as an SDI "cable extender," transporting a bit-for-bit copy of the SDI signal hundreds or thousands of miles away. This approach has been successful, and this group of standards is deployed in thousands of units all over the world.

SMPTE 2022 is intended for use outside the studio. In fact, any applications where it is used inside a facility are unknown. But, inside the facility, at the beginning of 2012, video is still delivered via the BNC connector, just as it was when the U.S. withdrew from Vietnam and the first Space Shuttle launched. Is it time to look at how IP and serial digital video might be used together within the studio?

Before talking about what it would take to make this change, let's take a quick look at why it might be compelling to merge IP and digital video. First and foremost is cost. IP technology is widely deployed on a scale that dwarfs the entire professional video market. With huge deployment comes not only lower infrastructure cost, but increased spending on R&D. Put simply: The more IP technology is sold, the more dollars a company has available to put into research. Another benefit of moving to an IP infrastructure is that there are many people who understand IP technology well. In fact, many professional video engineers have become knowledgeable about IP technology.

Almost every piece of professional video equipment connects to an IP network in one way or another. Engineers who know how the worlds of IT and professional video come together may find themselves in a good position. It may be easier for video engineers to obtain a solid education in IP technology given the huge number of courses available. Another advantage of IP networks is that they are self-routing. Information contained in the header of each IP packet tells the

network equipment how to route the packet. There are business cases where having this self-routing capability opens new business opportunities not available when using externally routed video networks. Finally, IP networks are ubiquitous. From a functional standpoint, how far is technology from a news person being able to plug an IP camera into a network connection in his or her hotel, or on a street corner, and being able to stream that video anywhere in the world?

Doing this, however, requires one significant, difficult and costly change: It will require a break in the connection between video format geometry and the electrical and physical interface — the BNC connector. Right now, just about every professional video standard written mixes together the concept of the video format and the BNC electrical interface. The industry needs to start thinking about separating the two, and doing so sooner rather than later.

Raster parameters

Separating video format from the electrical interface means talking about video formats in terms of pixels per line, lines per frame and so on, while excluding any discussion of how these signals appear on a wire or connector.

The following parameters could be used to specify the video raster format:

- *Video width:* typically expressed as the number of pixels per line. Many people might not know the total number of pixels per line is not the same as the number of active pixels per line. Both need to be specified. For example, 1080p60 has 2200 total pixels, but only 1920 of those are active on any given line.
- *Lines per frame:* Again, there are two parameters here — the total number of lines per frame, and the number of active lines per frame. The two are not the same. 1080p60 has 1125 total lines per frame, but only 1080 of those lines are active lines.
- *Pixel bit depth:* Most HD specifications have a bit depth of 10, but some of the higher-resolution formats have 12 bits. Of course, manufacturers have been experimenting with higher bit-depths for some time now.
- *Aspect ratio:* This is the ratio of picture width by picture height. The two aspect ratios encountered most TV applications are 4:3 and 16:9.
- *Scan type:* These are interlaced, progressive or segmented frame.
- *Frame rate:* Knowing how often complete frames are presented to the viewer is critical. Many different values have appeared over the years, reflecting the history of the particular format, including 24Hz, 25Hz, 29.97Hz, 30Hz, 50Hz and 60Hz. Again, manufacturers have been experimenting with frame rates as high as 240Hz.

To be clear, this video format information is already well standardized. But, the standards mix video format information with electrical interface specifications.

Focusing on standardizing how video bits are mapped onto IP networks then allows smart systems engineers to concentrate on developing new products and systems that efficiently transfer not only streaming video and audio, but also large video files plus the myriad of other IP-enabled technologies needed in modern studio production, such as camera lens settings, IFB, prompter text and control, intercom, and more.

The time has come to seriously look at moving beyond the BNC as the do-all electrical interface for professional video applications. BE

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

? Send questions and comments to: brad.gilmer@penton.com

What's on your wall?

The next generation of reference-grade video displays is here.

BY PETER PUTMAN

The CRT display, for many decades the only choice for viewing video content, is now history. And while there are several display technologies jockeying to replace it in the professional arena, it's not yet clear which will be the winner.

There has been a sea change in the world of electronic imaging over the past 10 years. Manufacturers have moved away from small assembly-line models to large-scale semiconductor "fabbing" of new display technologies, combining brighter displays with high resolution. The increased importance of the consumer TV marketplace led to dramatic drops in retail prices as flat-panel TV screens grew even larger.

Today, it is possible to buy a 50in consumer HDTV with full HD 1920 x 1080 resolution for less than $1000. That's great news for the home viewer but problematic for the video and film professional who is faced with the prospect of replacing older professional CRT monitors with ... what? Plasma monitors? LCD monitors? Organic LED (OLED) monitors?

Defining the task

What, exactly, is a reference monitor? In the simplest terms, a reference monitor is one that stays within close tolerances for performance, can be calibrated to specific brightness levels and color temperatures, has a color gamut that matches one or more standard color spaces, and exhibits consistent gamma performance from 0 IRE to 100 IRE — and higher.

The CRT was the standard for years because it behaved just as a well-designed tube amplifier ought to. Small changes in input voltages resulted in corresponding steps in luminance values, a linear response that correlated to the signals being captured by tube video cameras, and later, solid-state cameras using CCDs.

The range from video "black" to full white on CRT monitors (i.e. dynamic range) was not extreme, but wide enough to evaluate electronic images for broadcast and transfer to recorded media. A well-designed reference monitor with black levels measuring .2 nits (.06ft-L) and peak whites at 100 nits (29ft-L) exhibited a contrast ratio of 500:1 — more than adequate for everyday work.

This reference monitor could also accurately reproduce a specific gamma curve to match standard gammas used with live video content and filmed content transferred to video. The monitor might not be blazingly bright, but its light output was sufficient to be viewed under controlled ambient lighting.

Equally important, a reference CRT monitor would be expected to track a specific color temperature value from black to white, and all steps in between. This track could vary only by a small amount — say, 250K — to be considered for critical color and exposure correction, where larger changes in white point values create noticeable color shifts in subtle, pastel color shades and flesh tones.

As far as color reproduction was concerned, professional CRTs conformed to the SMPTE-C standard gamut, which closely matches the NTSC standard and slightly exceeds the EBU (PAL/SECAM) standard. Any limitations on the reproduction of certain color shades were due to the maximum saturated levels of red, green and blue phosphor compounds used in these monitors.

The candidates to replace CRT technology for evaluation-grade monitors fall into two categories: transmissive (light shuttering) or emissive (burst).

It can be said that HD video basically wrote the obituary for CRT technology. At the heyday of CRT reference monitors, most video production was done at SD resolutions

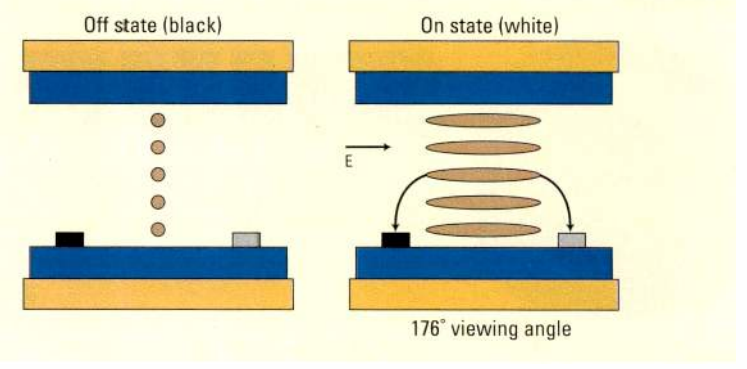


Figure 1. Diagram of in-plane switching (IPS) for LCD monitors. Figure courtesy LG Philips

like 720 x 480 (NTSC) and 720 x 576 (PAL). Because of the link between spot size and resolution, the highest resolution achieved by the best CRT monitors capped out at 1100 lines — about half of what was needed to accurately display 1920 x 1080 HD content.

There are several candidates to replace CRT technology for evaluation-grade monitors. They fall into either of two categories: transmissive (light shuttering) or emissive (burst).

Transmissive imaging

The leading contender here is the LCD. LCDs use liquid crystal compounds that align with changes in voltage to pass or block white light from a CCFL or LEDs. (See Figure 1.) Red, green and blue microfilters are applied to the front surface of each pixel to obtain full RGB color.

If a modulated light source is used, the light source can also generate color (red, green and blue LEDs). Modulated light sources are unique in that they can be used for local area dimming to enhance intrascene contrast for higher dynamic range.

Emissive imaging

Plasma display panels are the leaders in this category. Plasma pixels, which contain a mixture of neon and xenon gases, emit ultraviolet light when electricity is discharged through them. The burst of UV light in turn stimulates red, green and blue phosphors to glow. Plasma pixels switch at very high speeds and can handle faster frames rates than LCD displays. (See Figure 2.)

Because plasma monitors function as high-speed switching displays and provide only two operating states (on and off), they create grayscale images by using a pulse-width modulation (PWM) technique. The luminance level of the image is determined by the ratio of "on" cycles to "off" cycles within a specific time interval.

OLEDs are also classified as emissive displays and function just like other semiconductor devices, with a flow of electrons from anode to cathode at low voltages with high current.

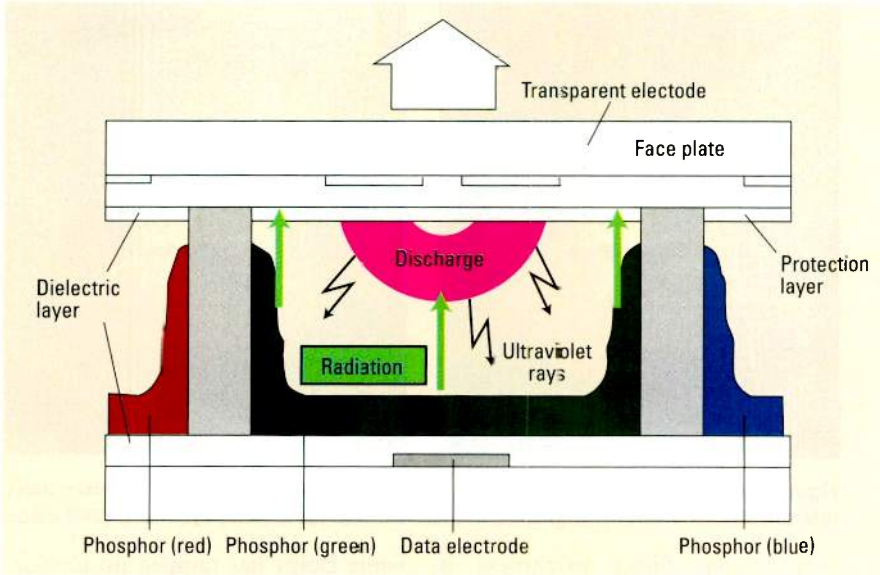


Figure 2. Cross-section of a plasma pixel

As electrons collide with "holes" in the organic film structure, photons are emitted with different colors. The color is dependent on the materials used to create the organic film layer. (See Figure 3.)

How they compare

When discussing contrast performance, the limiting factor is typically the level of black. A reference plasma monitor will easily achieve black levels at or below .1 nits (.03ft-L) after calibration, whereas professional LCD monitors can range as high as .4 nits (.12ft-L) with using conventional CCFL backlights. (LED-equipped LCD monitors with local area dimming can achieve the .1 nits threshold.) OLEDs essentially have no lower black level threshold, as they can be modulated at extremely low levels.

Plasma, LCD displays and OLEDs are all capable of equaling CRT color gamuts. All three can exceed SMPTE-C and BT.709 standard color spaces and cover all or most of "extended" color spaces, such as xvYCC and P3. (See Figures 4a-c on page 28.)

How about gamma performance? The standard gamma for a CRT is typically in the range of 2.3 to 2.4, and while the new generation of LCD, plasma and OLED displays can reproduce everything from flat (1.5 or less) to s-curve (film) gammas, they are also able to emulate CRT performance, provided they are not operated at extremely high levels of brightness. (See Figures 5a-c on page 28.)

Consistent grayscale (color temperature) tracking for LCD, plasma and OLED is not difficult, but is dependent on consistent gamma

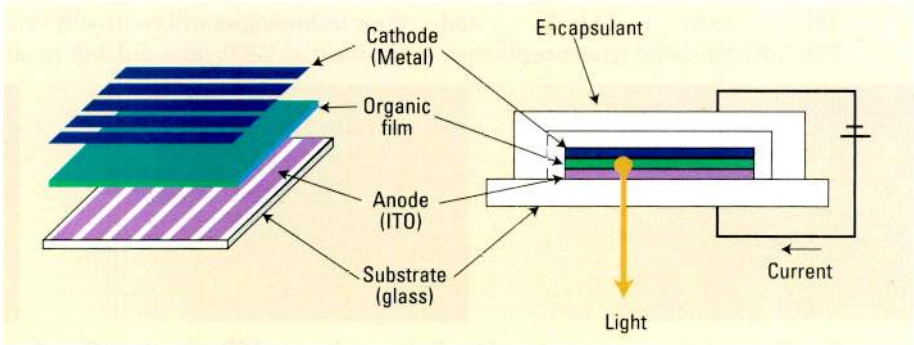
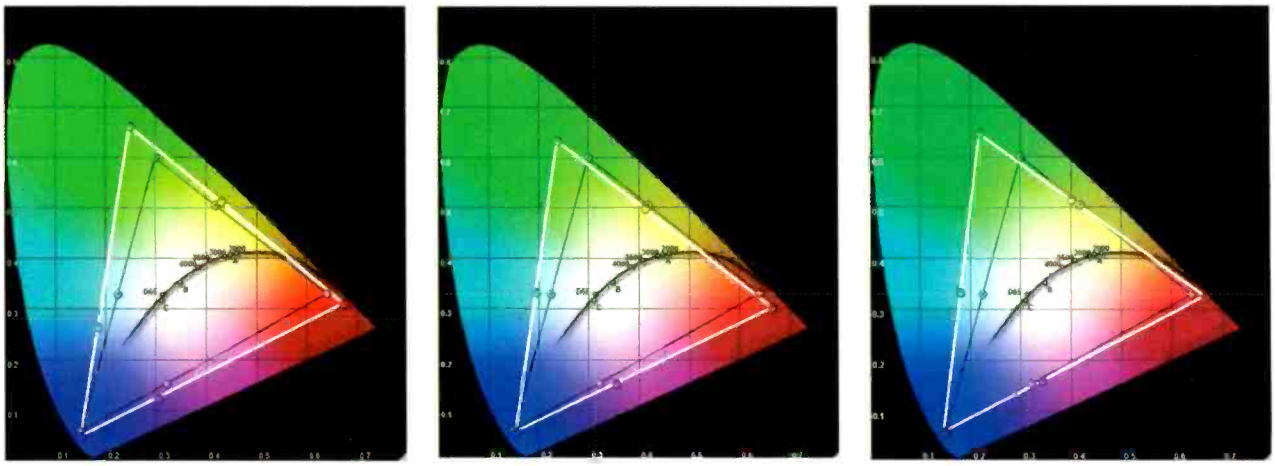
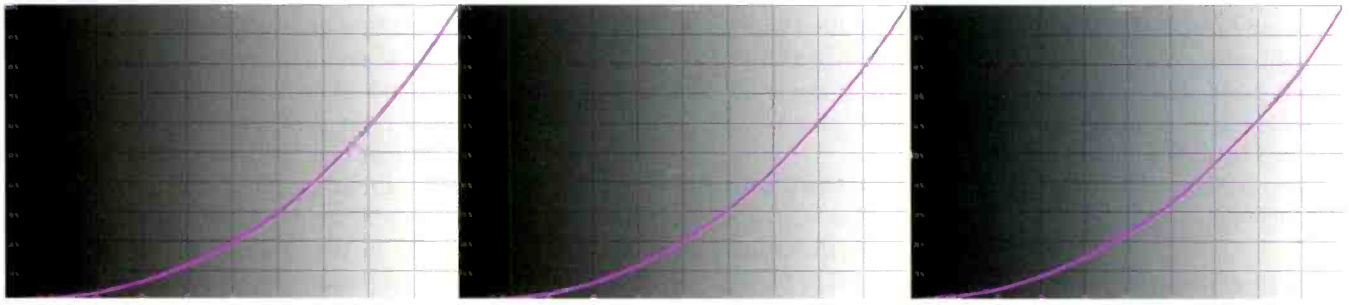


Figure 3. A simplified cross-section view of an OLED pixel



Figures 4a-c. Unconstrained color gamuts for a reference plasma monitor (left), reference LED LCD monitor (center) and reference OLED monitor (right). (The black outline represents the ITU BT.709 color space.)

performance. Sheer brightness is not the goal of a reference display; accuracy is. The latest generation of reference plasma monitors and LED-backlit LCD monitors can produce accurate grayscale tracks at any standard color temperature. (See Figures 6a-c.)



Figures 5a-c. CRT-like gamma curves as emulated on plasma (left), LCD (center) and OLED (right) monitors

Summary

Reference monitor products that use all three of these technologies are now available commercially. Panasonic is now shipping its TH-42BT300U (42in) and TH-50BT300 (50in) reference plasmas, while Dolby has ramped up production of its SRM-4200 42in LED LCD reference monitor that uses local area dimming for higher dynamic range.

Sony and TV Logic are both exhibiting and taking orders for OLED monitors. Sony's Trimaster EL-series OLEDs are available in 17in and 25in sizes, with additional screen sizes coming to market in 2012. TV Logic sells a 15in OLED monitor for studio, remote control and master control use.

It's still too early to say which of these technologies will eventually rule the roost as CRTs once did, but in all likelihood it will use emissive technology. Emissive technologies offer the widest viewing angles and best color saturation and combine them with high dynamic range and low black levels. (Wide viewing angles and low black levels remain a challenge for LCD displays.)

For now, plasma has that level of performance locked up in larger screen sizes, but bigger OLED displays are definitely in the works. Will we see any make their debut in 2012? Check back after NAB. BE

Peter Putman is president of ROAM Consulting.

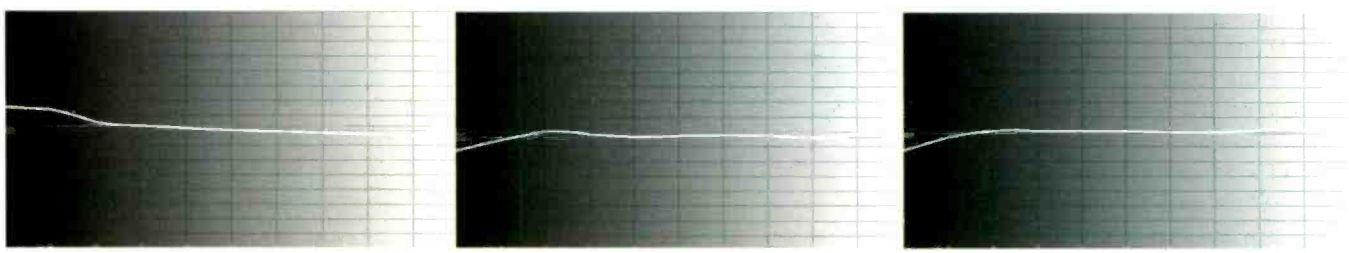


Figure 6a-c. Grayscale (color temperature) tracks for a reference LCD monitor (left), reference plasma monitor (center) and reference OLED monitor (right). (The solid center line represents 6500K.)

BXF

Follow these steps when implementing the standard.

BY EUGENE DIANA

Logical steps exist to follow when implementing the Broadcast eXchange Format (BXF) standard at a station. As a prerequisite, understanding what BXF is and is not, in tandem with being in accord with the benefits of utilizing it, can only help. This article begins the understanding process by addressing key human factors that may arise if the going gets tough along the way.

The standard

The BXF standard is the outcome of the collaboration of many seasoned clients and vendors in the broadcast industry. The goal was to promote a common language of electronic interaction among systems that mostly already communicate with one another inside the facility. Specifically, BXF includes a combination of a detailed, wide-ranging, well-considered, mostly vendor-agnostic xml schema, and a recommended-practices document. Taken together, the standard proposes structure, sets boundaries and offers patterns that cover many of the possible business functions that require system-integration.

BXF is *not* a specific, predefined set of messages. Instead, it acts as a framework within which the implementing system can use the logical parts to achieve its desired end. That said, it was built in a way that can guide the user toward an intuitive understanding of that framework's purpose. Additionally, BXF-compliant systems are not required to communicate on a transport-level using any specific protocol (for example, ftp, web-services), nor at any specific interval, nor synchronously or asynchronously, nor using data-encryption or not. It is the payload that is relevant to BXF.

The allure of using BXF also involves the inherent capability of providing data-validation for all messaging between systems. The XML schema ("grammar rules" for the BXF language) can be used to ensure that messages are not only structurally sound, but valid in the sense that the data being passed within the XML tags is legitimate given a specific field of data and regardless of the message's path. (See Figure 1.)

For example, suppose the system sends the following message: <SmpteDateTime>12/10/2011</SmpteDateTime>. While this may be well-formed XML, it is not consistent with the definition of the xml tag called "SmpteDateTime." Therefore, when this portion of the message is judged against the schema, it will fail. This means sending systems can take much of the responsibility in sending only "valid" and "well-formed" messages, thereby isolating much of the potential data issues (and their

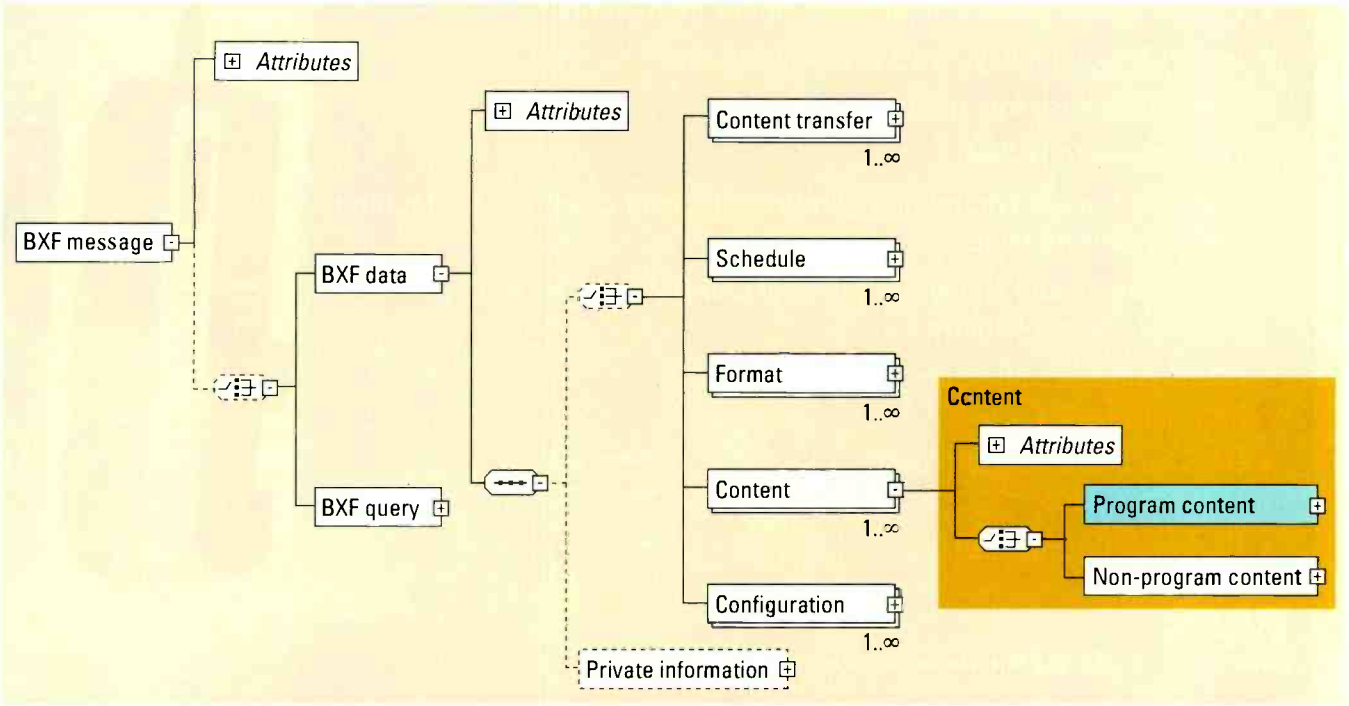


Figure 1. This shows the major branches of the XML schema. The branches consist of many message functions, ranging from managing schedules to performing your cooperating system's heartbeat. All of these combine to ensure availability no matter the message path.

resolution) to the sending system.

Another of the inherent abilities of BXF includes acknowledgement or negative-acknowledgement (ack/nack), which is performed by the receiving system and sent in response to every message. This feature allows systems to give to each other, and end-users, the sense of confidence that their message "made it" to the receiving system, thereby reducing manual communication between departments and further isolating the location of any integration problem.

Understanding business workflow

The next aspect to consider is which business functions will be covered by using BXF. Let's say in order for the traffic/sales system to start building program/break formats, the content's metadata is first needed from the program management system. When traffic finishes adjusting the formats, this information needs to be returned to the program management function.

Program grids are built using the content and its associated formats, and a rough schedule is sent to traffic so media buy contracts can be fulfilled. As media is acquired and prepared for air, the program management routine again refines the schedule for traffic.

These are just a sample of messages between two systems, with the associated ack/nack lifecycle, automated error-responses and appropriate feedback for the end-users. But, the systems are talking the same language, and if one system gets replaced, the next can step in and have a good idea of where things stand if it is already BXF-compliant.

XML schema

Once the business workflow is outlined, the particulars of using the xml schema itself need to be understood. The major branches consist of messages related to transferring content, managing a broadcast schedule, content sub-structure (formats), content metadata, and the configuration of the communicating system...not to mention the ability to perform various types of queries, as well as simply perform a heartbeat of your cooperating system to ensure availability no matter the message path. The steps taken are also well-defined, making it easy to ensure the program is running correctly. (See Figure 2).

An additional detail that is related, but technically beyond the purview of BXF itself, involves what message-transport methodology most suits your software system. Normally, the receiving system is the first to propose how it prefers messages to be sent to it. So, be prepared to be flexible in

```
<?xml version="1.0" encoding="UTF-8"?>
<BxfMessage xmlns="http://smpte-ra.org/schemas/2021/2008/BXF" xmlns:xsi="http://
www.w3.org/2001/XMLSchema-instance" id="urn:uuid:f8021ba5-c64e-4cf2-bb4b-
36b7a10f79fc" messageType="Request" dateTime="2011-10-11T16:26:48.78"
origin="Program Management System" originType="Program_Manage-
ment" destination="Traffic" userName="Program Management System User"
xsi:schemaLocation="http://smpte-ra.org/schemas/2021/2008/BXF BxfSchema.xsd">
  <BxfData action="add">
    <Content version="Program" action="add">
      <ProgramContent>
        <ContentMetaData>
          <ContentId>
            <AlternateId idType="ProgramId" authoritativeSource="Pg-
            mgmt">urn:uuid: l2201cd5-c64e-4cf2-bb4b-54c8e10f79ef </AlternateId>
            <AlternateId idType="FormatId" authoritativeSource="Traffic">urn:uuid:
            j9838ba5-c22e-4br2-ee4b-36b7a10f79aa </AlternateId>
          </ContentId>
          <Name type="DefaultName">VISIONS OF ITALY: NORTHERN STYLE </Name>
          <DefaultLength>
            <UtcDuration>PT01H00M00S</UtcDuration>
          </DefaultLength>
          <Genre type="DC">DOCUMENTARY</Genre>
          <Description>NONE</Description>
          <UsagePolicy>
            <AssignedChannels>WXYZ</AssignedChannels>
          </UsagePolicy>
        </ContentMetaData>
      </ProgramContent>
    </Content>
  </BxfData>
</BxfMessage>
```

Figure 2. This shows a specific, well-defined message path in the XML schema. This layout is advantageous because it allows for easy troubleshooting and/or ensuring the program is running correctly. The highlighted portions correspond to the chart in Figure 1.

how your messages get delivered.

In addition, decide how you would prefer your system to receive messages. Will it be a SOAP web-service, or a file-reception system or something else? If it is simple and clearly-defined for the consumer (i.e. the sending system), then you are halfway there.

Be prepared to think about communicating with such systems no longer in a batch-oriented way, but instead, event-by-event. The BXF/xml schema has this perspective built into its core, with an eye on the ability to affect a single event's destiny in a running play-list or example. Or, the system may need to provide instant feedback to the traffic system via "asrun" once a single event has been executed by automation.

Finally, commit to implementing BXF and doing it right. This involves appreciating some of the technical boundaries and checks and balances that are provided when working with a community-developed xml-based standard.

Realize that BXF is still in its first version, and although people with multiple perspectives have contributed, the community is eager for thoughtful input. The standard benefits from others digging in and proving its mettle. Your situation may deem that an addition or change is needed in order to handle a particular business situation. But, all told, BXF is possible, feasible, rewarding, cool and used by a range of vendors, so you won't be alone. BE

Eugene Diana is director of software development, Myers Information Systems.

A view from the top

Some of broadcast's brightest reveal where the industry is headed.

BY MICHAEL GROTTICELLI

Whether they work at a major broadcast network, 24/7 sports channel, TV production facility or a local station in a small market, most senior vice presidents of technology and chief engineers are faced with the same challenges: trying to do more with less (or the same) resources in a highly competitive and tough economic environment.

All of these key players in the engineering community, no matter where they work, revealed a surprisingly similar formula: Implementing an efficient (i.e. file-based), cost-effective production and distribution workflow is critical to long-term survival. To a lesser extent, they are also considering technologies such as 3-D and Mobile DTV.

Therefore, it is clear from the guys we spoke to that the technology and systems designs they are choosing to maintain their facilities have to help navigate these hurdles in the most cost-effective way. Single, dedicated boxes or workgroups are quickly becoming a thing of the past.

The importance of infrastructure

"The biggest technical challenge is not really technical in nature," said Chuck Pagano, CTO at ESPN. "To me, the challenge is having the right talent pool around you to analyze the pure value of new technical platforms and opportunities in hope that you circumvent the question of 'Is this a solution in search of a problem?'"

ESPN maintains two major broadcast/production facilities, one in Bristol, CT, and the other in Los Angeles. Roughly 50 percent of its infrastructure — its Los Angeles facility and its satellite/fiber transmission hub — is already 3Gb/s-capable.

"Our research shows that our sports fans are early adopters of new technology [3-D], and we are just serving our fans' appetite," — Chuck Pagano, CTO at ESPN

"The main advantage [to a 3Gb/s system] in current operations is more reliable handling of the 1.5Gb/s signals and the ability to handle 3Gb/s signals in response to market demand," Pagano said, adding that ESPN's facilities also have been outfitted with the latest shared-storage production environments in order to produce the voluminous amounts of content necessary.

The all-sports network also launched one of the first 3-D networks in June 2010 and continues to believe in the format's potential for television broadcasting.

"Our research shows that our sports fans are early adopters of new technology, and we are just serving our fans' appetite with this enhanced presentation format," Pagano said. "I believe that 3-D can become common in living rooms when the glasses-free display technology becomes common and affordable."

Mark Haden, vice president of engineering and IT at MLB Network (Secaucus, NJ) said his biggest challenge is maintaining the technical infrastructure needed to support the new shows and hundreds of hours of live programming seen on the network throughout the baseball season.

"The challenge for us is enhancing, upgrading and adding systems in a relatively short off-season," he said. "Another challenge is audio: Since our signature studio show 'MLB Tonight' is like a true newscast, we must deploy 5.1 surround, automatically control loudness in a file-based environment and get the overall audio quality up out of our 40-plus post-production rooms that generally have tight delivery deadlines."

"The challenge for us is enhancing, upgrading and adding systems in a relatively short off-season." — Mark Haden, VP of engineering and IT at MLB Network

MLB Network will be busy in 2012, purchasing new HD video and audio production systems and upgrading existing equipment, virtually doubling the capability of the network's graphics systems, and adding more storage and record channels to its SAN. It also plans to install an IP-controlled disaster recovery playout server with CG capability at its Level 3 DR earth station in Denver, add a sixth Cisco Ballpark Cam operating station, and install more intercom panels and wireless mics.

Merging IT with broadcast

Although IT-centric infrastructures and file-based workflows quickly are becoming the norm across the industry, the challenges to successfully implementing this type of collaborative work environment can be daunting if not carefully deployed.

"I'd say that managers should focus on the people," Haden said. "Traditional IT professionals and traditional broadcast engineers have the same DNA; they just learned their trades on separate islands. We are a 'merged' department, and emphasizing collaboration must come from the top. It sounds easy; it's not.

"That said, there is not enough happening on the assembly line — the college and university level," he added. "The broadcast IT profession is a hybrid, and we are seeing a few more graduates that understand this. The schools need to do a better job exposing their students to this emerging need. Right now, we are doing the cross training, and it's worth the investment."

At CBS in New York, two of the largest projects in 2011 included the rollout of the CBS Media Distribution Center, which converted the network's master control facility into an entirely file-based HD workflow, including not only commercials but also all program content. The other major rollout was the Pitch Blue system CBS Worldwide Distribution uses

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for syndicated programming, which distributes content to ABC, CBS, NBC, CW, FOX, MyNetwork and independent stations.

The signal is distributed to more than 850 real-time servers that automatically record the syndicated programming for more than 1350 television stations. Bob Seidel, vice president of engineering and advanced technology at CBS, said, "[This distributed process network is] a self-healing network. Each of the 850 servers report their status to CBS and our partners, GDMX (Warner Brothers) and Deluxe, and request repair packets to correct any transmission errors.

"WCBS' Mobile2 Cellular sport utility vehicles have proved very effective in blizzard conditions." — Bob Seidel, CBS VP of engineering and advanced technology

In addition, many of the network's local owned-and-operated stations have migrated to newsroom automation to improve their news control room efficiencies. The newsroom automation is fully HD and based on a file-based workflow.

"A number of our owned-and-operated stations have deployed 3G as well as 4G cellular newsgathering equipment to supplement their traditional microwave, ENG and satellite newsgathering vehicles," Seidel said. "For example, WCBS' Mobile2 Cellular sport utility vehicles have proved very effective in blizzard conditions [including during this fall's Hurricane Irene on the East Coast]. Many satellite dishes needed to be stowed due to high wind issues, while the cellular vehicles continued to transmit stable reliable picture and sound. We plan to roll out additional 4G cellular newsgathering vehicles in 2012."

Reducing costs

Ken Michel, vice president of content systems and engineering services for the Disney/ABC Television Group, said improved efficiency and reduced operating costs are his main concerns.

"We will be investing in technologies, systems and products that have the potential to reduce costs, streamline and/or simplify our operations, improve the quality of the product we put on the air, or can extend our product to new platforms," he said. "As part of our normal course of capital investments, we will continue to invest in infrastructure terminal equipment, monitor-wall systems, data networking components, camera robotics, video servers and power monitoring systems. As we head into a presidential election year, ABC News will be looking at new graphics systems, digital journalist tools, small-format cameras, large-format HD cameras for field acquisition, field editing systems, field-acquisition support equipment, cell phone bonding technology, BGAN-type terminals and remote-controlled cameras."

"We will be investing in technologies that can reduce costs ... and improve the quality of the product we put on the air." — Disney/ABC VP of content systems and engineering services Ken Michel

For ABC (New York), the past year has been filled with technical projects that helped improve the news production workflow.

"We actually had a few big challenges this year. The first was building an automated control room for our News division," Michel said. "Transitioning all of the network news programs to an automated scripted process using the existing NRCS and completely new technologies for the control room, graphics and server playback was quite a challenge for the entire organization. I believe this effort is the first for a major network news organization to use automation to assemble and produce all of its programs.

"The second big challenge for the network was transitioning to file-based delivery for program commercial and promo content. With the sunset of the D-5 HD tape format, we needed to replace our decades-old tape-based infrastructure and associated workflows (sneakernet) with a new file-based infrastructure for electronic program delivery. Building our own internal fully redundant infrastructure with sufficient bandwidth and security to accommodate the ingest, transport, tracking and storage of very large media files across diverse geographic locations has been a bit of challenge as well."

Challenges for independent stations

At the local level, the challenges for independent stations have been equally daunting. Moving from SD to

HD in all facets of their operations has been costly and resource-intensive.

"The primary technical challenge during 2011 was to complete our transition to HD," said Dan Billings, director of engineering and technology at Waterman Broadcasting in Fort Myers, FL, a station group that oversees ABC (WZVN-TV) and NBC (WBBH-TV) affiliates, as well as WVIR-TV, an NBC/CW duopoly in Charlottesville, VA. "Our studios, master control and infrastructure had already been upgraded to HD; however, we were still acquiring and editing our field video in SD. However, now that we have made the move to HD, we are very pleased with the performance and quality of our video from the field and, to this date, are still the only ones in the market to be live reporting in HD."

"We are still the only ones in the market to be live reporting in HD." — Dan Billings, director of engineering and technology at Waterman Broadcasting

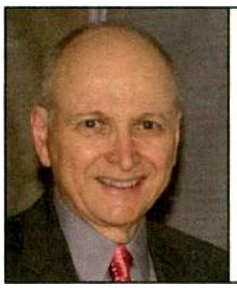
An HD MPEG-2/H.264 upgrade of its fixed satellite uplink and ENG satellite vehicle is all that remains to make the broadcaster's plant 100 percent HD compatible.

"We will also be downsizing and upgrading our satellite uplink truck to a new, more manageable, HD-equipped Sprinter," Billings said. "We're also planning to upgrade our radar and weather systems."

He added that terrestrial Mobile DTV is on Waterman's radar for 2012, but it is proceeding with caution.

"We plan to look at the state of mobile television development at NAB in the spring," he said. "If manufacturers are widely implementing receivers in their devices by then, and if we determine a solid business plan is possible, we will move forward with an implementation plan for 2012."

Bill Jarett, vice president of engineering at Scripps Networks (which maintains a large production facility in New York that produces the majority of programs for the Food Network and another in Nashville, TN, which produces the Great American Country channel), said his company is involved in a multiyear effort to migrate to file-based workflows across all of Scripps Networks Interactive properties.



"We are continuing our ongoing research [to support] our goal of an all-file-based workflow." — Bill Jarett, VP of engineering at Scripps Networks

The company considered file-based workflows as early as 2004 at its New York City location, but it backed off due to concerns about the maturity of the technology and interoperability issues.

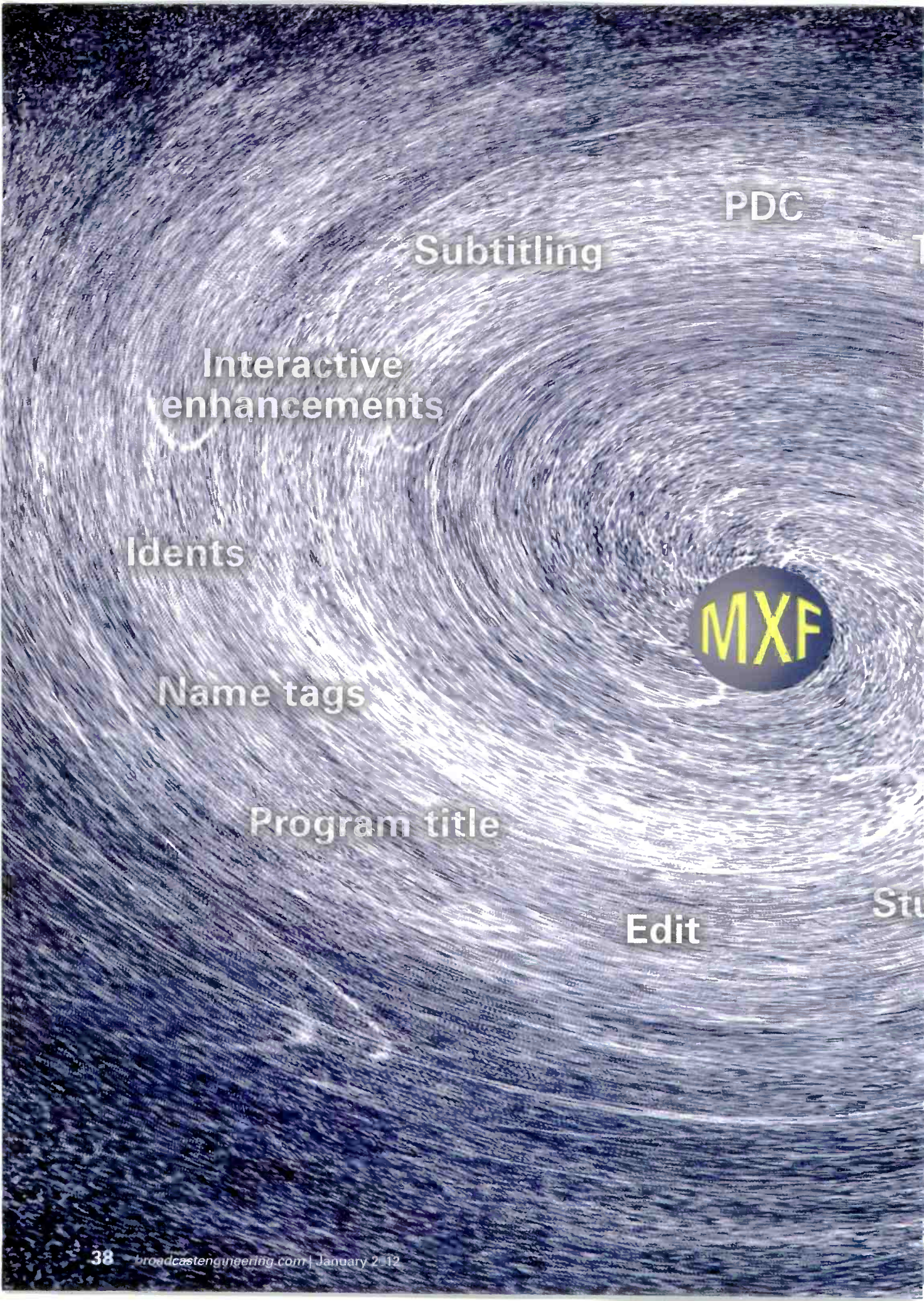
"[In 2004] the state of the software and hardware necessary to make that transition [to a file-based workflow] and provide essential centralized control of media workflow management across storage, editing and transcoding platforms was also not as robust as we would have desired, which confirmed our decision to delay that project," he added. "We are, however, continuing our ongoing research with evaluation of software and hardware from the major manufacturers in each applicable area that supports our goal of an all file-based workflow."

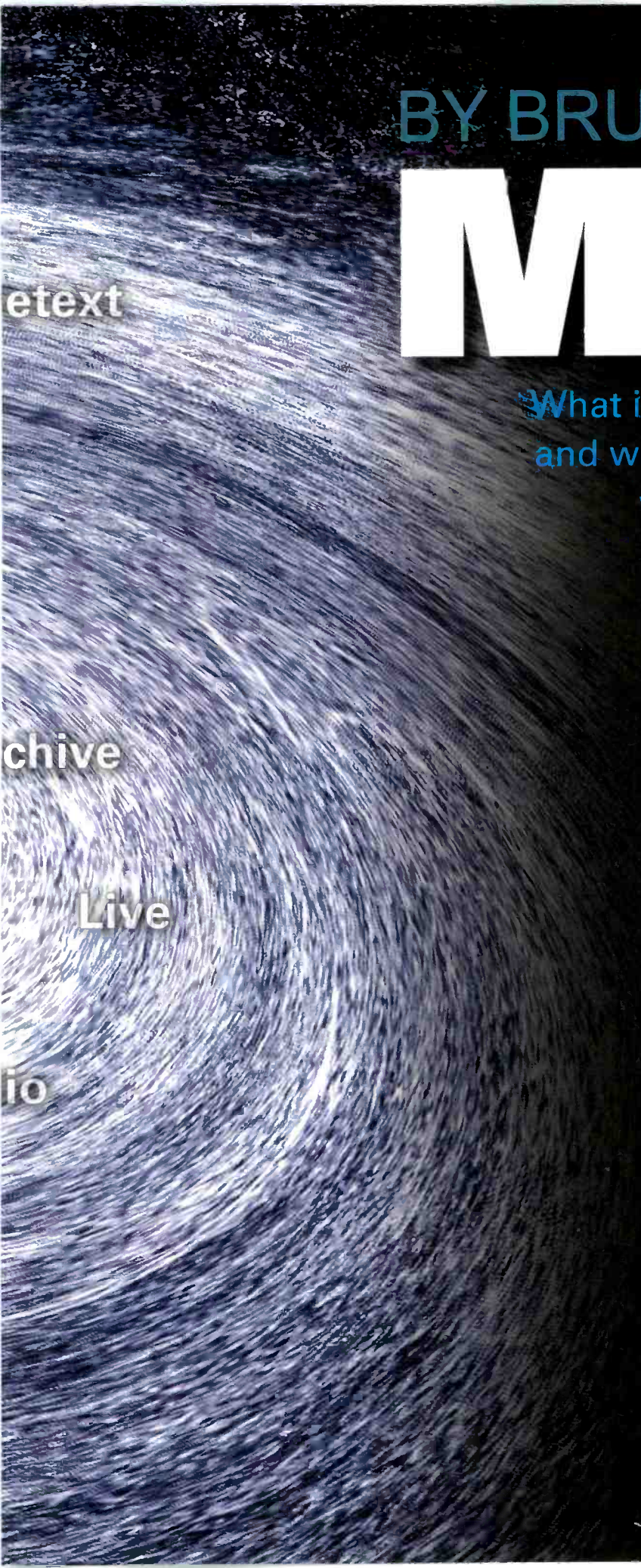
The right technology

At the end of the day, broadcasters are preparing for every possibility in order to develop alternate business models and generate new revenue whenever and wherever possible.

"Broadcasters are being called upon to distribute their content on a wide variety of platforms using a plethora of video compression formats and data rates," said CBS' Seidel. "One piece of content may need to be encoded and stored in 37 or more different flavors. Technologies that can monitor and quality control this wide variety of content-distribution formats will be invaluable to broadcasters for maintaining their cost base for producing and distributing this content." BE

Michael Grotticelli regularly reports on the professional video and broadcast technology industries.


PDC
Subtitling
Interactive enhancements
Idents
MXF
Name tags
Program title
Edit



BY BRUCE DEVLIN

MXF

What is it, how does it work, and why hasn't it solved the world's problems yet?

Back in the 1990s, a group of engineers, representing a number of users and manufacturers, got together with a mission: develop an open file format that would facilitate the interchange of video, audio, data and associated metadata within a file-based workflow. This initiative eventually led to the development of the SMPTE-approved MXF in 2004.

When we initially designed MXF, we had a number of fundamental design requirements: We wanted it to enable users to use and work on the files, even as they are being created, before the completion of their transfer to a disk, NLE or playout server. We thought it was important that it should allow for the synchronization of separate components and that it should provide for graceful recovery after interruption by ensuring that enough information should be contained in that file to allow it to easily recover from corruption. And of course, it had to be open, standardized and compression-format independent. But most of all, it had to be simple and flexible.

Together with the fundamental design requirements, we also had one overarching operational goal for MXF: We wanted it to be applicable to a large variety of workflows, to carry faithfully the metadata and essence throughout the life cycle of a program, movie or news clip.

Operational goal

As a piece of content goes through its life cycle, it accumulates more and more bits of essence and more and more metadata until it is eventually ready to be sent out to a playout system or other kind of delivery or publishing network.

viewed in a couple of different ways.

The metadata view of a file represents what type of movie or TV program the file is trying to represent, whereas the physical view of a file represents how the bytes are arranged on the surface of the hard disk. (See Figure 2.)

ways to optimize some element of a workflow. For instance, in a frame-wrapped OP1a file, everything in that file is interleaved frame by frame. The same asset could be physically arranged as a bundle of component files that are synchronized by an MXF AS-02 version file. Because MXF is able to

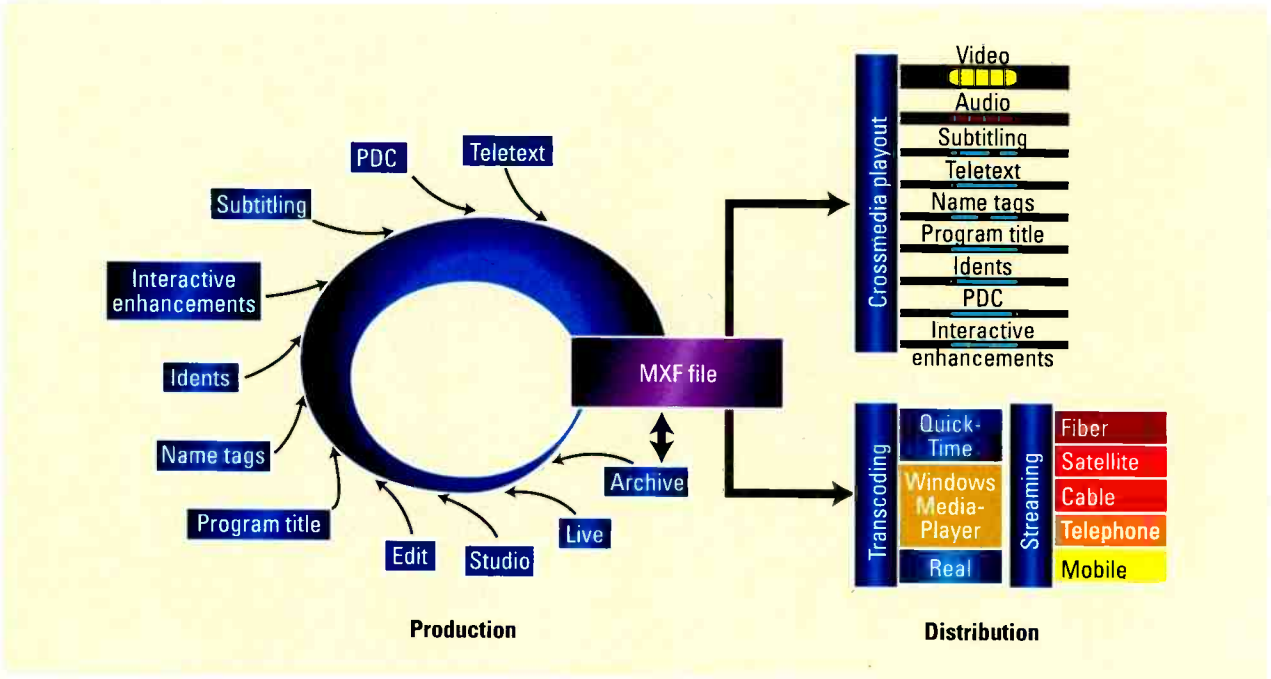


Figure 1. With MXF, metadata remains attached to video and audio essence throughout the production process, playout and archiving, so there is no need to keep re-entering metadata.

MXF is intended to transport material throughout the production chain, gathering metadata and different versions of material as the project progresses, with the goal of finally distributing the content to multiple destinations with different bit rates, resolutions and quality of service requirements. (See Figure 1.)

Because MXF is designed with workflows in mind, all the handling processes are seamless to the user. It just works quietly in the background. The metadata remains attached to video and audio essence throughout the production process, playout and archiving, so there is no need to keep re-entering metadata.

Two views

To help with operational objectives, MXF is designed so that it can be

Within the metadata view, there are two different sorts of packages: a Material Package, which describes the timeline of an MXF file and what's going to happen when you press the play button, and a File Package, which describes the video and audio that is physically stored in the file.

It is possible to have two MXF files that have identical metadata, but are physically arranged in two different

separate the metadata view from the physical view, it allows seamless interchange of media and the vital metadata that goes with it and allows for the creation of different flavors of MXF optimized for specific workflows.

Multiple flavors

MXF was developed with an enormous amount of input from users to ensure that the format really met

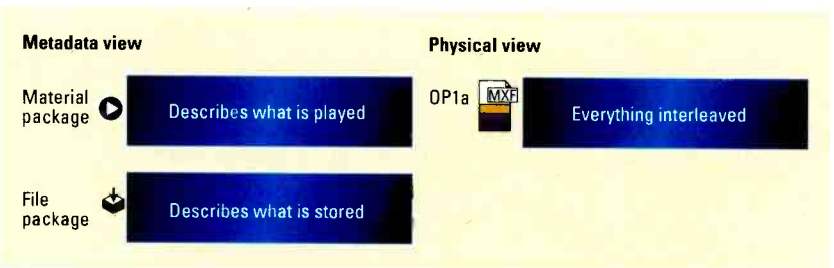


Figure 2. The metadata view of an MXF file appears on the left, and the physical view of how these bytes are put on disk is on the right.

their needs. The resulting flexibility also allowed vendors to develop their own interpretation of the standard for their codecs as a competitive differentiator. This inherent flexibility has led to the deployment of a number of different flavors of MXF, each of them having similar MXF metadata but implementing different physical views that are optimized for different applications.

Let us start with generic OP1a. OP1a is a simple tape-like implementation of the MXF format that stores audio and video data in a single interleaved MXF file. It is flexible and contains no real constraints on file construction rules. This makes its implementation quite simple. On the downside, this high level of vendor flexibility also means that interoperability can suffer when different vendors interact for the first time.

A close relative of OP1a is the XDCAM HD format. Designed by Sony, XDCAM HD is much more constrained than OP1a. It has much better interoperability, and it tends to be mostly used in workflows that require lower bit rates, such as HD at 50Mb/s. On the down side, it is specified to have a maximum of eight channels of mono AES audio and even with these constraints, interoperability issues remain. There is currently a working group within the Advanced Media Workflow Association (AMWA) looking at XDCAM interoperability and defining an even more constrained variant called AS-10.

So let us now have a look at one of the most common componentized versions of MXF, OP-Atom. Avid was one of the major contributors to the MXF standard, and as such, sponsored the creation of a particular variant of MXF called OP-Atom. It is highly constrained; it only allows one component and all the synchronization of the components is done in the AAF file. However, OP-Atom files generated by Avid's Media Composer often have non-MXF metadata in them. This is called "dark metadata" and can lead to interoperability problems when exchanging files between different manufacturers.

Panasonic's P2 system also uses OP-Atom to record the actual video essence and audio essence. The P2 format is constrained, with good interoperability and extensible use of metadata. However, there are certain limits in the P2 file size, which can cause operational problems. Moreover, the P2 design has chosen an XML format and not MXF to synchronize the audio and the video. Although the XML synchronization file references the stored MXF media, the structure of the XML can lose metadata when round-tripping with a generic MXF file.

In spite of the efforts to ensure seamless interoperability among vendors, the various flavors of MXF have led to compatibly issues.

There is another variety of componentized MXF that is used by digital cinema, which uses yet again a different way to synchronize files called composition play list (CPL). This XML file has a different structure from the P2 XML and from the AVID AAF. While it is an extremely constrained format that is well-suited for all aspects of digital cinema delivery, it is limited to RGB color space and JPEG 2000, which makes it too constrained for a general purpose interchange format and unsuitable for TV workflows.

As we are starting to see, in spite of the best efforts of the MXF standard to ensure seamless interoperability among the various vendors, the various flavors of MXF are still leading to incompatibly issues. And while interoperability is improving as manufacturers are learning how to better implement the standards, users continue to experience some frustrations created by incompatible systems that can't read each other's MXF files.

This problem has led to renewed collaboration between media companies including AmberFin and a dozen other vendors through AMWA to draw up some application specifications (AS) as the basis for simple, easy interoperability.

The application specifications are not particular to any one vendor. They define a set of constraints on how the file is constructed to match the operational and technical requirements at a particular point in the workflow.

If even tighter constraints are required for, say, a specific broadcaster's technical practices or a particular program genre or distribution channel, these can be defined as "shims," a set of facility-specific restrictions that are defined by the business and are written into a managed and version-controlled document.

MXF AS-02 and AS-03, for instance, have been designed to streamline file-based workflows within and between organizations.

AS-02 is a mastering tool; it is designed to meet the needs of content creators and distributors who face program versioning challenges. With AS-02, video, audio and data are stored in separate media files to enable efficient versioning of programs for distribution. AS-02 is a "componentized" file format — not a single file, but a collection of elements bound together under the concept of a bundle, collected in a folder. A bundle is completely self-contained and holds all the assets and metadata needed to generate several versions of a program for use in a multiversion, multilingual, multidelivery media environment.

Today, we have good read support for this format, but write support is lagging behind. The structure of AS-02 can make multiversion workflow quick and produce light loading on a facility's network infrastructure.

MXF AS-03 is intended for delivery of finished content directly to a playout server. AS-03 constrains the MXF toolkit to efficiently carry final deliverables in a compact, robust and directly playable format. An AS-03 file is always a single file, for a single program. The content of these files is not intended for further processing before delivery to the viewer but for direct playout from any server. The file contains a finished program or program segment with its associated metadata and typically includes video, audio and subtitles plus technical and AS-03-specific metadata for describing the file. AS-03 files contain defined metadata sets for content identification and verification versus delivered traffic metadata.

AS-03 works perfectly for delivering MPEG-2 content to playout servers but needs some modifications if you want to use the same format for contribution between broadcasters and post houses. To address these application differences, AMWA is developing AS-11, a file format for the delivery of finished programming from program producers to broadcast stations or program origination facilities. Based on AS-03, AS-11 should allow for codecs, which are MPEG (or non MPEG) with higher bit rates for contribution purposes. A first implementation of AS-11 is being proposed by the UK Digital Production Partnership, based on the AVC-Intra codec.

Conclusion

That was a quick tour of some of the most common MXF formats. When planning your workflow, it is worth considering carefully when you might use each of these. If you are in an environment where you want to do audio versioning workflows or in an environment where you need to store different components for different bits of workflow, something like AS-02 makes a lot of sense. But if you want to lock everything together so that when you move from A to B nothing can ever fall off, then a format like AS-03 or as AS-11 might be more appropriate. After all, these application specifications are being defined specifically to help the user community get more interoperability and have an easier job of choosing the right MXF format at the right time, in the right place.

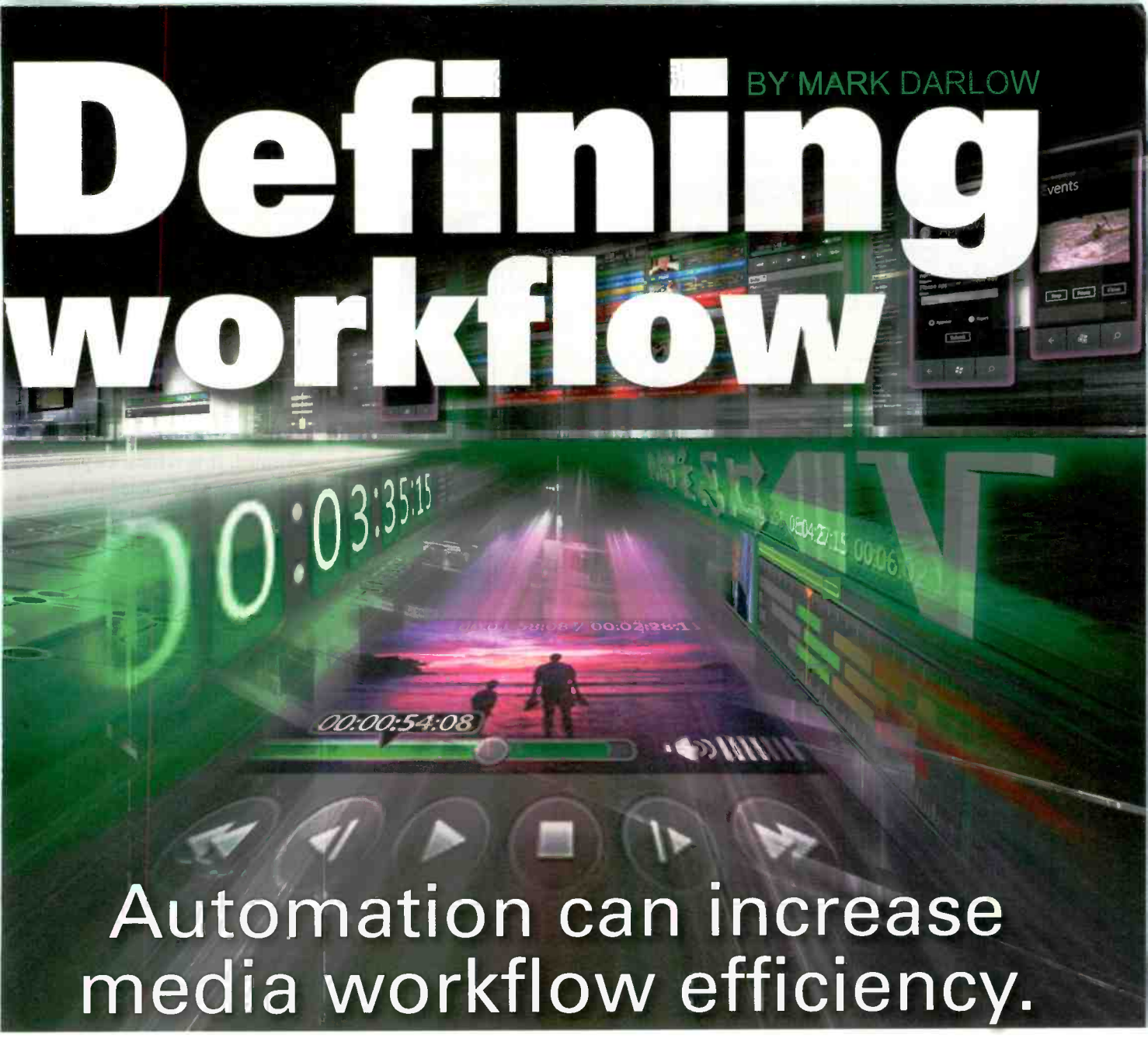
In spite of the efforts to ensure seamless interoperability among vendors, the various flavors of MXF have lead to compatibly issues.

If you are working with MXF and are interested in contributing to its continued development, you can go the SMPTE website and join the standards community. The website contains a list of all the groups you might want to join. 31fs looks after MXF. There is also the MXF book, which will give you a good human-readable resource of what the MXF standard was intended to do. Above all, remember that MXF is just a file format. It is merely a tool for building great file-based workflows. The success of MXF will be dependent on how we use that tool.

Bruce Devlin is chief technology officer at AmberFin and co-author of the MXF specification.

Defining workflow

BY MARK DARLOW



Automation can increase media workflow efficiency.

The broadcast industry has never been one to shy away from buzzwords. The term "workflow" topped the list in 2011, capturing the attention of virtually every broadcaster — and every manufacturer working hard to adapt their digital platforms to quickly evolving requirements.

But workflow, perhaps more than any preceding industry buzzword, causes a great deal of confusion due to its many different meanings. A quick survey of station managers and technical engineers that inquires to the definition of workflow will prompt such responses as "asset viability," "efficiency," "monetization," "program normalization," "platform-agnostic" and "standards-based," among others.

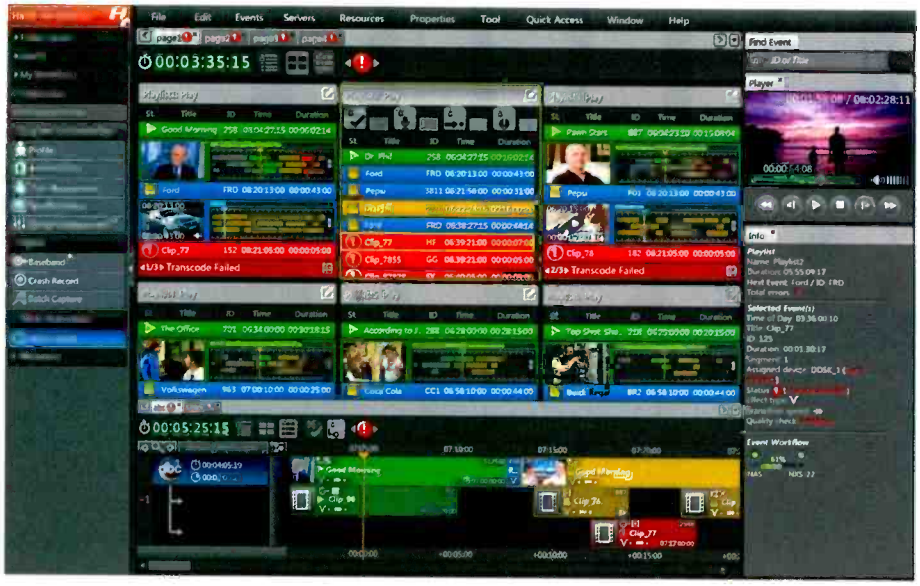
Most would agree that workflow is a process that encompasses many small, definable tasks that link together to achieve a desired result. Workflow also can be defined as the progress performed. Automation is more than just controlling broadcast devices.

The future: "Smart workflow"

Workflow in itself is just a process. Although careful definition and construction of the process can provide some efficiency, at what point does it move from being purely mechanical to being a "smart workflow," adding real value and effectiveness? That gain in efficiency comes when workflows are automated.

Automation encompasses much of what people describe as efficient workflow. It is more than just controlling broadcast devices. It requires that a system have knowledge not only of tasks but also the procedural steps, organizations and people involved, required I/O information, and tools needed for each stage in the business

Automation can be the element that takes media workflow to the next level of efficiency. Images courtesy Harris.



Automated workflows must offer clear visual fields that present necessary data on a single display.

process. Automation not only manages the process but also monitors information about status, potential bottlenecks and workloads, providing information that is crucial for effective day-to-day decision making. Automation and knowledge can turn a workflow into a smart workflow.

Automation and knowledge can turn a workflow into a smart workflow.

The explosion of metadata

As processing power has multiplied and bandwidth has grown, broadcasters must consider the many new ways their content can be delivered. This proliferation of platforms has also caused an explosion of content metadata — to the point where metadata often is scattered among several systems and people. This creates islands of metadata that are sometimes redundant, sometimes siloed and often completely wasted.

Solving the metadata challenge

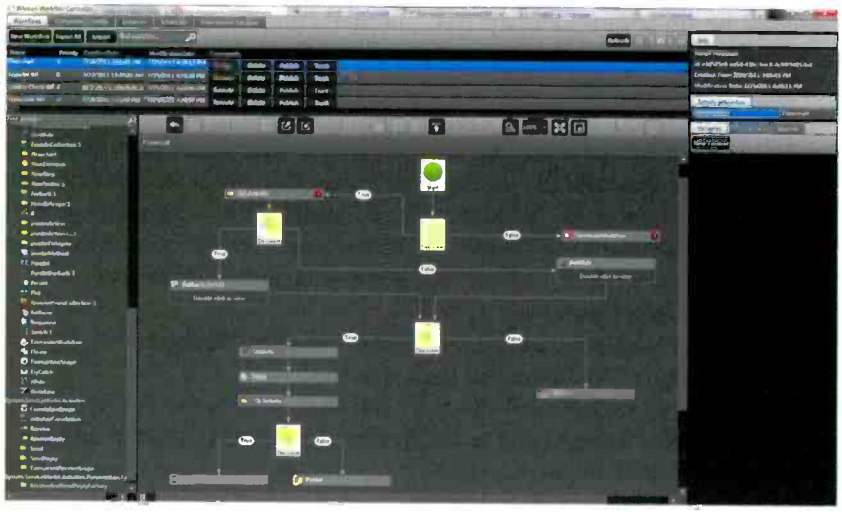
Smart workflows need information, and sharing data is crucial to the process. A smart workflow uses this data to make decisions and route content appropriately. From this point, a rules-based engine can initiate and manage events, actions, resources, tasks and their relationships along many paths.

The first step to establishing this interoperability is to evaluate the content workflow. The ability to gain a detailed understanding of workflow — including production, programming, sales, traffic, ingest and playout components — will help clarify how elements relate to each other within the environment. Build a diagram that captures each step of the process, from the trigger that starts the workflow through to the metadata required to complete the steps — and the manpower commitments along the way, including tasks performed. It is critical to pay close attention to what metadata is originated and how much metadata is captured manually.

Step two is an analysis of the workflow, starting with the metadata. Look for data that is captured multiple times and for data that doesn't seem to fall into the flow.

Communication and usage of scheduling data is often a workflow bottleneck. Schedule data such as format requirements, playout rights, and time and date windows often are communicated in inefficient ways. Schedules requiring multiple versions with different playout formats should automatically trigger workflow steps to create those versions at the right points.

Also consider the need for information that might not show up on the standard workflow while analyzing the metadata. The facility's



A smart workflow should capture metadata on content and make it available to appropriate decision makers when they need it.

standards and practices approver will not have to make a phone call to find out the schedule windows for questionable ad copy if the captured metadata was automatically inserted into the workflow. And the metadata that signals content has arrived and is available for viewing makes life simpler for those who must find and view pieces of content.

Validation of the process is ideal once the metadata flow and capture has been analyzed. This will clarify which steps in the overall process are necessary. Automated tools can find and detect many problems that in the past required manual intervention.

Loudness is one example. A smart workflow can instruct a system to create a new version of the content with the loudness problem corrected.

A second example is a content length issue. Say that a piece of content scheduling to air in the morning is identified as 30 seconds long, but it seems to be two seconds.

Any format to any destination at the lowest cost is a goal for the smart workflow.

An alert message is immediately sent to the operator's mobile phone detailing the problem — a problem that can now be solved by the proper decision maker.

The idea is to find a comfortable balance of automated and manual process steps that do not ignore the savings that come with task automation. This is particularly true when evaluating how you prepare and move material for nonlinear playout.

Consider the idea of and efficiencies found with a "just-in-time" production process. The just-in-time process allows the workflow to use scheduling metadata and destination requirements to construct specialized versions for each platform. In doing so, it may choose to swap infrastructure or cloud components based upon availability and costs to maximize device capabilities across the content chain. Any format to any destination at the lowest cost is a goal for the smart workflow.

The process of analyzing and redefining workflow requirements often identifies inefficiencies that can be resolved through a simple process change. It is surprising how many historical process steps are no longer needed.

Automation is key

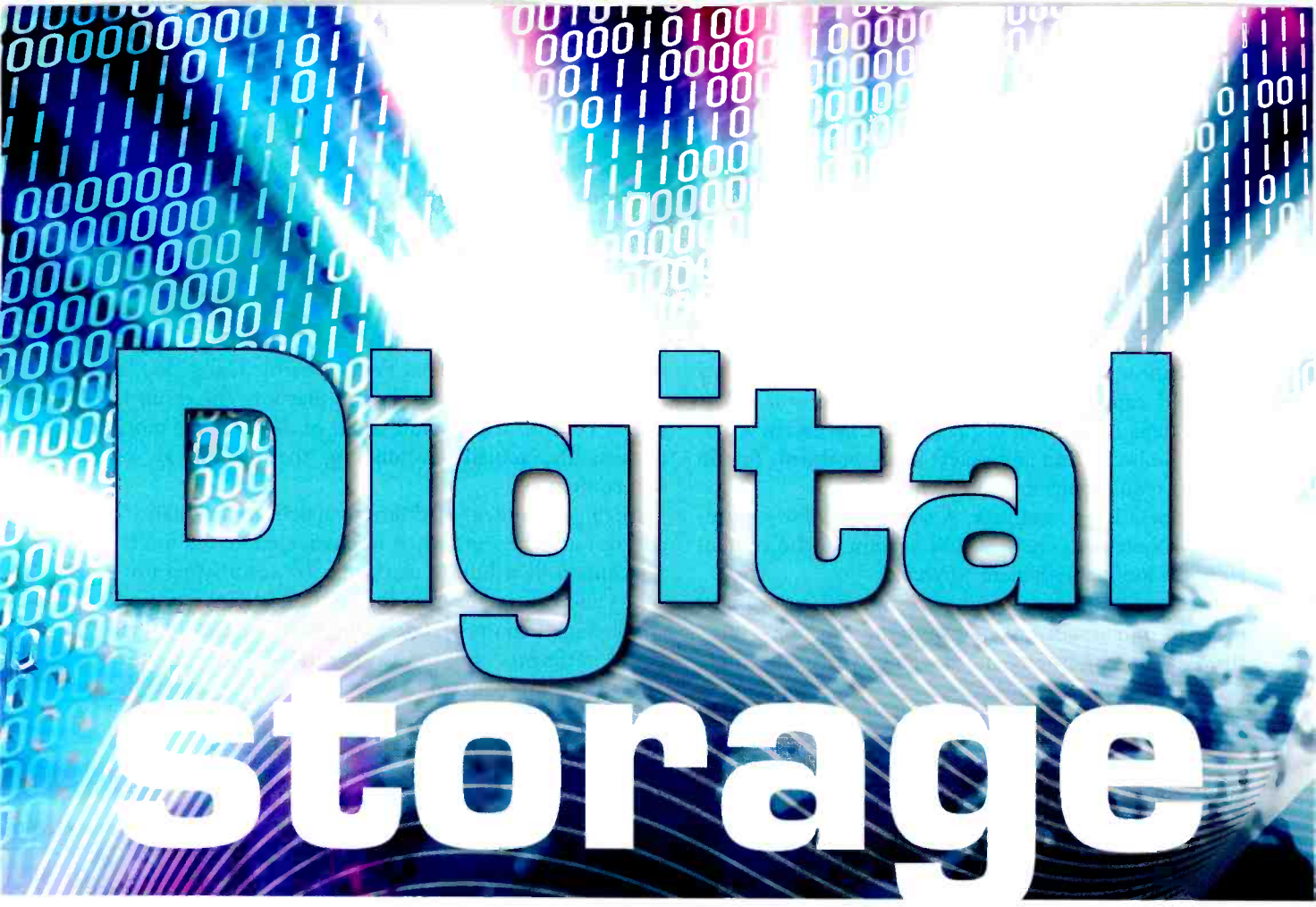
Consider overlaying workflows with automation tools once needs are defined. This may include the management of media, tasks or people resources. Unnecessary processes often can be eliminated, streamlining workflows and freeing up valuable time and resources.

Automated workflows must provide management by exception to be efficient. They must also offer clear visual fields that present necessary data without moving among multiple displays or data screens.

As distribution mechanisms evolve, operators need to easily visualize the processes of file-based workflows and the distribution of the content to the proliferation of platforms, while at the same time being able to monitor content preparation and playout. The result is higher control of the automation of devices, but more importantly, actually automating the production of that content.

Intelligent content workflows can deliver real financial and resource benefits when implemented across multiple content distribution platforms. By automating processes and communicating the appropriate information and metadata to the best decision makers at the optimal points in the process is the way to fulfill the true promise of the workflow concept. BE

Mark Darlow is senior product line manager, Automation and Digital Asset Management, for Harris.



What is the future of content production and delivery?

BY TOM COUGHLIN

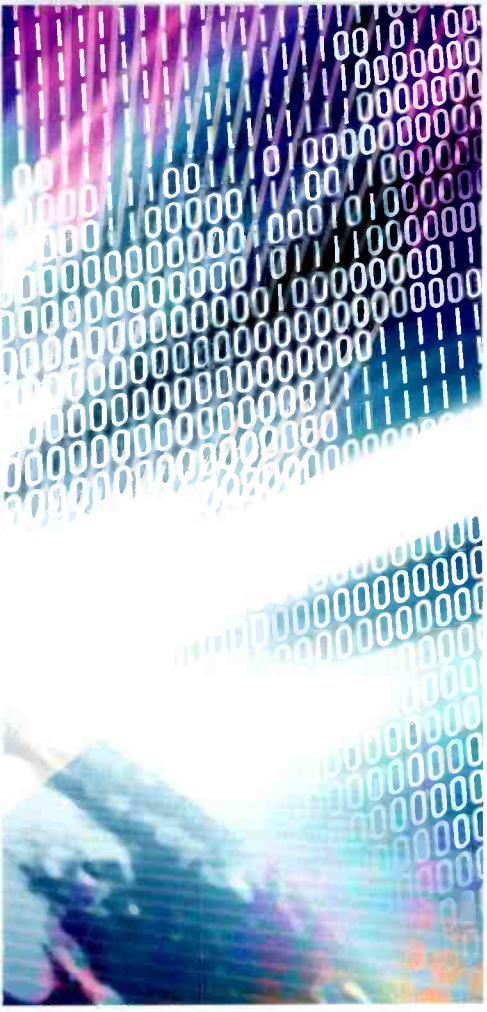
The increase in HD content for traditional broadcast, satellite and cable TV distribution, as well as the proliferation of new distribution channels for content through the Internet and mobile networks, places heavy requirements on playout systems and the digital storage that makes them possible. Pending movements to broadcast-stereoscopic content and increasingly higher-resolution content in the future will demand more bandwidth and storage capacity in order to create higher-quality viewing experiences. This article examines the drivers, requirements and projections for digital storage to support the growing professional video broadcast production and delivery market.

In late 2010, Coughlin Associates conducted a professional media and entertainment storage survey using mostly SMPTE members involved in that arena. The study was a follow-up survey to a similar one performed a year previously. This latest survey provided information guiding the recently released "2011 Digital Storage for Media and Entertainment Report," Coughlin Associates, 2011. Data from this report is used and discussed in this article.

The full picture

As shown in Figure 1, content storage capacity for acquisition for digital TV is experiencing considerable growth due primarily to increased use of high-resolution content and eventually by 3-D TV content. Because of the performance requirements for content capture and remote requirements of field capture direct attached storage (DAS), growth is pronounced with some increase in real time of online network storage for studio and fixed work. Near-line storage is lower performance, and so its use in content capture is relatively small. Note that episodic content will demand even more storage than simple broadcast due to richer content, which tends toward the sort of storage capacity and bandwidth seen in mid-range feature films.

The physical storage media for professional cameras is undergoing rapid evolution as film and magnetic digital tape is affected by the rapid file-access convenience of hard disk drives, optical discs and, increasingly, the ruggedness of flash-based solid state storage. Figure 2 shows the percentage of various recording media used by the survey recipients in professional video cameras. While tape and HDDs are almost the same in 2009 (34 percent and



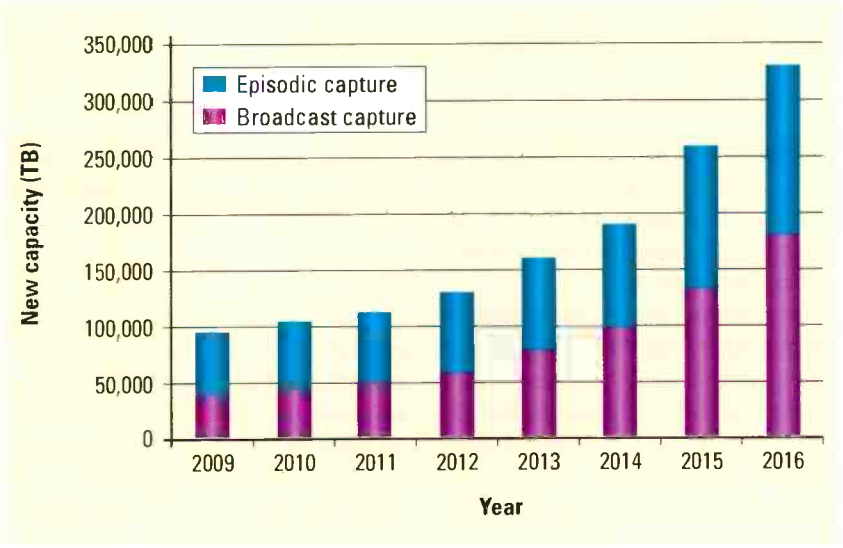


Figure 1. Shown here is the annual storage capacity growth expected for TV content acquisition.

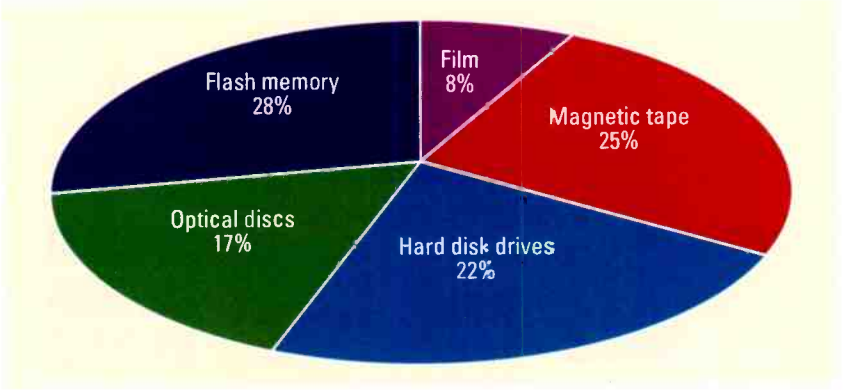


Figure 2. This shows the percentage of various recording media in professional video cameras.

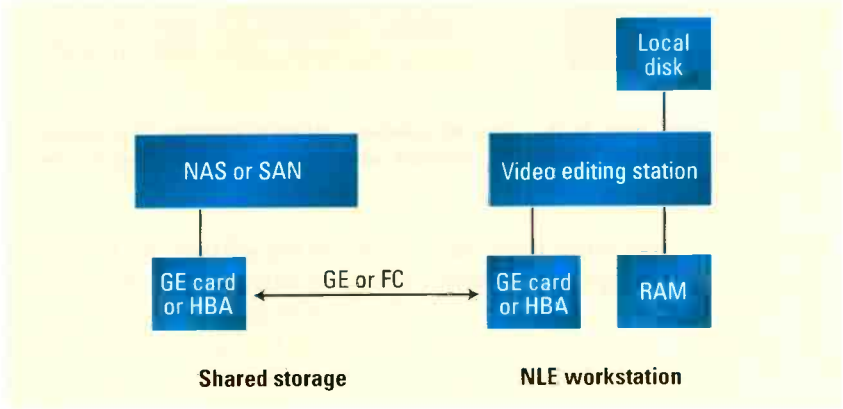


Figure 3. A professional nonlinear editing model is shown here.

23 percent, respectively), film has dropped from 15 percent to 8 percent, while optical discs increased from 9 percent to 17 percent and flash memory increased from 19 percent to 28 percent, respectively.

Higher resolution and stereoscopic content will drive additional storage and bandwidth requirements for TV production workflows. Figure 3 shows a schematic editing station with direct attached as well as network storage.

Asked about use of direct attached and network storage in digital editing and post production, the survey gave the following statistics:

- 83.8 percent had DAS (down from 91 percent in 2009). More than 69 percent of these had more than 1TB of DAS (up to 52 percent in 2009).
- 81.2 percent had NAS or SAN (about same as in 2009). More than 58 percent had more than 16TB of NAS or SAN (up from 44 percent in 2009).

As the size of an editing facility grows, the percentage of network storage increases to facilitate collaborative workflows. Online storage also is finding use in collaborative workflows with both higher-resolution content and lower-resolution proxies.

Feeding the machine

Digital storage capacity for all active-content distribution (cable, satellite, broadcast, mobile and Internet networks) will increase about 4X from 2010 to 2016. Digital storage capacity for the distribution of content over the Internet and mobile networks is expected to increase at a faster rate, about 5X, over the same period. Video-on-demand distribution over cable, Internet and mobile networks often uses a content delivery network architecture, where frequently-accessed

content is sent to cache storage locations closer to customers in order to improve their access of content and prevent overloading the central content server. (See Figure 4.)

In content distribution applications, a large near-line storage library keeps current library content, with a smaller amount of storage capacity, in a higher performance hard disk drive and increasingly solid state-drive storage for serving out content. Edge servers in content delivery networks typically contain between 1/1000 to 1/100 the storage capacity of the central server depending upon the activity in the local geographic area supported by the edge server.

Following are survey observations for video on demand electronic content distribution:

- Average hours on central content delivery systems was about 700 hours (up from 200 hours in 2009) with about 200 hours ingested monthly (this was 150 hours in 2009).
- The majority had more than five percent of content on edge servers. (Five to 20 percent was most common. In 2009, the majority of survey participants had less than 5 percent of content on edge servers.)
- About 16 percent used flash memory on their edge servers. (This was 20 percent in 2009.)

New shape coming

While current SD video broadcast has data rates of about 5Mb/s, 1080 HD content requires about 24Mb/s. 4K and 8K Super Hi-Vision (previously known as Ultra-HD) broadcast content may require 120Mb/s to 260Mb/s when it is introduced late in this decade. Significant bandwidth increases (at least 4.8X) are required to move to 4K resolution for home video display. It is much more likely that this will be available on physical distribution media (likely optical discs) before this level of resolution is available on broadcast, satellite or cable, and especially over the Internet or mobile networks. Two hours of a Super Hi-Vision movie could require more than 266GB of storage. (Compare this to 25GB on single layer Blu-ray disks and 4.7GB on DVDs.)

Providing the sort of data rates required for these high-performance content delivery systems will probably require greater use of flash memory-based high-performance storage, perhaps in front of SAS HDDs. These flash-based SSDs could be SAS, or perhaps even PCIe-based, to provide the sort of bandwidth required. Behind the content delivery storage systems, SATA drive arrays will be used for a content storage library, and magnetic tape may be used for archiving and long-term content retention.

Flash memory and other solid-state storage at the front end of content delivery systems will become more common as content resolution increases. Also, new storage and network interfaces offering higher data transfer rates will become more popular, including the new Thunderbolt direct attached interface, higher speed SAS interfaces (soon to increase to 12Gb/s), 16Gb/s fiber channel, 10Gb/s and higher Ethernet and even InfiniBand for some clustered storage applications.

Similar to increased bandwidth, front-end storage capacity to transmit HD content will grow at a similar rate. Content servers with multiple petabytes of content will be common by the middle of this decade. On the receiver side, DVRs will require several terabytes of storage for a useful number of content hours. Even streaming video content (like that provided by Netflix and Hulu) at these resolutions would require buffer caches 5X to 10X larger than those used today.

The quest to provide customers with ever-more engaging digital content will drive continued investment in capital equipment for the video production and distribution market. This will drive bandwidth and storage demand in production, transmission and consumption. Copious and lower-price distribution bandwidth, as well as more economical digital storage of all types, will bring conversion costs down to a level that encourages universal adoption. BE

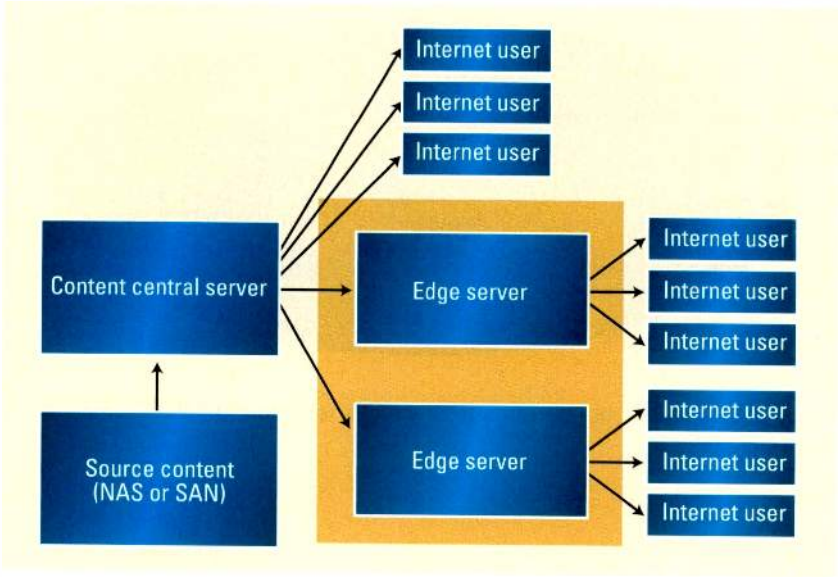


Figure 4. Shown here is an Internet content delivery system. The design is built to improve user access to content and prevent overloading a central content server.

Tom Coughlin is president of Coughlin Associates.

TV-Everywhere software

Content providers can scale up their services' value.

BY MICHAEL MANZO

Crafting successful business models for TV Everywhere (TVE) requires a true operational shift away from traditionally siloed information into true data interoperability with regard to entitlements. This means multichannel video programming distributors (MVPDs) need appropriate information about their subscribers and a subscriber data management (SDM) system to enable new features.

The SDM portion is critical because MVPDs need granular information about viewers' needs. This information enables the provider to develop valuable business analysis about which services to provide. An SDM solution can even be taken a step further by integrating it with other content and business systems to develop the maximum return for every piece of the value chain. This article will look at new ways to provide options to the viewer and potential new revenue to the content provider.

The authentication-and-authorization layer controls access to particular content based on a subscriber's entitlement profile (i.e., the services they have paid for or are permitted to use). This requires the software to recognize who the customer is, regardless of how they access the service. The software then overlays their entitlement (permissions) profile and monitors and tracks viewer behavior for billing and research purposes.

For example, restrictions may be applied to individual pieces of content or bundles of content (such as TV channels or premium films), or according to time-of-day, physical location, device, quality of service or multiple access by the same customer.

An effective premium entitlements and content monetization layer will act as the operator's own sales staff, allowing the subscriber to, for example, go beyond a basic package and purchase premium content on a one-time basis (e.g., an episode or season of HBO's "Boardwalk Empire"). It will also tie individual pieces of content

Email Address	Role	DoB	Parental Controls	Spend Limits
billy@email.com	Restricted	01-01-2001	7 - 13	$25
jill@email.com	Administrator	05-01-1969	None	$0.00
Add User				

Figure 1. Adding authorized users for television-everywhere access needs to be simple and well-defined.

to predetermined viewing periods (e.g., a one-time stream or unlimited views). In this instance, billing, policy and SDM all work seamlessly to provide such flexibility.

This portion of the playout architecture requires more extensive content rights agreements with content providers. Such agreements allow operators to sell subscription content in a TVE environment in exchange for a percentage of the resulting revenue.

Next is the necessary safeguard of parental controls, which provides a subscriber-initiated buffer to certain content based on age appropriateness, time of day, cost or other factors. Although system policy management comes first, user-adjustable charging restrictions also help operators better cater to families. Such granular controls are achieved by using content metadata that feeds into the software and manages viewer access based on these parameters.

Last is fraud protection. This is where identity management is a key element. This function may be embedded in the SDM software or exist as an independent component. MVPDs need to ensure that log-ins from one account are being used only by household members and not by outside parties.

Figure 1 illustrates how user preferences are embedded into one TVE system. The options shown are just examples. A TVE system can be customized based on an operator's preferences and billing structure.

User registration and preferences

In the example shown in Figure 1, John adds his wife, Jill, as another administrator, and his son, Billy, as a viewer. John has set parental controls for Billy to ensure age-appropriate content is available to him. He also sets Billy's monthly spending limit. If John wants further customization of controls over his son's viewing, such as time-of-day restrictions and customized usage reports, they typically can be purchased from the operator. As an administrator, John can set preferences for the entire household.

An effective premium entitlements and content monetization layer will act as the operator's own sales staff.

The content to which a user is entitled can be based on many parameters, including service plan, settings, profile, usage activity, demographics and location. In this example, some of the content to which John is entitled is shown in Figure 2. John has subscribed to only the basic tier, so although some content is free to him, he still has the option to purchase and view premium content on an ad hoc basis. The custom suggestions he sees are rooted in the SDM system, while the policy-management function provisions the content based on subscriber profile parameters. The billing software then handles the invoicing.

When the son, Billy, logs in, the content that he is allowed to view, shown in Figure 3, is quite different because Billy is allowed access only to content rated G or TV-Y. The content-restricting portion of this operation is a combination of operator policy management and parental controls. Charging limits also can be

Figure 2. Basic-tier subscribers have the option to purchase and view additional premium content on an ad hoc basis.

Figure 3. This menu shows the additional-cost viewing that a child might see.

...ch viewer. This ...r shock" scenarios ...ildren inadvertently ...e bills.

...wishes to see a premium not included in his or plan, the operator may purchase options. One 24-hour view window for ...emium content. Another might be access to a single movie. Such options offer high value to all players — viewer, operator and content owner. Operators should be sure these kinds of options are included in any contract rights agreements.

Up-sell, cross-sell

SDM, policy and charging controls can enable operators to offer personalized, dynamic, subscriber-aware promotions to up-sell and cross-sell services. Such an infrastructure makes it easy to link past viewing behavior with recommendations and methods of fulfillment. For example, imagine an operator immediately offering a discounted soundtrack for the film following its conclusion or enacting promotions that provide a subscriber with one free movie for each five viewed.

This modeled experience rivals, if not bests, popular OTT offerings in many ways.

This modeled experience rivals, if not bests, popular OTT offerings in many ways. For operators losing their perceived importance in the value chain, this and similarly built television-everywhere architectures provide an excellent way to showcase value to consumers on an everyday basis by integrating functional, intuitive interfaces and flexible purchasing options.

This type of viewer interface however, must be rooted in network software systems that can service the level of variable behavior and preferences outlined earlier. Even though similar software is in place at many MSOs, a true television-everywhere system that interfaces with each aspect of content viewing and billing represents a true operational advantage over low-cost, low-overhead OTT players. The resulting software integration helps the consumer enjoy a more customized and personalized experience, while operators are better positioned to generate new revenues from the newly afforded options. BE

Michael Manzo is chief marketing officer of Openet.

AJA's Ki Pro Mini

Cocklins Video Services wanted a digital recorder that captures high-quality 10-bit 4:2:2 footage.

BY STEVE COCKLIN

Based in Maryland, Cocklins Video Services is an Emmy Award-winning company that has been in business for more than 30 years. Our work runs the gamut from broadcast documentary video production to corporate training videos to Web video for clients including ABC, CBS, CNN, NBC, PBS, National Geographic, and corporate and government agencies.

We brought AJA's Ki Pro Mini digital recorder in house a few months ago, pairing it with the Sony PMW-F3 camera. We do all of our editing and finishing on Avid Media Composer 5.0.

I first heard about the recorder last year when we put in our order for the F3. The camera natively captures XDCAM 8-bit 4:2:0 35Mb/s but outputs via HD-SDI or HDMI 10-bit 4:2:2. We wanted a recorder capable of recording at 10 bits with the 4:2:2 sample rate because most of our clients want broadcast standard or higher. At the time, the Ki Pro Mini was the only 10-bit recorder available and was within our price range. I had never edited in ProRes before, and after reading Apple's white paper, I was clearly impressed with their approach to the codec. When I got the recorder in for testing, I was blown away. ProRes is a great codec, and the output from the recorder is high quality.

A lot of DPs swear by Sony's XDCAM codec out of the F3, which at first looks just as good as ProRes coming out of the recorder until you start doing color correction. With 10-bit ProRes out of the recorder, you can dig further into the highlights and shadows, easily correct over- and underexposure problems, and the video doesn't break down. Recording 10 bits over 8 bits increases your color value from 256 colors to 1024 colors per RGB channel, giving you a lot more data, or shades of colors, to work with during color correction. You are literally going from millions of colors at 8 bit to more than a billion colors at 10 bit (1024 x 1024 x 1024). The color-corrected material out of the recorder looks fantastic.

The Ki Pro Mini is one of the few recorders that is able to record the S-Log option out of the F3. S-Log is what Sony refers to as its digital negative. S-Log provides 13+ stops of dynamic range. This enables the editor to pull readable images out of the highlights and shadows, and allows for a more balanced grade of the image. Sony's S-Log stretches out the gamma curve, providing more data to work with — especially at the upper portion of the graph where the highlights live. S-Log, until now, was only available on Sony's more expensive F23 and F35 digital cinema cameras. Needless to say, recording S-Log in the past was an expensive option.

Steve Cocklin, right, and his wife, Anne, run Cocklins Video Service. The company pairs the AJA Ki Pro Mini recorder with a Sony PMW-F3 camera using the camera's HD-SDI out. The recorder captures 10-bit 4:2:2 using Apple's ProRes codec.

With 10-bit ProRes out of the recorder, you can dig further into the highlights and shadows, easily correct over- and underexposure problems, and the video doesn't break down.

One of the big benefits of the recorder is that it detects time code from the SDI signal coming out of the camera. When you start the F3, it detects time code and starts to record the video and time code coming out of the HD SDI/SDI ports. Physically, the recorder is small and lightweight, and the case is made out of powder-coated aircraft-grade aluminum — not plastic. The recorder supports all resolutions and frame rates coming out of the F3 via HD-SDI. The range of crossconversion options from HDMI and SDI to HD-SDI make it convenient when working with add-on accessories. I recently purchased a SmallHD DP4 EVF (electronic viewfinder) for the camera. I feed HD-SDI out of the A port of the dual-link BNC connectors on the F3 into the recorder and take HDMI out of the recorder to run the EVF. I can now run my onboard viewfinder via HDMI and run my client monitor via SDI out of the recorder. I could even use the HDMI loop-through out of my EVF to power an additional HDMI monitor.

Our typical workflow is that we shoot with the PMW-F3, capture with the Ki Pro Mini — usually to Apple ProRes at 145Mb/s — and then transcode to Avid DNxHD for editing in Media Composer.

Our typical workflow is that we shoot with the F3, capture with the Ki Pro Mini — usually to ProRes at 145Mb/s — and then transcode to Avid DNxHD for editing in Media Composer. You don't have to convert; you can edit on the timeline in ProRes with Media Composer 5.0, but for my purposes, I do the conversion. That will soon be a thing of the past as AJA announced at IBC2011 that it is adding Avid's DNxHD codec support to the recorder. An upcoming firmware update will enable DNxHD support and a "super out" feature for SDI and HDMI. This superimposed output shows the transport state of the media (recording, playback) as well as the time code value. This new upgradable feature will allow those using the recorder to confirm recording and see time code out of the recorder via their accessory EVFs or client monitors. This was a popular request on the various forums, and AJA support listened.

We built a rig for the camera and recorder, and mounted both the recorder and the batteries with the Ki Pro Mini cheese plate. I shoot with two 64GB and two 32GB Extreme Pro CF cards, which are recommended by AJA. I swap them out as each card reaches capacity. The CF cards are relatively inexpensive compared to P2 cards, and they offload faster.

I'm a big fan of the setup. I always have my computer with me for media management on shoots, and I can just plug the recorder in over an Ethernet cable and easily navigate its menus to delete clips, reset take numbers, personalize with the client's name, etc. It's easier to work on a computer than with the button/menu system on the device, but if I can't get to my computer, navigating with the button menus, once learned, works well when shooting in the field.

The recorder is a piece of gear we work with day to day. We just finished a number of corporate productions with executive interviews for IBM, Mythics, the U.S. Holocaust Museum and the National Audubon Society. We have been working on a pilot episode for a reality series on drag racing, some green-screen work and jib shots of the U.S. Capitol for a WETA documentary. They were all shot using the recorder.

One of the less visible benefits of owning the recorder is AJA's great customer support. Any time I've called with a question, I have either spoken to someone right away, or I quickly received a call back. We are happy with the Ki Pro Mini and the way this whole rig has been working for us. **BE**

Professional videographer Steve Cocklin and his wife/soundperson, Anne, run Cocklins Video Services.

Chyron's BlueNet

Raycom Media has adopted the graphics workflow across its 31 news-producing stations.

BY DAVE FOLSOM

Last year, Raycom Media's review of its broadcast operations focused on ways to leverage the size of the station group's business, along with innovative technologies and equipment, to make its internal preproduction workflow easier and enable its stations to turn out more news. More specifically, the station group's primary goal was to address systems and workflows at its 31 news-producing stations and improve their efficiency, both independently and as a group. The second goal of the review, no less important, was to improve the look of its on-air graphics.

Raycom Media's upgraded graphics systems allow reporters to create on-air graphics for news using a built-in CG screen, without any need for assistance from station staff.

The station group undertook a graphics system upgrade not only to give its big-market stations a sharp, dynamic look and feel, but also to enable sharing of high-end graphics across the enterprise with smaller-market stations lacking the same back-room technical capabilities and staff. It wanted to bring the advanced graphics elements expected in a modern newscast to all its stations, regardless of their size.

Raycom stations in contiguous markets share video content that adds value to newscasts and, in turn, boosts individual stations' in-market performance. Staff members use the BitCentral Oasis media management system to access and then drag and drop content from an ENPS rundown to their own timelines (over a WAN) and take that content to air. Having already established ENPS and BitCentral across the enterprise, Raycom shifted its focus to graphics creation, adopting a Chyron BlueNet workflow built on the CAMIO workflow asset management server, two dual-channel LEX3.1 on-air graphics systems per station, Lyric PRO graphics creation software, an iSQ remote monitoring and playout controller, and a LUCI ActiveX plug-in to its stations' AP ENPS newsroom computer system (NRCS). The result is a cohesive self-service graphics production workflow that also can scale out to a full-service workflow leveraging the team at the enterprise's graphics hub.

Self-service graphics

This workflow was chosen not only because of Chyron's reputation, but also because the systems worked particularly well using the station group's WAN. CAMIO systems installed at stations across the WAN give station staff the ability to share content across the enterprise on a peer-to-peer basis without any real need for outside assistance. The seamless drag-and-drop interface prevents staff from losing track of assets, and mechanically it operates simply, leveraging the stations' existing network and requiring no special modifications to the current workflow. Because the graphics servers are networked enterprisewide, the station group can synchronize and copy templates and assets from one server to another and maintain confidence in the security and availability of its graphics assets.

The two identical LEX3.1 systems installed at each station provide internal redundancy, ensuring no single point of failure exists even though their four channels are software-controlled as if they are in a single box. Each box replaces three discrete systems by enabling playout of lower thirds and electronic stills, while providing a clip player for opens, closes and bumpers — virtually any source of video. That is an important part of process control and slenderizing news preproduction, which goes a long way toward making it easier to take more hours of content to air.

The station group uses Lyric PRO software for creation of its graphical look and templates, and it provides many of the high-impact visual effects features familiar from pro

sports broadcasts. It was a pleasant surprise that the software could import content from other graphic sources, such as Adobe AfterEffects and Photoshop. The station group had created station looks in these other software packages, and having to recreate them was a daunting prospect. As it turned out, station artists were able to import those graphics and then add features using the graphics-creation software included in the new system.

The workflow itself is based on graphics templates also created in Lyric PRO. These templates allow text, images or video elements to be replaced within the NRCS application that the content creation staff uses. The LUCI interface with ENPS facilitates this element of the workflow and has proven to be the most important element of the graphics system. It has changed how and where graphics are created and linked to news stories. If photographers or reporters get into the script and want a lower third to introduce a segment, they have access to the equivalent of a basic CG screen. This screen allows them to select the appropriate template by number and type in the text. The lower third is saved and attached to the script, and no one else has to touch it.

For more complex graphics, LUCI also enables staff to search for the appropriate asset (such as a movie or image) on local servers and then fulfill the template, save the finished graphic and drag it into the NRCS script, which triggers distribution of the graphic to the playout device. In either case, the staff can look after these basic graphics themselves: There is no need for a request. It is a capability that saves time and makes life a lot easier. Given the burden of preproduction these days, with some stations doing 40 hours or more of news a week, do-it-yourself functionality is extremely valuable. The ideal always has been to keep graphics and media attached to the script, and this new workflow is allowing Raycom to realize that goal.

Systems training

Two levels of training were necessary to get the graphics system up and running. In addition to training station artists on Lyric PRO, which was critical to getting the look right, station group managers took a day at each station to focus on the operation and management of the new graphics systems. Training of day-to-day users was a simpler process than one might think, as the iSQ software provides single-GUI, PC-based control of independent output channels of MOS-generated playlists.

Through installation and maintenance, the station group relied on the standard documentation that was provided upon purchase. However, to address the size and scope of this particular rollout, it created a document that outlined for trainers, installers and stations exactly how the graphics systems should be set up — naming conventions, IT connectivity, etc. — at their locations. That living document has really taken project planning to a new level. It has enabled stations to get installations down to a matter of hours and use the rest of their allotted time to take advantage of the trainers' expertise. Today, the graphics hardware and software systems are working as advertised. Most hiccups are related not to the equipment, but rather to the stations' own internal processes.

Raycom expects to be pushing the new workflow hard by election time, which is always a great time to show what your graphics systems can do — and to take new creative elements forward into future broadcasts. BE

Dave Folsom is vice president and CTO at Raycom Media.

Wohler's Pandora

The loudness analyzer addresses the demands of global loudness standards.

BY MARTIN WINSEMIUS

TV loudness is an issue that has been simmering with the viewing public for a while. But, it's taken on new urgency with the passage of the Commercial Advertisement Loudness Mitigation (CALM) Act in the United States and other similar regulation in various stages of enactment throughout the world. In the past few months, loudness monitoring and control has moved much higher on broadcasters' to-do lists, and many are identifying requirements and evaluating systems designed to address the issue. The net effect is that producers and broadcasters need to replace VU with LU (relative Loudness Units, ITU-LKFS or EBU-LUFS absolute units) for average program level measurement, and replace PPM with TP (True Peak) for peak headroom insurance.

A solution is Pandora — a compact, affordable and easy-to-read loudness analyzer that can be employed at any point in the broadcast chain requiring simple, accurate loudness monitoring. The loudness analyzer provides a clear, accurate reading of loudness measurements for any SDI video signal with audio, to help broadcasters and producers alike ensure that content meets EBU R128, ITU BS.1770, and ITU BS.1771 standards.

Striking a balance

Broadcasters are concerned about monitoring the final output and being able to log and report on the data in order to demonstrate compliance, or defend against loudness complaints. Producers, on the other hand, need loudness monitoring tools that can integrate with their existing editing, mixing and mastering processes in order to deliver a compliant program to the broadcasters. While most monitoring and control solutions are targeted to either one side or the other, Pandora offers tools that address requirements for both groups. For instance, the system can be set to continuous mode, which enables broadcasters to monitor output, and manual start-stop mode for production and post-production editing. In addition, the unit's form factor can be adapted for either environment — as a desktop mount for production live mixing and post-production editing, or as a rack-mount solution for broadcast compliance monitoring.

Figure 1. Pandora's layout shows both absolute loudness (left pane) and integrated loudness relative to level setting (right pane).

Easy configuration and use

Many broadcasters, as well as production and post houses, are entering new territory as they attempt to adopt loudness monitoring. That being the case, they need tools that will reduce the complexity of complying with multiple standards. The loudness analyzer boils standards-based monitoring down to selecting between ITU vs. EBU reference/limit sets, without requiring operators to have much knowledge about the inner workings of the standards. Operators can set their own reference parameters, including over/under limits, as well as integration time and metering modes. A unique feature of the unit is its integration with the Apple iPod touch which provides a vivid display and an easy-to-use touch-screen interface. (A separate iPod touch purchase is required.) Since the Pandora software is available free from the iTunes App Store, operators can always access the most current version required to maintain compliance with evolving industry standards and practice.

Measurements at a glance

Accepting and analyzing AES or PCM de-embedded from SDI as stereo, 5.1 or multichannel audio, the analyzer gives the user an accurate reading of loudness, and true peak measurements for up to eight

channels, over a user-defined period of time ranging from five seconds to 60 minutes. A large, numerical display shows LKFS/LUFS/LU readings, and a warning light indicates when adjusted on the fly by referencing the real-time multichannel display plus the program LU meter looking backwards over the appropriate integration time period.

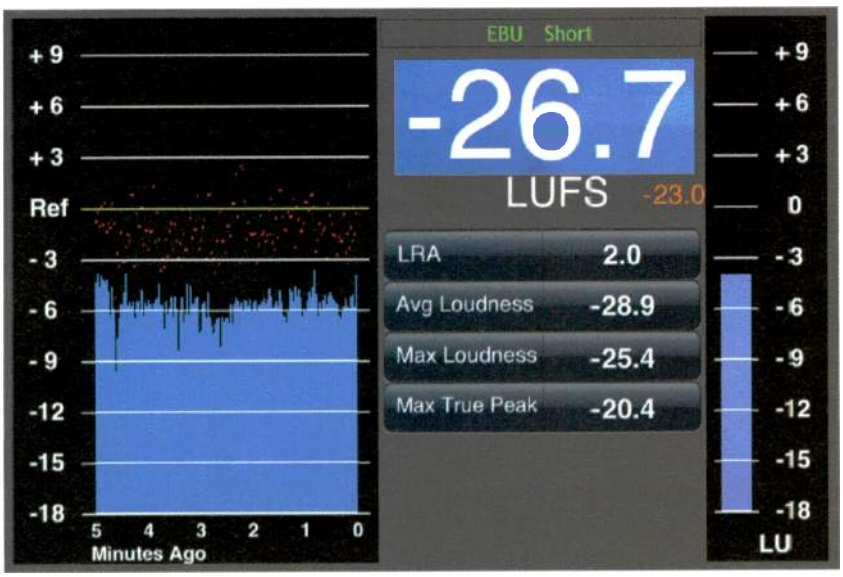


Figure 2. This shows a program's loudness level in graphical form.

this value exceeds acceptable thresholds. The unit's multichannel level meter display in the left pane shows absolute loudness values as multicolored bars, with red true peak floating segments in real time. The right pane always shows integrated loudness for the entire program set relative to the reference level setting. (See Figure 1.) Live production audio mixing can be

Additionally, the loudness analyzer allows users to set a range of loudness parameters, including reference level and integration time, as well as configure the system for 2.0 (stereo), 5.1 or 7.1, (surround) or free-form 8 x 1 (AES or SDI) operation. A single-menu matrix sets up meter arrangements and channel assignments with loudness contributions.

Figure 3. Pandora can perform years of compliance logging and does not need to be hard-wired to do so.

Much of a program's peak, loudness and dynamic range profile can be intuitively derived from a loudness histogram. A finger swipe to the side shifts to the unit's histogram view to give a graphical representation of program loudness at any given point over the preceding time period set, with the red line showing true peak levels. (See left pane in Figure 2.)

Broadcasters will like the ability to view the histogram over the 24-hour maximum period, while producers can set views to program length from seconds to hours as needed.

Comprehensive logging

Although the CALM Act is now law, the FCC has yet to define its complaint pursuit criteria, which means broadcasters must take an "overkill" approach to logging in order to cover all potential scenarios. Via the iPod touch's 8GB or more of data storage, users can perform compliance logging over years of time. (See Figure 3.) This deep log memory enables standalone use where a network connection is not available, and preserves original data in case a downloaded file is lost or suspect. The system provides the ability to email log data over a wireless connection, eliminating the need for the system to be hard-wired to a receiving computer and network.

Conclusion

With loudness standards continuing to evolve, so will the sophistication of tools for monitoring and logging loudness levels in both production and broadcasting environments. Pandora offers an attractive and conveniently sized system for addressing the demands of global loudness standards, giving operators the precise information they need to confirm loudness levels and maintain new standards compliance. BE

Martin Winsemius is sustaining engineering manager for Wohler Technologies.

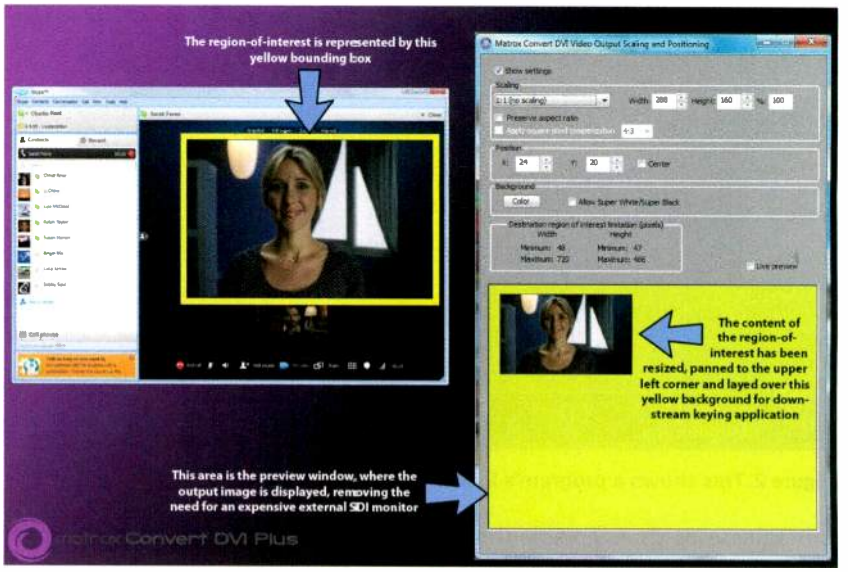
Matrox's Convert DVI Plus

The scan converter easily airs computer-based content.

BY CHARLES P. AMYOT

Computer-based content is now an integral part of daily life. YouTube, Skype, Google Earth, and countless other websites and Web services contain relevant, up-to-the minute, often exclusive video clips, photos and other images. Broadcasters would like to enrich their programming with such material but are unsure how. The brute force method would be to shoot the computer screen directly with a camera, but this technique compromises image quality. An alternative would be to use a typical HD-SDI scan converter with genlock, but this approach can cost thousands of dollars, and often requires a separate audio embedder.

At a fraction of the usual cost, Matrox offers an innovative new scan converter, Matrox Convert DVI Plus. It takes in the DVI-D output of a computer's video card, or any progressive digital video signal, up to 1920 x 1200 pixels, and converts it simultaneously to digital SDI and analog component, composite or S-video outputs, with the computer's audio embedded directly into the SDI stream. Stereo RCA outputs enable use of analog audio with the analog video formats. The unit can be genlocked internally, thanks to a time-based corrector, or externally to an SD analog black burst bi-level or HD tri-level genlock source.



One of DVI Plus' most advanced features is the ability to control region-of-interest. This can make using YouTube or Skype content much easier as extraneous information can be omitted quickly using presets.

Region-of-interest support

Region-of-interest support is among the most advanced features of the scan converter. This feature allows the user to select just a portion of the on-screen content for output. By simply dragging the mouse, rather than fiddling with buttons on the unit itself, the user can draw the region of interest directly onto the content. The broadcast thus can include a YouTube video or a Skype conversation without showing the entire webpage or user interface, and the unit's integrated hardware scaler can resize the selected area of content to fit the entire screen. Keyboard shortcuts for the region of interest, presets for the output resolution and genlock settings can be saved for future use, saving users time in taking this content to air.

The DVI Plus is eassy to operate via a live preview window in its GUI, which can replace an expensive external monitor.

Easy interface

The Convert DVI Plus is uniquely easy to operate via a live preview window in its GUI, which can replace an expensive external SDI preview monitor. Because the operator sees exactly what is being broadcast on all outputs, the content can be easily scaled and positioned to appear exactly where it is desired in the broadcast. A colored background can be used in conjunction with the scaled video for downstream keying applications such as providing over-the-shoulder shots for news programs and lower-third graphics or score tickers for sports broadcasts.

Focus on quality

The scan converter offers a variety

of built-in features that aid the user in getting the best output possible for any computer-based content. Full proc amp controls allow for calibration of color and brightness levels on all outputs, and the system automatically applies proper color space conversion from RGB to YUV. In addition to providing anamorphic, letterbox, pillarbox and centercut presets, the system offers aspect ratio conversion to compensate for the fact that computer pixels are square whereas SD broadcast pixels are rectangular. An anti-flicker filter reduces artifacts that result from converting progressive images to interlaced video, resulting in a more stable output. To handle content transitions seamlessly, the operator can use the system's freeze feature to freeze the output, make changes to the content and then unfreeze the output. The control panel can be locked and password protected by an administrator to prevent accidental modifications or tampering.

In stand-alone mode, any DVI device, such as a medical or industrial camera, can be used as the input.

Maximum versatility

Operators control and configure the scan converter using a PC-based user interface via USB connection on systems running Windows XP, Windows Vista and Windows 7. Mac drivers are also available for Mac OSX Snow Leopard and Lion. Once configured, the unit can be programmed to behave as a stand-alone appliance. The system maintains configuration information even when turned off and the control computer is disconnected. In stand-alone mode, any DVI device, such as a medical or industrial camera, or another computer, can be used as the input. A rack-mount kit allows users to secure up to two units in 1RU.

Controlling equipment costs and minimizing the need for expensive staff training, while providing high-quality programming, is the job of every broadcast engineer. Matrox scan converters are being used in broadcast operations across the globe to assist in achieving that goal. **BE**

Charles P. Amyot is product manager for Matrox Video Products Group.

Satellite services and systems, part 2

Improved technology has sharpened reception quality.

BY JOHN LUFF

Last month's column began with a short reference to the first transatlantic satellite transmission over Telstar (1965). Of course, the more interesting end of the transmission loop is the reception, without which there is not much value to the effort. It is easy to forget sometimes how low the power level of early international satellites was.

While touring the Teleglobe Canada facility near Montreal a number of years ago, I was confronted with the primitive nature of technology at the dawn of satellite transmission. The facility's first antenna for transatlantic work was 108ft in diameter, with a beam so small the antenna was hunting constantly to keep the beacon from the satellite in the center of the pattern. Three huge C-band amplifiers were connected to an immense antenna, two of which were needed to saturate the transponder despite the enormous gain of an antenna 108ft in diameter. The LNA was bigger than a shoebox.

By the 1990s, orders of magnitude less power were enough. A single small solid-state amplifier was all that was necessary to saturate a modern transponder.

Much of the credit for this goes to the improvements in spacecraft, including their enormous size difference. Telstar could have been put on top of a file cabinet, but modern synchronous satellites have solar arrays as large as a 737, more than 110ft. This size difference produces immensely more power, which permits much higher transmit power (in the range of 25kW), especially when combined with larger antennas on modern spacecraft.

In addition to the improvements in technology in spacecraft, transmission systems have been revolutionized in the digital era. Early deployments used analog modulation, requiring high power to achieve noise-free reception. But, beginning in the early 1990s, deployment of digital compression changed everything. The first European Telecommunications Standards Institute (ETSI) codecs were deployed on both sides of the Atlantic and allowed transmission of SD pictures at 34Mb/s, with improvements allowing rates as low as 8Mb/s for some news coverage.

Compression and modulation work hand in hand to deliver improved performance and more affordable business platforms.

Transmissions normally were sent over links using quadrature phase shift keying (QPSK), allowing 2 bits to be transmitted per symbol. Noise immunity was good, but as satellites and ground systems became more phase stable and lower in noise, modulation of more bits per symbol became both possible and highly desirable for economic reasons.

Increasing satellite capacity

Satellite capacity is sold on the basis of two factors: the power required by the spacecraft and the bandwidth occupied. To increase the data throughput one can increase the bandwidth, but that increases price, so high-order digital modulation standards have evolved to allow more bits to be transmitted in the same RF bandwidth.

But there is a tradeoff that is actually quite insidious. More bits transmitted per hertz will be more susceptible to noise, requiring more power, which of course costs more. The equation is established in part because each transponder can handle only a fixed amount of power. Two carriers in one transponder means less power available to each, and nonlinearly loading a transponder may not allow for easy math in calculating the effective cost of the space segment.

Thus, the trick is to design an end-to-end system that can use less bandwidth and at the same time survive in noisy environments. That is exactly where the innovation is coming, along with improvements in compression for sound and picture that will permit fewer bits to represent the content without compromising the quality.

High-order modulation

Holistically, compression and modulation work hand in hand to deliver improved performance and more affordable business platforms. The current standard most often used for backhaul internationally (and domestically) is DVB-S2, promulgated by the DVB consortium in Europe. DVB-S2 offers modulation at higher orders, including 8PSK and 16/32APSK. The former uses eight phases of the carrier to represent the data, allowing double the information density provided by QPSK. Similarly, 16APSK and 32APSK offer up to 16 bits per hertz.

As noted earlier, higher-order modulation is more susceptible to noise, including black-body thermal noise

and that created by other sources of interference. One method of reducing the impact is to use more resilient forward error correction. But as before, contributing more of the payload to error correction steals from the delivered content. There is simply no free lunch. Thus, "tuning" modern systems is sensitive to many factors, all of which must be considered in harmony to achieve good link performance.

For instance, if a service uses a fixed modulation standard and content bit rate, a larger antenna and more capable LNA/receiver decoder (IRD) may be needed to achieve adequate margin for fade during weather events. If the operator has the luxury of planning the full link, it needs to take into account the capability of all of the hardware and that of the spacecraft. What works on one transponder may not work as well on another in the same spacecraft.

There is a temptation to break this Gordian knot simply by pushing out more power or putting up a larger transmit antenna to achieve adequate results. Before resorting to that approach, it is recommended that broadcasters see the earlier paragraphs related to the cost of the space segment. More power may well cost them more money.

Modern IRDs for broadcast use must adapt a huge range of standards. First, the modulation standard (actually multiple variants with different error-correction schema) must be supported. Second, each service may use MPEG-2 or MPEG-4 (AVC or H.264). Audio may be PCM, MPEG compressed, AC3 or Dolby E. And of course, the video may be SD or HD, though the time is approaching when delivery of SD content will dwindle to insignificant values, especially with advances in compression technology. Outputs may include upconversion and downconversion capability as needed du jour.

One final comment on the subject must be made. Digital Satellite Newsgathering (DSNG) adds additional complexity, particularly with flyaway antennas for use in remote locations. Communications channels and data connections often must be accommodated. Careful band planning is required, and specific knowledge of the communications plans of networks and location providers is critical if a remote transmission is to be free from hair pulling and wailing at the moon. **BE**

John Luff is a television technology consultant.

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

TASCAM DR-100mkII

24-bit/96kHz linear PCM recorder includes four built-in microphones — two cardioids and two omnidirectional; a pair of XLR microphone inputs with phantom power enables the use of prograde condenser microphones, and line in and out connectors are also provided; features include balanced line inputs, S/PDIF digital inputs and locking connectors; ideal for high-end portable recording, DSLR filmmaking and post-production effects gathering.

www.tascam.com

RTW TM3 TouchMonitor

Audio monitor includes the features of the larger TM7 and TM9 versions, but with a lower cost for the basic stereo version and a 4.3in touchscreen; features PPM and true peak measurements; offers loudness metering in compliance with all globally relevant standards, include EBU R128, ITU BS.1770-2/1771, ATSC A/85 and ARIB; instruments include single-channel and summing bar graphs, an LRA instrument and numerical displays.

www.rtw.de

NewTek 3Play 425

Four-input, two-output slow-motion system supports the simultaneous display, recording and instant replay of all channels; designed to give users an affordable option to deliver instant replay and slow motion for broadcast, webcast, arena scoreboard displays and more, without sacrificing quality; existing customers of the NewTek TriCaster can incorporate 3Play 425 into their programming over Ethernet, freeing up the live video inputs for cameras.

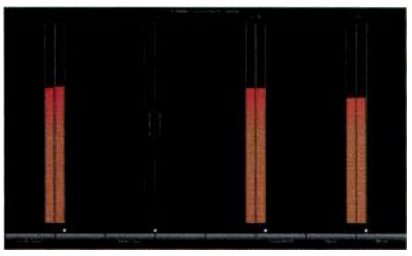
www.newtek.com

Avid Interplay Media Asset Manager (MAM) 4

New version of enterprise media management system features an intuitive user interface to facilitate workflow collaboration; easily scalable; lets users network their operations, control movement of media between Interplay MAM and storage systems, configure metadata, and leverage an SOA-type structure to easily integrate in-house and third-party applications; new features include Interplay Common Playback Service, a Web-based media player that lets users view, annotate, add metadata, log and create shot lists with any cataloged media from any location.

www.avid.com

OmniTek OTM/OTR software upgrade



Version 2.3 of the software for the OTM and OTR waveform analysis and test signal generation systems introduces GEN_2, a software option that adds a second test signal generator; this gives the capacity to output two images or sequences at the same time — one to SDI OUT 1 and the other to SDI OUT 2; additional features include a Loudness Range display and True Peak versions of PPM displays.

www.omnitek.tv

SeaChange International MediaServer 1200XD

Video server is equipped with flash SSD drives; latest addition to the company's MSV1200 range of video servers; features up to 26 percent lower power consumption and up to 30 times lower failure rate in a stand-alone unit; offers flexibility in resolution and video formats, making it ideal for channel expansion and adding HD capabilities; at 3RU, the server holds up to 4.8TB of media data with RAID 6 dual-parity data protection.

www.schange.com

Panasonic AW-HE120

Pan/tilt/zoom camera delivers full HD video capture in an integrated PTZ system; features a fast 20X zoom lens and three 2.2-megapixel ULT MOS imagers supporting HD imaging; produces high-quality video in a wide range of shooting conditions; equipped with the same sensors and DSP used in Panasonic broadcast camcorders like the AG-HPX370; offers a signal-to-noise ratio approaching 60dB, 1000 TV lines of resolution, and advanced features such as 16-axis color correction and Panasonic's Dynamic Range Stretch; both HD/SD-SDI and HDMI outputs are standard.

www.panasonic.com/broadcast

Crystal Vision SYNNER-E 3G

Combines a video synchronizer, tracking audio delay, embedder, de-embedder, audio processor and video proc-amp — all on one 4in x 10.5in board; features four-group audio handling, advanced processing of Dolby E, integrated fiber connectivity and flexible delay compensation; simplifies systems design for those working with 3Gb/s, HD or SD sources in AES and Dolby E environments; can be used as a video synchronizer or as a delay line.

www.crystalvision.tv

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Assistant Chief Engineer - KSTP-TV

Senior engineering position available at Hubbard Broadcasting flagship station in St. Paul, MN. Must have demonstrated success as a TV engineering supervisor with recent experience in digital, analog, RF, and IP/network-based systems. Must have a valid drivers license and clean driving record. Apply with cover letter and **resume: apply@hbi.com** EOE

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Emergency Alert System?

The failed test showed the system is far from its goal.

BY ANTHONY R. GARGANO

One wonders if there is anything at all in Washington that isn't broken. Dysfunctional government has dropped the American public's approval rating of Congress to the historical low point of just 9 percent. With the massive failure of the recent nationwide Emergency Alert Systen (EAS) test, it would appear that FEMA, which demonstrated an epic level of dysfunction during and after Hurricane Katrina, is leaving no stone unturned on its relentless path toward displacing Congress as the least-admired body of government.

The test showed colossal gaps of functionality and architecture of a system found to be woefully lacking in capability. If not for the seriousness of purpose, test results would be comical. Take the cable system that missed the test time completely. When it finally activated the alert, viewers were taken to a home shopping network before the alert finally showed. (It was something, perhaps, to entice last-minute, doomsday shoppers?) Satellite did equally as well, as some DIRECTV viewers listened to the Lady Gaga song "Paparazzi" instead of emergency information.

From the beginning, broadcasters have always played the pre-eminent role in various implementations of a system designed to reach the public during a time of national emergency. But, it has been many years since the first CONELRAD (CONtrol of ELectronic RADiation) system was introduced in 1951 under President Harry Truman, and communications technology has moved light-years forward in capability since that time.

With television in its infancy, the prime focus was on radio as the system's backbone. Under CONELRAD, all television and FM broadcasts were to be shut down. AM radio broadcasters would also cease normal broadcasting, but designated primary stations would switch operating to 640KHz or 1240KHz, the designated Civil Defense CONELRAD frequencies.

During an alert, transmissions on the CD frequencies were intermittent, and broadcasts rotated through a series of different stations. The theory behind the original system was that by constantly shifting transmitter sites, Soviet bombers' radio direction-finding equipment would be thwarted from homing in on American cities. This sounds a bit incredulous today, but this was just a decade after Japanese bombers used a Honolulu radio station to home in its attack at Oahu.

If the system wants to reach the most people in time of emergency, it should use the wireless network.

In 1963, CONELRAD was replaced by the Emergency Broadcast System (EBS). With progress in both technology and strategic thinking, EBS embraced television broadcasting as well as radio. Stations transmitted on their assigned frequencies instead of 640 and 1240, and TV stations carried the same audio as radio broadcasters. Never used for a national emergency, the system was used many times at the local level, particularly for severe weather alerts.

At the start of 1997, the EBS was supplanted by the EAS. The system's stated goal since has been to allow the President to speak to the populace within 10 minutes after activation. As the most recent test exposed, there is a long way to go to reach that objective. But, as technology has continued to quickly evolve, EAS now must rely not only on broadcasters but cable, fiber distribution, satellite TV and satellite radio companies — all of which, collectively, must get it right for an effective, integrated system.

Broadcasters can only control their own transmissions. Once they are picked up by a cable, fiber or satellite provider for distribution, all bets are off. Now, the responsibility lies with the provider, and the broadcaster is out of that loop. This reliance, as the recent EAS test illustrated, is poorly placed. Ironically, FEMA leans heavily on the broadcast leg of the EAS tent. Meanwhile, simultaneously, it joins with wireless companies and others looking to usurp broadcasters' spectrum.

It is time to let broadcasters off the hook for participation in a system that would have made Rube Goldberg proud. The current United States population is 300 million. The CTIA, the international association of the wireless industry, reports 285 million Americans now have cell phone accounts. The number of active cell phones owned outnumbers the total population. When EAS was adopted in 1997, cell phone penetration stood at 14 percent. Today, it is virtually 100 percent. The bottom line: If the system wants to immediately reach the most people in a time of emergency, it should use the wireless network. With a cell phone in virtually every American's hands, FEMA needs to rethink how to carry out its EAS mandate and leave Lady Gaga to iTunes. BE

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

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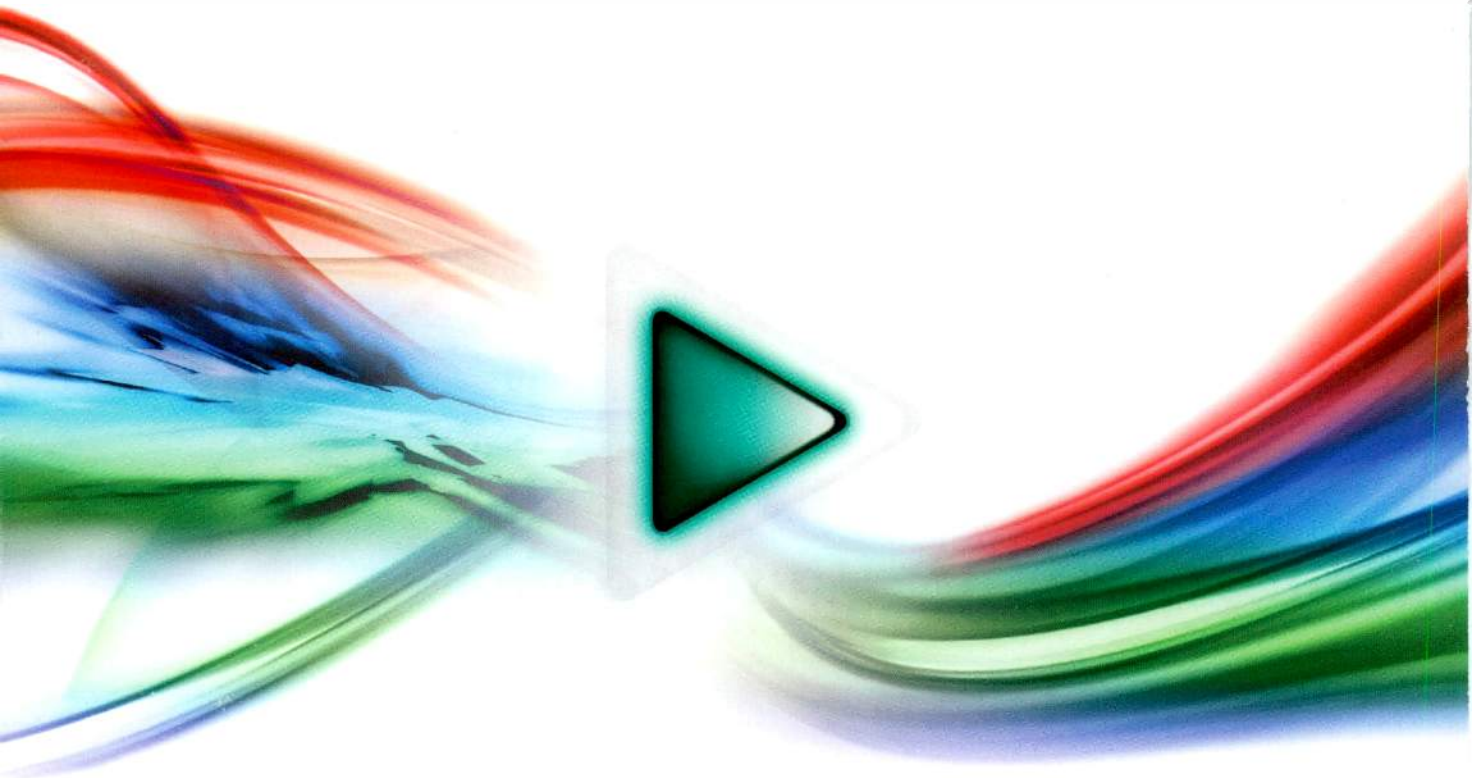

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