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TABLE OF CONTENTS

VOLUME 55 | NUMBER 1 | JANUARY 2013

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FEATURES

continued on page 6

JUST THE FACTS!

On Jan. 1, the Senate confirmed the nomination of Mignon Clyburn to a second term as FCC Commissioner. Clyburn was first sworn in Aug. 3, 2009, by Sr. District Judge Matthew Perry, Jr., of the South Carolina District Court.

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ON THE COVER:

In 2012, broadcasters stood poised on the brink of sweeping change, driven by changes in viewers' and advertisers' expectations and viewing habits.

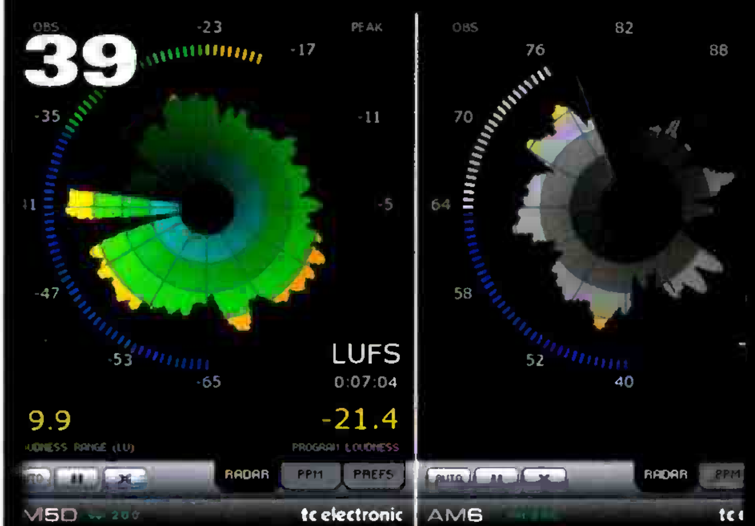

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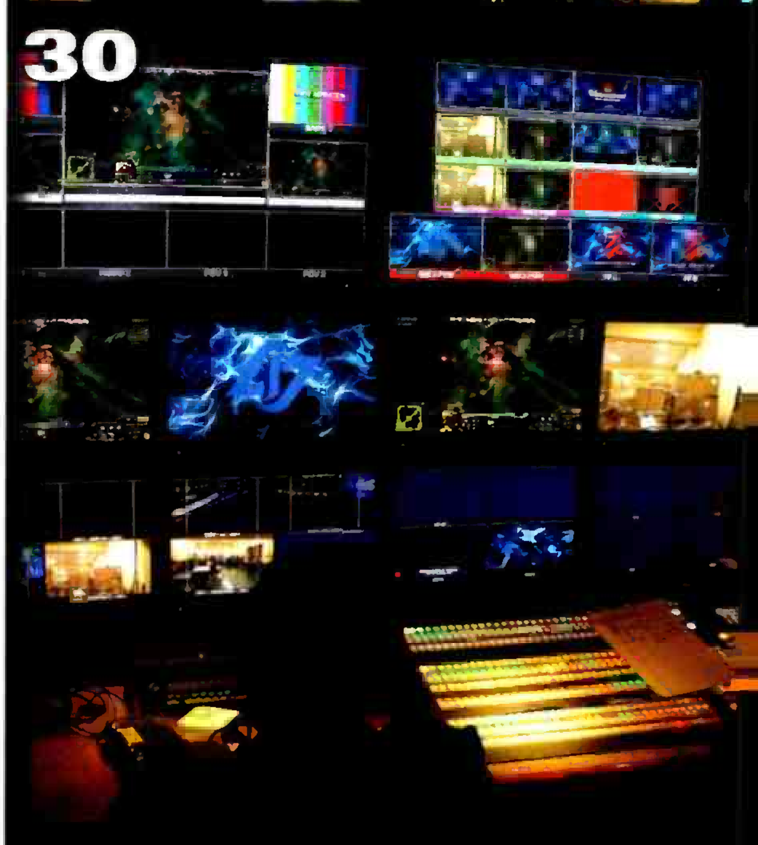
TABLE OF CONTENTS (CONTINUED)

VOLUME 55 | NUMBER 1 | JANUARY 2013



Good enough

Speaking before the annual International Association of Broadcast Manufacturers conference, Grass Valley president and CEO Alain Andreoli examined the dilemma between the IT and broadcast communities. Andreoli said that because of their powerful positions, broadcast technologists have supported an infinity of proprietary standards, resulting in a matching number of "small" specialist vendors. The result, according to Andreoli, is that broadcast technologists often purchase best-of-breed products from small specialist vendors.

One result is a "hunter-gathers" versus "farmers" dichotomy, where the broadcast industry resembles the wild but needs to "change into a farm." While the wild option provides a variety of choices and solutions, the farm approach results in a seamless and efficient contents management factory.

Perhaps not surprising, given his background, Andreoli advocates a smaller group of vendors with interoperating solutions, much like that seen in the IT industry.

"Our space needs a few specialized but scaled 'IBM-like' leaders," Andreoli said, "who can unify the contents lifecycle management and reduce costs."

He is not alone in this viewpoint. Peter Angell, COO of media company IEC in Sports, expressed the view that "our business needs to embrace 'good enough'; take YouTube as an example."

For comparison, Angell cited the World Cup production budget of $200 million and a tennis match, which might have a $5000 budget, "… but we use the same equipment," he said. "Sport is using more equipment and more people, but content is not always high-value like World Cup. The content is the issue, not what it has been shot on."

Angell also referred to today's young viewers, saying, "the generation in five years' time will not be interested in broadcast."

Having been to my share of company press conferences and private meetings, I can confirm that Andreoli's and Angell's viewpoints are not unique among the heads of such companies. In fact, many CEOs would probably love to see everything (d)evolve into software.

Even so, there is evidence that broadcasters are increasingly moving from the gold standard of "broadcast quality" to Angell's "good enough" perspective. Simultaneously, successful companies are moving equipment decisions from being CAPEX-centric to an OPEX focus. Why buy when you can rent? Such changes may neither be good nor bad; they are just today's reality.

Simultaneously, these pressures mean human engineering skills must change. Being able to use a vectorscope may be useful, but that skill may not get you as far as being able to maintain an IP router. Knowing how to "chart" a camera may be less valuable to a company than being able to properly configure a Wi-Fi connection.

I grew up in an era where engineers proudly spoke of their "broadcast quality" standard. But, does that even apply when much of today's consumer equipment can exceed the OTA performance of the local TV station? How can a chief engineer justify a $50,000 broadcast-quality ENG camera and lens, when 50 percent of news shots are done at night, in the dark, in front of city hall — and the news director wants to equip five crews? Will the viewer "see" any difference in the talking head with a less expensive solution?

Yes, there will always be events where we'll want slo-mo and super low-light 4K performance. But, other programs may suffice with a $2500 Wi-Fi-enabled camera originating from the local coffee shop.

Will some viewers be able to tell the difference? Perhaps. Will it really matter? Maybe not.

Tell me what you think. BE

Brad Dick

EDITORIAL DIRECTOR

Send comments to: editor@broadcastengineering.com

Log and RAW workflows

Advanced cameras require more complex post-production workflows.

BY STEVE MULLEN

A new trend in camcorders is their ability to record data from several on-board codecs. For example, take AVC-Intra and AVC-Ultra. The announced Cinema Camera from Blackmagic (BMCC) carries this trend further by supporting two compressed codecs — ProRes 422HQ and DNxHD — plus uncompressed RAW. ProRes, in turn, can be had with either of two gamma curves applied: REC709 (the standard gamma for HD recordings) and logarithmic ("FILM" mode). Figure 1 shows the BMCC's recording options.

	DeBayered		Non-deBayered (RAW)
	REC709 Gamma	Log Gamma	
Uncompressed recording			12-bit 4:4:4 RGB CinemaDNG
Compressed recording	10-bit 4:2:2 Y'CrCb ProRes 10-bit 4:2:2 Y'CrCb DNxHD	10-bit 4:2:2 Y'CrCb ProRes (FILM)	

Figure 1. BMCC compression options

Post-production workflows for these advanced cameras will be more complex than those for ENG/EFP camcorders using traditional compression systems. These workflows require specialized knowledge and can be time consuming. This article will present a brief overview of log and RAW workflows.

DeBayered — REC709 — Compressed

Figure 2 shows a schematic illustrating the data-flow within a BMCC. The right path shows its 15.81mm x 8.88mm (1.78:1) CMOS sensor whose 12-bit serial-RGB signal is deBayered with scaling from 2432 x 1366 photocites to a 1920 x 1080 HD frame. REC709 gamma is applied to this 4:2:2 Y'CrCb signal that is then compressed by a ProRes 422HQ or DNxHD (220Mb/s) codec. The encoded 10-bit data are recorded to an SSD.

Because recordings are standard ProRes or DNxHD, they can be edited as would any other compressed format. They require no special post workflow.

DeBayered — Log — Compressed

Again referencing Figure 2, the right path shows that the serial-RGB signal from the 12-bit sensor is deBayered to 1920 x 1080 pixels. Logarithmic gamma is then applied to this 4:2:2 Y'CrCb signal that is then compressed by a 10-bit ProRes codec. The 10-bit ProRes encoded data, carrying slightly less dynamic range than the

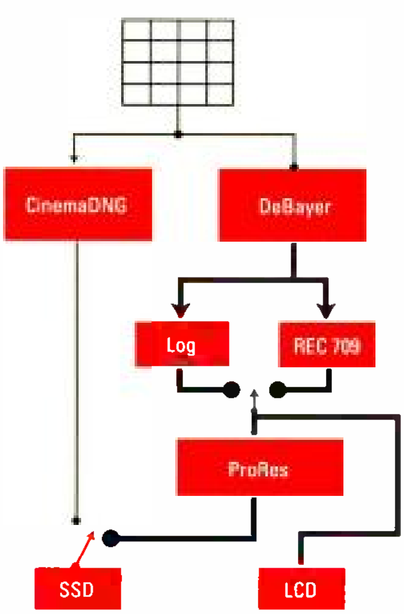


Figure 2. BMCC data-flow schematic

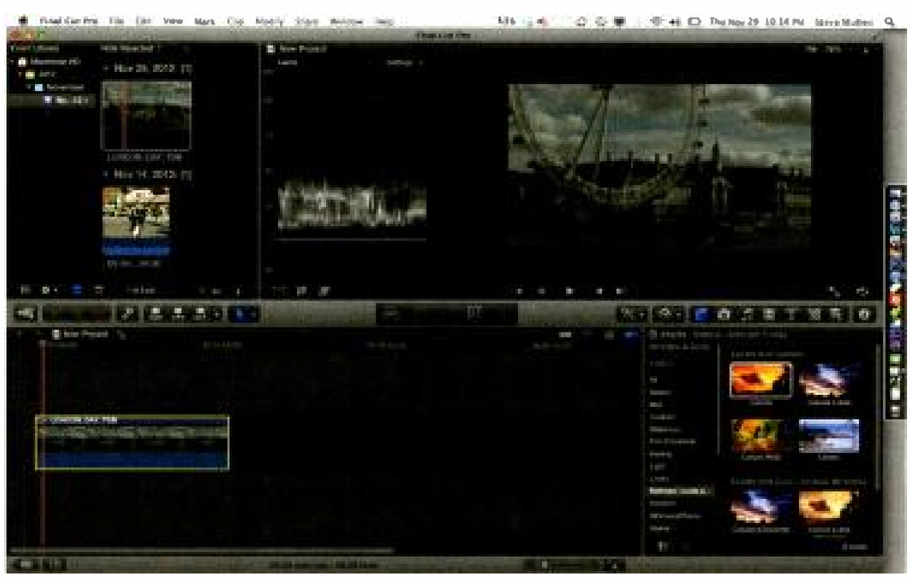
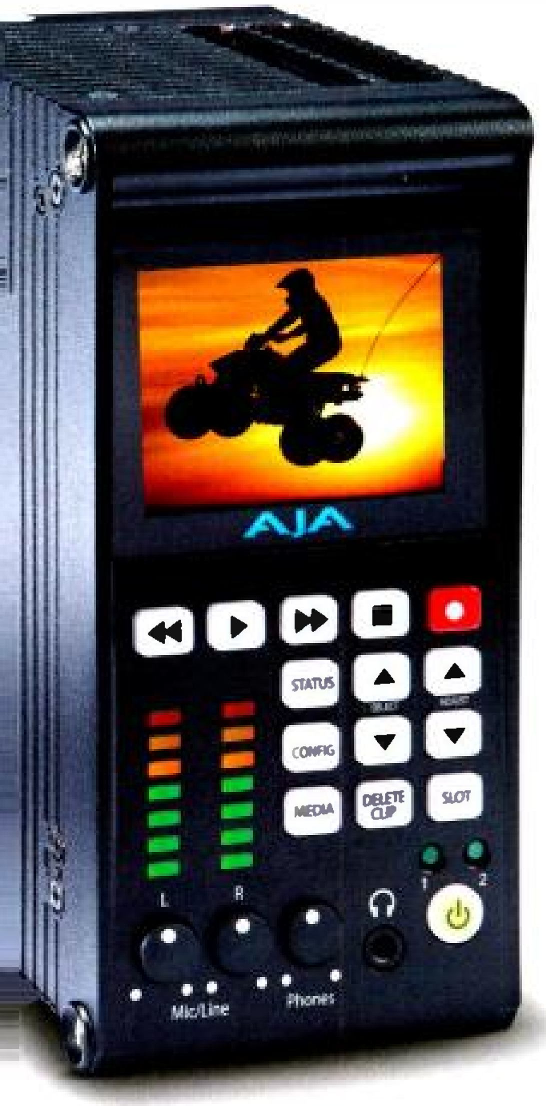


Figure 3. A log curve, which results in a washed out image



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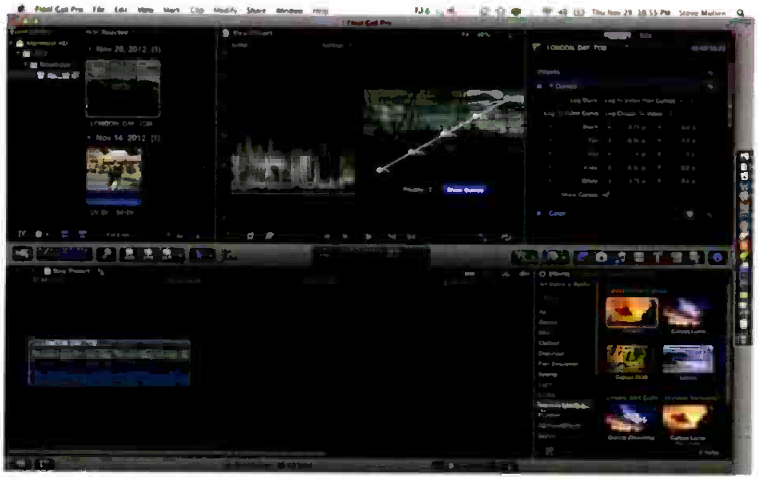

Figure 4. A linear curve with five nodes

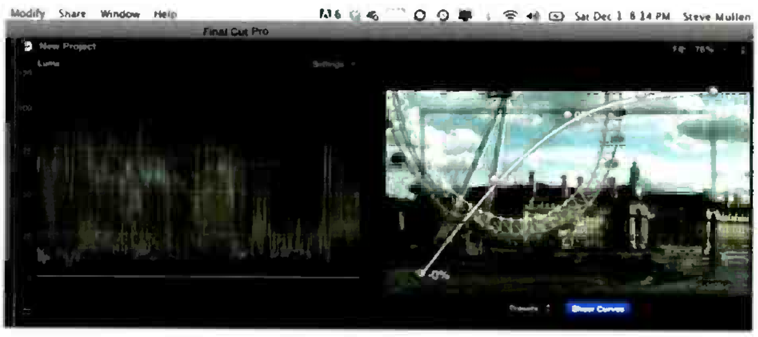

Figure 5. A linear curve with five nodes on top of a visible frame

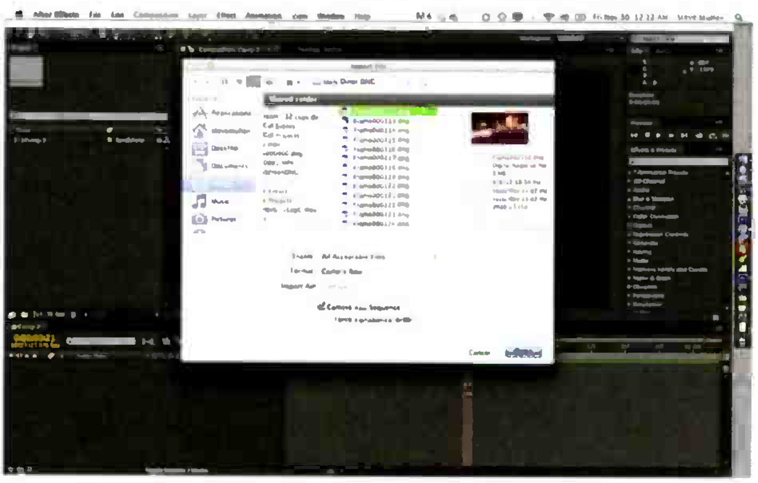

Figure 6. The Files>Import File command window

13-stops claimed to be carried by the camera's RAW data, are recorded by an SSD.

Log ProRes is imported into your NLE the same way REC709 ProRes is imported. Begin by appending footage into a timeline. The log difference is seen when viewing a clip either from a source Event or in a Timeline. As shown in Figure 3 on page 10, a frame from log ProRes appears washed-out. (Image courtesy of the Diamond Brothers.)

To restore contrast, software such as FXFactory sold by Noise Industries is employed. Drag the Curves function from the Natress Levels and Curves collection onto a clip.

As shown by Figure 4, you first set Log Mode to "Log to Video then Curves." With this setting, log ProRes is mapped into video space so contrast is restored. You have a choice of the floating-point mapping function to use. Set Log to Video Curve to one of three curves: Log Cineon To Video (LogC); Log B To Video; and Log A To Video. Each creates a subtly different look. I prefer using Log A, although others may prefer Log C.

A curve with five nodes appears superimposed over the visible frame. (See Figure 5.) These nodes appear in the waveform monitor as five luma peaks. One disregards them when looking at the signal.

Figure 5 displays the image that is the result of pushing the right-most nodes higher thereby compensating for the underexposed shot.

The final step is to click the Show Curves button to disappear the superimposed curve. You can now proceed with editing the footage.

RAW — Uncompressed

The left path presented in Figure 2 shows the 2.5K 12-bit CMOS sensor feeding logic that wraps the serial-RGB raw signal as CinemaDNG data. Captures are made at 23.98p, 24p, 25p, 29.97p and 30p. These uncompressed 12-bit data are recorded to an SSD.

Several applications can handle RAW footage. These include: DiVinci Resolve (from Blackmagic); Speedgrade for Premiere CS6; and Adobe After Effect's (AE) RAW importer. I used After Effects for this article.

After launching AE, go to Preferences and choose Import>Sequence Footage. Set the Frame Rate appropriately. Click OK.

Now set the Files>Project Settings. Set Depth to "16bpc" which defines the project to have RGB channels with each channel utilizing 16-bits. Click OK.

Then, issue the Files>Import File... command. (See Figure 6.) Now browse to a folder of DNG frames. Select the lowest number frame and confirm Format is Camera Raw. Also, confirm Camera Raw Sequence is checked. Click Open to import the clip and auto-open the Camera RAW window. The frame will be deBayered to create an RGB image.

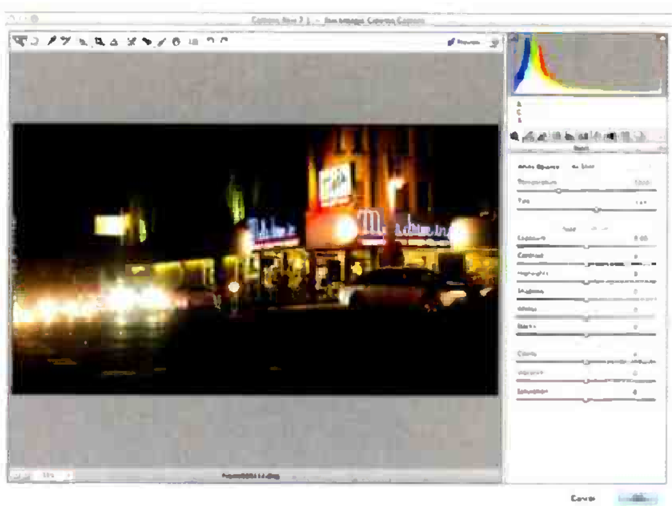

Figure 7. A panel with white balance controls

On page 12, Figure 7 shows the control panel with white balance controls that are by default set to "As Shot." This footage, courtesy Marco Solorio (©2012, OneRiver Media), looks perfect — too perfect for use in a noir production. Figure 8 shows the scene with the Custom color temperature dialed down to 2700 degrees.

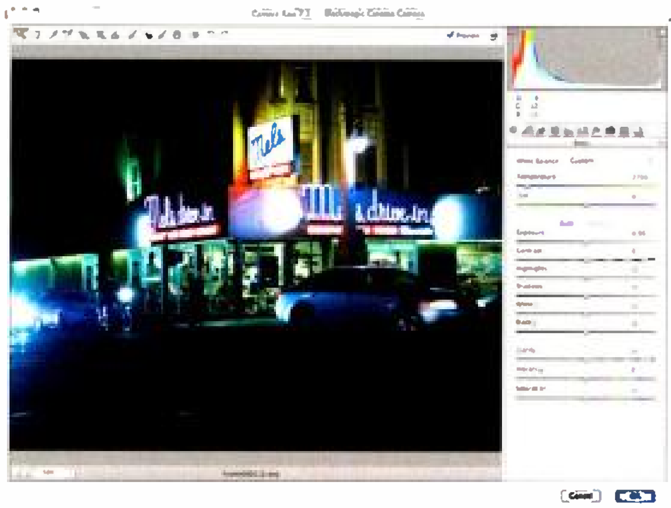

Figure 8. White balance dialed down to to 2700 degrees

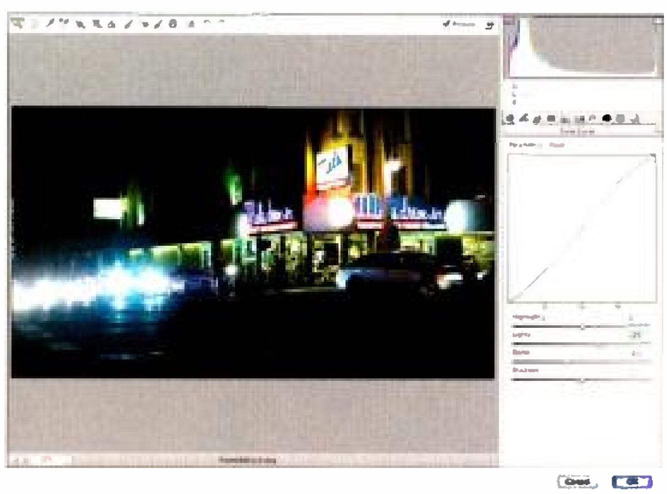

Figure 9. An S-curve applied to a RAW frame

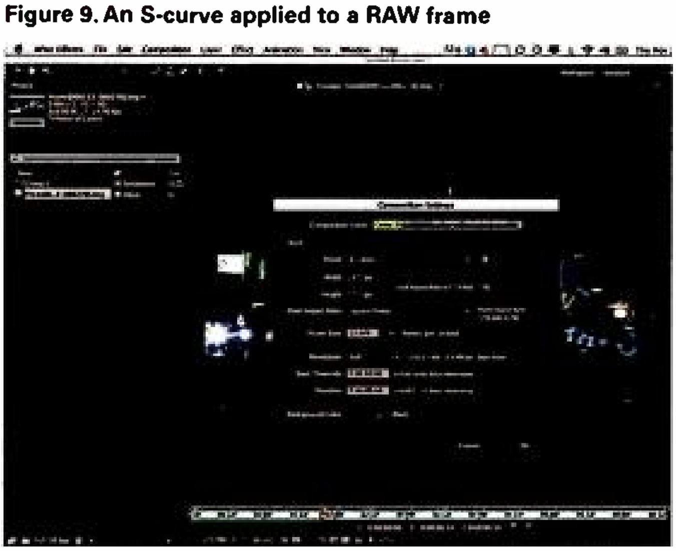

Figure 10. The setting of a new composition command

Next, a slight S-curve is applied to deepen shadows and add punch to the highlights. This is done with another panel. (See Figure 9.) When finished grading the RAW frame, click OK to make all frames in a clip share the same settings. This type of adjustment is called a "one-light" grade.

Next, issue the Composition>New Composition command. Set Preset to "Custom" and dial in 2432px and 1366px. Now, set the Frame Rate to 23.976 and click OK. (See Figure 10.)

Double click the clip so you can see it in the Viewer. Issue the Composition>Add to Render Queue command. Set the Output Module to "Custom: ProRes 4444." Doing so defines a conversion of 12-bit RAW frames using floating path math to 16-bit values that are exported as ProRes with 4:4:4 color sampling. Lastly, render the composition. It will take some time to deBayer each frame.

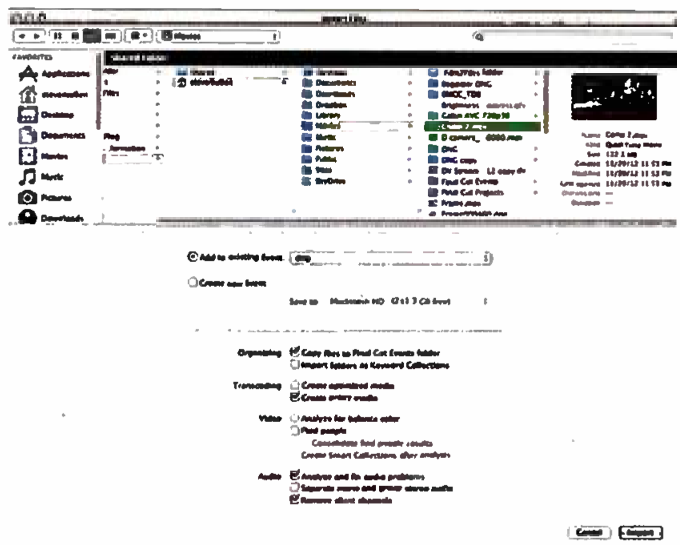

Figure 11. An FCP X import dialog box

Now launch your NLE. Figure 11 shows the import dialog box for FCP X. By creating a proxy (ProRes) file at import, editing will be done using this performance-oriented file.

During export, ProRes 4444 source files are written to disk. (Effects and composites must, of course, be decompressed — from ProRes 4444 — to RGB floating point. These segments will be compressed to ProRes 4444 during export.)

While pre-processing RAW isn't difficult, it is very time consuming. Working with log ProRes is far faster because the deBayering is done in-camera rather than in software on a computer. **BE**

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

ADDITIONAL RESOURCES

The following are available on the *Broadcast Engineering* website:

- A Broadcaster's Guide To Camera & Lens Technology
- Discover the benefits of AVC-Ultra
- Compression for digital cinema cameras, part 1

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Adding a dimension

3-D broadcast production is on its way.

BY ALDO CUGNINI

Although the jury is still out on whether 3-D entertainment delivery has reached a mainstream threshold, there is no doubt that the implementation of electronic distribution of 3-D content — in a form that is compatible with today's digital transmission systems — is a requirement for keeping all business paths viable. Several initiatives are now under way that are together forming a new 3-D ecosystem.

3-D file and content delivery is becoming formalized. On the production side, X3D (ISO/IEC 19775) is an XML-based file format that has been developed to integrate network-enabled 3-D graphics and multimedia. Each X3D application is a 3-D, time-based space that contains graphic and aural objects that can be loaded over a network and dynamically modified through a variety of mechanisms. X3D does not define physical devices, transformations or parameters, such as screen resolution and input devices, but rather it provides for the interpretation and implementation of 3-D functionality.

Each X3D application establishes a definition and composition of a set of 3-D and multimedia objects, and a coordinate space for those objects. X3D can specify hyperlinks to other files and applications, can define programmatic or data-driven object behaviors, and can connect to external modules or applications via programming and scripting languages. X3D was designed to be broadcast-ready, supporting all manner of fixed and mobile devices.

Transmission compatibility

Both the ATSC and DVB are developing "frame-compatible" add-ons to their respective DTV systems. In order to be transmission-compatible (i.e., fit within an existing broadcast signal), a decimated version of the left and right pictures is transmitted in a manner that fits into a 2-D broadcast. This results in several possible 3-D structures:

- *Top-and-Bottom* is composed of two stereoscopic pictures — left and right, which are sub-sampled to one-half vertical resolution.
- *Side-by-Side* is composed of two stereoscopic pictures — left and right, which are sub-sampled to one-half horizontal resolution.

There is no doubt that the implementation of electronic distribution of 3-D content — in a form that is compatible with today's digital transmission systems — is a requirement for keeping all business paths viable.

Of course, these structures, although they are backwards-compatible in the broadcast sense, cannot be properly decoded and rendered by a legacy 2D receiver, which would show the two images next to each other on the screen, and not separated into right and left components.

The ATSC is developing a service-compatible hybrid-coded (SCHC) 3-D system, which is one particular case of service-compatible real-time delivery (SCRT). The stereoscopic 3-D video is transmitted as two independent video elementary streams, where one of them is compatible with the legacy 2-D TV service.

The ATSC 3-D Specialist Group T3-S12 is also working on hybrid delivery of additional view video by broadband or non-real-time (NRT) broadcast. Because the RF channel has limited bandwidth, this method uses a separate broadband channel to deliver additional view video to minimize the impact to the on-air service. This part also includes the use of NRT for pre-download of additional view video as an NRT object via an RF channel or broadband side channel (e.g., Internet). S12 is also studying hybrid delivery of additional view video by M/H, which proposes the use of video delivered over ATSC-M/H (Mobile DTV) as a secondary view video.

The DVB has published a set of commercial requirements directed to the ability to provide a 3-DTV service utilizing the existing HDTV infrastructure. The DVB 3-DTV specification requires the L and R images to be arranged in a "spatial multiplex" (frame-compatible format), so that the resulting signal is backwards-compatible with receivers that process conventional HDTV signals. Allowed formats include Side-by-Side and Top-and-Bottom. Numerous progressive and interlaced formats are included in the specification.

Research has shown that reducing the quality of one of the left/right images (to some degree) does not cause eye discomfort — a postulate borne out by some contact lens wearers who prefer to correct their vision unequally in each eye, with one for distance and one for reading. But because all viewers do not have the same balance of acuities, the DVB

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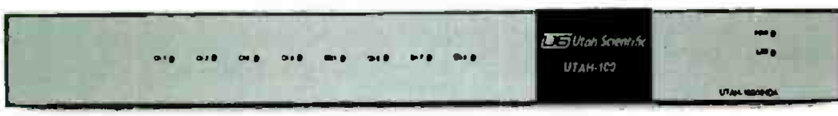

The **UTAH-100/XHDA** is a 3G-capable High Definition Distribution Amplifier with a big difference. It has 8 amplifier blocks, each of which can be programmed by the internal web interface to serve 2, 4, 6 or 8 outputs.

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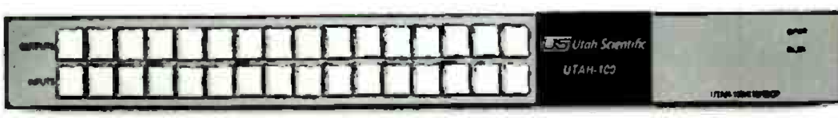

The UTAH-100 family offers a wide selection of routers in all signal formats in sizes from 8x8 to 32x32 with standard built-in web control and options for built-in or remote control panels, third-party control interfaces, redundant power supplies.

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recommends that the largest public interest is best served by providing equal-quality images to each eye. As some researchers have proposed backwards-compatible systems that use different paths for the left and right signals, with different bandwidths, resulting in different left/right image resolution, it could be that a number of different approaches emerge in different regions.

Playback environment

Receivers and the playback environment are getting more sophisticated. On the receiver side, new interfaces have been defined to carry the 3-D signals over HDMI to a display. In the 1.4a version of the specification, the 3-D video format is indicated using a Video Identification Code (VIC) in the AVI InfoFrame (indicating the video format of one of the 2-D pictures), in conjunction with a 3-D_Structure field in the HDMI Vendor-Specific InfoFrame. Top-and-Bottom and Side-by-Side are two of the supported HDMI 3-D video format structures; others include L + depth and L + depth + graphics + graphics-depth. Additional 3-D video formats may be specified in a future version.

As for audio, several companies are now working on enhanced audio reproduction that goes beyond 5.1 channels. With the advent of 3-D video, developers want a new "virtual" sound placement to augment the 3-D experience. In order to reproduce a sound-image placement at an arbitrary position in a room, a speaker layout is needed in three dimensions: height, width and depth. This means that the 3-D sound-space requires using at least eight speakers, positioned at the eight corners of a solid. When incorporating a center and LFE (low-frequency effects) channel, the smallest full 3-D sound speaker layout is a 9.1-channel configuration. Higher numbers of speakers have been proposed, too, such as 11.1 channels and even 22.2.

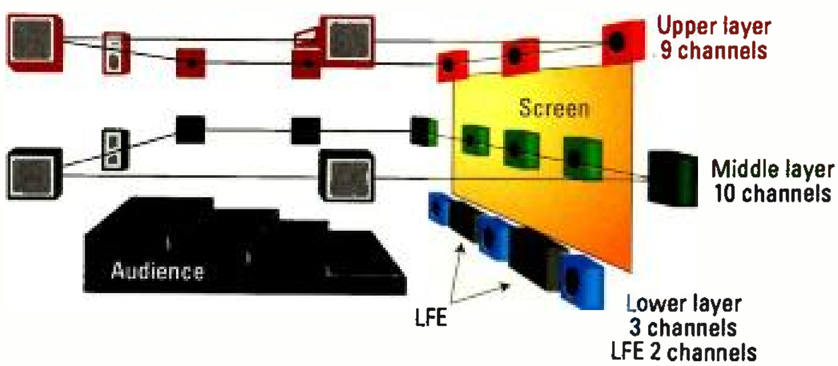


Figure 1. Based on the work of researchers at NHK, international standardization of a 22.2 multichannel audio format is under way.

Although it may be impractical for most home viewers to support more than 5.1 channels, larger systems are already appearing in commercial theaters, and we should expect them to show up in exotic home theaters as well. In order to provide maximum compatibility and re-purposing, each of these formats can be downmixed to a more-traditional 5.1-channel package. Different production and downmix approaches have been developed to account for arbitrary speaker placement in the final user environment, too.

Research engineers at NHK years ago proposed a "High-Presence Audio Format," intended to be used with Super Hi-Vision (now known as

Ultra HD). Based on their work, international standardization of a 22.2 multichannel audio format is under way (See Figure 1.) The researchers enumerated various requirements for such a system. It must:

- be able to localize an audio image anywhere on the screen;
- be able to reproduce sound coming from all directions surrounding the viewing position;
- be able to reproduce a natural, high-quality 3-D acoustic space;

With the advent of 3-D video, developers want a new "virtual" sound placement to augment the 3-D experience.

- have an enlarged optimal listening zone;
- be compatible with existing multichannel audio formats; and
- support live recording and live broadcasting.

Coming attractions

The next step for 3D technologies will be auto-stereoscopy, i.e., 3-D displays without the need for special viewing glasses. The current state of the art produces such a display, but with a narrow audience viewing angle. By some accounts, this is the limiting factor that prevents mass acceptance of the technology, but researchers are working on solutions, so we may not have to wait long — given sufficient demand, enough content and the right business models. **BE**

Aldo Cugnini is a consultant in the digital television industry.

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

ADDITIONAL RESOURCES

The following are available on the *Broadcast Engineering* website:

- Half of households worldwide to have 3-D-ready TVs by 2019, says report
- Stereo 3-D and 4K: What's the attraction?
- Viewers shun 3-D at London Olympics

Plug and play

Ethernet auto-negotiation is a fundamental concept.

BY BRAD GILMER

As engineers who maintain professional media networks, we may plug in hundreds or even thousands of Ethernet RJ-45 cables during our careers. In almost every case, the links just work. Understanding how we are able to interconnect 10Base-T, 100Base-T and GigE devices is worth knowing, especially when devices do not behave as expected.

Interoperability

In the early days of computer networks, a number of different cable mediums were tried, including RG-11 coax, RG-59 coax and Unshielded Twisted Pair (UTP). In the end, UTP and the RJ-45 connector won out over other alternatives. At the same time, Ethernet became the dominant networking technology. (There were other early networking technologies such as ARC-Net and Token Ring, but in almost all cases, these were dropped in favor of Ethernet.)

The first widely deployed Ethernet technology was 10Base-T, operating at 10 Mb/s. 10Base-T can operate either half-duplex (meaning that a Network Interface Card (NIC) can send or receive, but not at the same time), or in full-duplex (meaning that NIC cards can send and receive simultaneously). 10Base-T networks were deployed all over the world. But, even as 10Base-T was rising to become the dominant networking technology, designers came up with a faster network known as 100Base-T, capable of running at speeds up to 100Mb/s. And, of course, now we have GigE, or 1000Base-T, running at 1Gb/s. All of these standards support either half-duplex or full-duplex operation.

Today, plug a variety of computers, network switches and other networking devices into a wired Ethernet network, and they all pretty much just work. But, what makes this possible?

Link integrity

A fundamental concept in 10Base-T is link integrity. To establish whether a connection was live or not, 10Base-T included the regular transmission of the Normal Link Pulse (NLP). NLPs were sent every 16ms. This heartbeat pulse was used as the basis for a Link Integrity Test (LIT). If a receiver does not receive either an NLP or a data packet within 50ms to 150ms, then the NIC enters the link fail state. This disables the sending and receiving of packets. But, importantly, the NIC continues to send NLPs. When the problem is corrected, and the receiver begins receiving NLPs, or packets, the NIC clears the link fail state.

> **Plug a variety of devices into a wired Ethernet network, and they work. But, what makes this possible?**

This approach allowed applications to quickly determine if a network connection was alive or dead. But, the LIT did nothing to help when one NIC card was configured for half-duplex and the other for full duplex.

With the introduction of 100Base-T, the number of combinations and permutations available when connecting a device to a network increased. After all, you could have two devices operating at 100Base-T, one device operating at 10Base-T and another operating at 100Base-T, and so on. This is not to mention whether the devices were in half-duplex or full-duplex mode. How could designers ensure that end users could simply connect two devices and have them talk?

Auto-negotiation

The solution was to come up with a way for the two devices to communicate their capabilities. It was decided to use the space between NLPs to transmit a fast link pulse (FLP). The FLP is a string of 33 positions, occupied alternately by clock pulses and data pulses. Once a connection is established, NICs cease to transmit the FLP. The FLP contains, among other things, a technology ability field and an ACK bit. Using the FLP, an NIC can signal its highest capability. For example, one NIC might signal that it can operate at 100Base-T, full-duplex. The other NIC may signal that it can operate at 100Base-T, half-duplex.

Once the technology ability field is received, an NIC looks at a Priority Resolution Table and selects either its highest priority capability or the capability of the other card, whichever is lower. Here, the card would send a revised FLP, indicating 100Base-T, half-duplex and an ACK. Both cards would cease transmitting FLPs, and the link state would be set to UP.

Auto-negotiation capability is optional for 100Base-T cards, but it is mandatory for 1000Base-T NICs. In addition to negotiating speed and duplex settings, auto-negotiation is used to establish a master-slave relationship between two devices. The master-slave concept was added in the 1000Base-T standards.

Practical application

So, how does this work in the real world? Rich Hernandez lays out some great examples in a paper titled "Gigabit Ethernet Auto-Negotiation," published by Dell. Let's take a look at his three cases. In the first one, you connect a 10Base-T half-duplex device to a GigE switch. In the second case, you connect a 100Base-T half-duplex device to the same switch. In the last example, you connect a 100Base-T auto-negotiation capable device to the GigE switch. Remember, the first two devices do not have auto-negotiation capabilities. Let's look at some diagrams that will help illustrate what is going on as each pair negotiates a link.

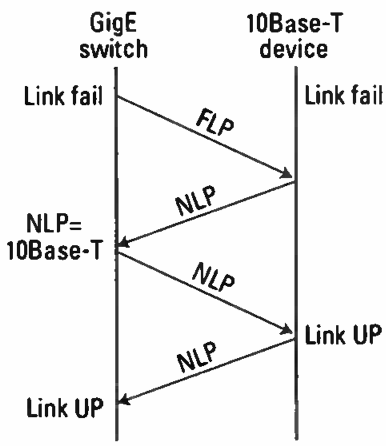


Figure1. A GigE switch is connected to a 10Base-T half-duplex device.

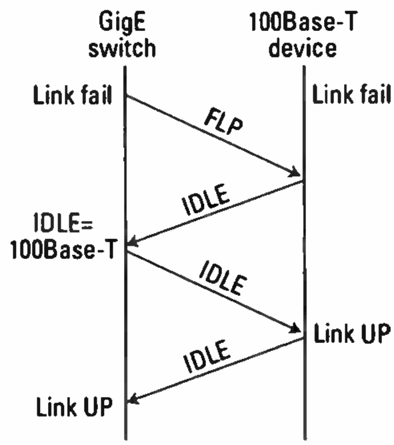


Figure 2. A 100Base-T device without auto-negotiation is connected to a GigE switch.

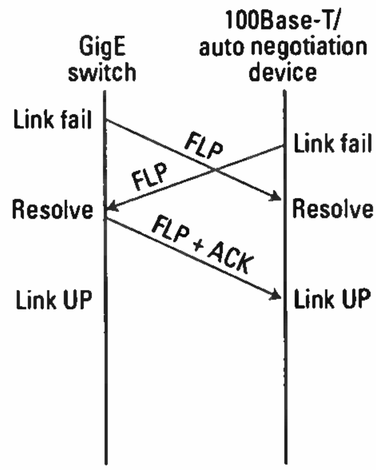


Figure 3. This shows a case where both devices are auto-negotiation capable, but with a speed mismatch.

In the first case, both devices begin in a link fail state. (See Figure 1.) The GigE switch begins sending Fast Link Pulses. The old 10Base-T device begins sending NLPs. When the GigE switch receives the NLPs, it immediately hands off negotiation to a legacy 10Base-T Physical Medium Attachment module.

From this point on, the GigE switch behaves as if it were a legacy 10Base-T device. It begins sending NLPs. Both devices detect NLPs and transition from link fail to link UP state. As Hernandez notes, the default condition when a GigE device detects a 10Base-T device is half-duplex. If the 10Base-T device is set to full duplex, it will not work.

In the second situation, we are connecting a 100Base-T device without auto-negotiation to a GigE switch. (See Figure 2.) Again, both devices begin in a link fail state. The switch begins transmitting Fast Link Pulses. At the same time, the device, which knows nothing about FLPs, begins transmitting idle symbols. The GigE switch detects the idle symbols and immediately knows that it is trying to negotiate with a 100-Base-T device. As with the 10Base-T device, only half-duplex is supported when a GigE device is establishing a link with a non auto-negotiation device.

The GigE switch begins sending out idle symbols, both devices then recognize the other, and they change their status from link fail to link UP.

In the final case, both devices are auto-negotiation capable, but there is a speed mismatch. One is a 100Base-T device, and the switch is GigE. Figure 3 shows that the devices begin in link fail. Both of them transmit FLPs. The highest capability of the 100Base-T device is 100Base-T, full duplex. Both devices recognize that this is the fastest, shared capability mode, so the GigE switch configures itself for 100Base-T full-duplex. At that point, the devices change state from link fail to link UP.

Errors

When auto-negotiation works, it works well. But, problems can arise when a GigE switch expects a slower device to be in half-duplex mode and it is instead in full duplex. When this happens, links may either become extremely slow, or they may not work at all. It is critical that engineers who maintain professional media networks understand that incorrect duplex configurations in older equipment can cause serious performance problems.

The root of the issue is in the original Ethernet collision and backoff method of sharing a single piece of media. There is no guarantee in Ethernet that two cards will not try to talk at the same time. When they do, both cards detect a collision, stop transmitting and then retry after a random period of time. In a multiplex mis-configuration situation, the card in half-duplex detects a collision and retries. The full-duplex card does not retry, but it does detect that the incoming packet is bad and discards it. So, be sure you configure cards correctly.

Looking ahead through the coming months, we will explore additional basic networking concepts. BE

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

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

+ ADDITIONAL RESOURCES +

The following are available on the *Broadcast Engineering* website:

- Monitoring IP networks
- Computer networks Part 1
- Computer networks Part 2

IP newsgathering

While most regard it as a supplement to traditional ENG and SNG, the technology is gaining traction.

BY PHIL KURZ

Since IP newsgathering made its initial splash when CNN pioneered the technology for its coverage of the Israel-Hezbollah conflict in 2006, it has steadily gained momentum not just as a go-anywhere way to contribute live and edited pieces from war zones, but also as a reliable path for local stations to contribute stories from the field. When it comes to its place in the newsgathering pecking order of technology, it seems most local broadcasters echo the sentiment of Pete Sockett, director of engineering and operations for WRAL-TV, which serves the Raleigh-Durham-Fayetteville, NC, market.

"IP newsgathering definitely has grown up a lot in the past couple of years," he says. "It's a great addition to our toolbox to do news."

This complementary role for IP newsgathering is understandable. With a $1 billion-plus infrastructure dedicated to supporting traditional point-to-point microwave and satellite contribution as well as a long track record of reliable service, ENG and SNG have claimed for themselves premiere status when it comes to delivering live reports from the field.

However, a few stations are beginning to make IP newsgathering their primary, and in at least one case their only, means of field contribution. Morris Network, which owns stations in Georgia, Kentucky, Mississippi, North Carolina and Tennessee, is phasing out both ENG and SNG live units in favor of IP newsgathering.

"You take a live unit, satellite or whatever," says Dean Hinson, president of Morris Network. "There's travel time, setup time, breakdown time. You have a lot of resources tied up in that arena." However, the

WRAL-TV news photographer Chad Flowers, a 20-year veteran with the Raleigh-Durham, NC, station, contributes footage from the field with the LiveU IP newsgathering backpack. Photo courtesy Tony Gupton.

Dejero IP newsgathering system the Morris Network deployed has eliminated that downtime, improved the productivity of its newsgathering crews and extended the reach of its stations' news coverage, he says.

It would seem such a bold decision may be dangerous. After all, Hurricane Sandy disrupted operation of one-fourth of the cell phone towers in the 10 states affected by the storm, according to the FCC. Del Parks, VP of engineering and operations for the Sinclair Broadcast Group, notes such cell tower disruptions can spell disaster for IP newsgathering.

"If cell service goes down, you have a problem," he says, "but LiveU (the brand of bonded IP newsgathering system deployed by Sinclair) as an extension of traditional newsgathering puts you in places you couldn't be."

Two Sinclair stations deployed IP newsgathering systems during the storm. "They expanded our coverage and put viewers into the storm," Park says.

Ka-band satellite services, such as Inmarsat's BGAN and ViaSat's Excede Newsgathering, provide a way to side-step disruptions to the cell service. Jim Casabella, director, Advanced Technology, ABC Owned Television Station Group, says roughly one-third of the group's news crews have some sort of IP newsgathering and that it is looking to supplement them with Ka-band connectivity in the near future.

"One of the Achilles heels of IP newsgathering is guaranteed availability," Casabella says. "When it works, it works. What IP over Ka-band gives you is guaranteed QoS. I think Ka-band will allow IP newsgathering to grow and be a larger part of the toolkit than it would have been otherwise."

The bottom line appears to be that IP newsgathering is growing in prominence. Most see it as a supplement to traditional ENG and SNG, but at least one pioneering station group is committing to it entirely. With Ka-band satellite service to supplement cell networks, that approach may be less risky than it seems on the surface. BE

Phil Kurz regularly reports on the broadcast industry and is the writer of several Broadcast Engineering's *e-newsletters, including "RF Update."*

+ ADDITIONAL RESOURCES +

The following are available on the *Broadcast Engineering* website:

- TV stations mull myriad of ENG camera choices
- Hurricane Sandy cell tower toll underscores continued importance of ENG, SNG
- IP newsgathering brings new opportunities, challenges for TV stations

ATSC 3.0

The next-generation digital broadcasting standard is already on the drawing board.

BY MARK RICHER

In 1995, the DTV Standard (A/53) was approved by the Advanced Television Systems Committee (ATSC). Since that time, the committee has successfully extended the system with new functionality such as the Mobile DTV Standard (A/153) and Non-Real-Time Content Delivery (A/103). The emerging evolutionary step — dubbed the "ATSC 2.0" standard — will enable new functionality, including non-real-time transmission, advanced video compression, enhanced service guides, audience measurement and conditional access.

ATSC 2.0 will provide interactive capability by creating connections between live TV and Internet content, as well as live TV and non-real-time content, through triggers and objects in the broadcast stream. Broadcasters will be able to insert interactive elements into the broadcast stream. Triggers cause the content to be activated, whether delivered in the stream or obtained via Internet. These enhancements are backwards-compatible.

ATSC is also looking further ahead, planning for terrestrial broadcast television's next big development. This look includes transitioning to an "ATSC 3.0" system that will provide even more services to viewers, but requires a clean break from first-generation DTV system technology.

Broadcasting is similar to other industries; technology leads the way and is the impetus for major transformation. A change will be needed to adapt to expected technological advances. So, while working on the backwards-compatible ATSC 2.0 enhancements, the committee is also looking down the road to ATSC 3.0, a revolutionary OTA transmission system expected to emerge within the next decade.

TG3

On Sept. 6, 2011, ATSC announced the formation of a new Technology Group (TG3), under the leadership of Jim Kutzner of PBS, to develop ATSC 3.0. The ATSC Board of Directors defined the TG3 Scope of work as follows:

"The ATSC 3.0 Technology Group (called TG3) will develop voluntary technical Standards and Recommended Practices for the next-generation digital terrestrial television broadcast system. ATSC 3.0 is likely to be incompatible with current broadcast systems and therefore must provide improvements in performance, functionality and efficiency significant enough to warrant implementation of a non-backwards-compatible system. Interoperability with production systems and non-broadcast distribution systems should be considered."

ATSC 3.0 is a revolutionary, over-the-air transmission system that is expected to emerge within the next decade.

In its development process, the ATSC Board of Directors has asked TG3 to consider the following:

- Increase efficiency of service. "Efficiency" has many definitions and can be achieved and measured by many means (e.g., increased bits per Hertz, and improved audio and video compression). At a minimum, coverage and service must be maintained, but ideally service would be improved over conventional ATSC service. Any new system must be highly robust for both fixed and mobile service. Also, a new system must account for the differences of the three television bands, how possible implementations within each band are similar and how they differ.
- A new system should consider the substantial difference in operating parameters between fixed and mobile service. Services for mobile and fixed receivers may or may not have different physical layers or different operating modes, but should be optimized for each service.
- A new system should consider other distribution media and services now in use or possibly in use in the future. This will require a consideration of broadcast system architectures and how they integrate with other media. One consideration could be the development of an independently layered system with standardized interface points among the layers.
- A new system should consider the inclusion of return channel capabilities for user interactions, service usage measurement and other uses.
- A new system should also consider accessibility features from the beginning.
- Other considerations for a new broadcast TV system should include the impact of white space devices, a higher upper limit on audio and video quality, additional audio channels and perhaps separate radio services, and guaranteed correct audio and video synchronization.
- Most of all, a new broadcast system should bring greater value to broadcasters and viewers. This may include the consideration of new system architectures, such as aggregating broadcast spectrum.

The initial work of TG3 has been focused on the development of use cases that define potential functions that a new DTV system could provide to consumers. Ultimately, these scenarios will be used to develop the technical requirements for ATSC 3.0.

Work is also under way within TG3 on plans for development of the physical layer of ATSC 3.0. A preliminary list of target attributes has been created, and a draft Call for Proposals (CFP) is under development with a planned release in the first quarter of 2013. As work moves forward on the physical layer, efforts to define the transport and application layers will begin.

Regardless of what transmission methods and technical details are made part of ATSC 3.0, it's a certainty that mobility will be a centerpiece. This is given the exponential growth in the number of smart phones and tablets carried by people each month. At the same time, broadcasters are increasingly interested in the possibility of providing Ultra High Definition services to the home for 4K and higher resolution.

FOBTV

On Nov. 11, 2011, television broadcasting executives, technologists and engineers met in Shanghai, China, and agreed that global cooperation is essential to developing strategies and technologies necessary to ensure the future of terrestrial TV broadcasting. During the 2012 NAB convention, the formation of the Future of Broadcast Television (FOBTV) Initiative was announced. The goals of FOBTV include development of ecosystem models for terrestrial broadcasting, development of requirements for next-generation terrestrial broadcast systems, selection of major technologies to be used as the basis for new standards and standardization of selected technologies by existing SDOs.

Global standard benefits

Development of a global terrestrial TV standard will provide significant benefits for broadcasters, manufacturers and consumers. First and foremost, a global strategy will show the commitment of the broadcasting industry to embrace new technologies that will encourage interest from global technology developers to develop next-generation products. Of course, mass production drives down the cost of professional and consumer products. As handheld and mobile devices become increasingly important as target devices for reception of terrestrial TV, it is important that these devices work as users travel across borders.

FOBTV has developed use-case scenarios from participating organizations (including those from ATSC, as described above), and is now in the process of creating a vision paper for a global end-to-end model for the next generation of broadcast television. Based upon the paper and the use cases, FOBTV will develop technical requirements and issue a Request for Proposals (RFP).

The initiative has approximately 60 participating organizations and is a voluntary, non-profit association open to any organization that signs the Memorandum of Understanding available at *www.fobtv.org*. BE

Mark Richer is the president of the ATSC.

ADDITIONAL RESOURCES

The following are available on the *Broadcast Engineering* website:

- ATSC sets its focus on future of digital terrestrial television with new technology group
- HDTV on steroids
- ATSC to explore next-generation broadcasting spec that could be incompatible with today's technology

X-Link and VIP-X technology from Evertz is used for multiviewer-based monitoring in the control room of ABC's new syndicated show, "The Katie Show."

The Katie Couric studio

A new HD production facility supports the syndicated show.

BY DAVID LINICK

In September 2011, when the Disney/ABC Television Group (DATG) announced that it would launch a new daily syndicated show featuring Katie Couric, the daunting task was to create a new studio for the program.

The first order of business was to find a suitable HD "home" for the show. After reviewing several possible locations, it was decided that facilities within the ABC Television Center on West 66st in New York would be updated and become the new location for Katie.

As it happened, the facilities used by the syndicated show "Who Wants to Be a Millionaire" would become available after "Millionaire" finished its production season in November 2011. The new season of "Millionaire" was scheduled to move to another ABC facility, which freed up the studio, control room and technical support spaces for the necessary upgrades.

The production facility for "Katie" includes studio TV-1, control room TV-7 and support spaces built in what was originally TV-1's control room. One great advantage of the setup is the adjacency of these three workspaces.

An additional pre/post-production facility, built specifically for "Katie," is co-located with the show offices in an ABC building on Columbus Avenue.

Syndicated show

Because it is a syndicated show rather than a network show, "Katie" does not use any of the ABC Network program origination, graphics or post-production facilities. For other than incoming remotes and outbound feeds to DATG's uplink provider, the new stand-alone facility incorporates production, post, commercial integration and show playout.

These requirements drove the design of critical areas in the production process, including the development of the media center in one of the support spaces and the pre/post-production facility at the Columbus Avenue facility.

Broadcast Operations and Engineering (BO&E) executives had a general guideline that informed every decision made in designing the studio. The plan was to use the best, proven technologies to build a facility that would allow the "Katie" team to implement its vision for the show and would allow it to change and adapt easily to meet evolving show requirements.

In order to achieve this goal, a working group consisting of representatives from the BO&E, DATG and show staff was formed to develop the requirements for the new facility. The BO&E staff was tasked with implementation of these requirements.

Technical infrastructure

The TV-7 control room complex, including production control, audio and transmission, was originally built in 1995 as an SD facility. In preparation for the upgrade to HD, all equipment and cabling was removed. Only racks and power were left in place.

The technical core of the facility is built around a 288 x 288 Evertz EQX router. Based on the concepts developed for ABC's HD central switching, the router interface between sources and destinations that are not local to the main TV-7 control room complex is implemented via fiber-based I/O. Fiber interfaces are provided for the connectivity to the ABC's Central Core for incoming remotes and outbound programming, for connectivity to the Media Center and the Columbus Avenue pre/post facility.

A 60-fader Studer Vista 9 audio console, supported by two Soundcraft mixers, serves the show's needs, including supporting appearances by live musical acts. Recent acts have used rental equipment that includes Riedel RockNet interfaces.

Evertz X-Link and VIP-X technology, integral to the routing system, is used for multiviewer-based monitoring in the control room, audio room and the media center.

Production control room

A Sony MVS-7000X production switcher, fitted with 80 inputs and 48 outputs, was selected.

The original CRT-based monitor wall was replaced by an LCD-based monitor wall driven by the Evertz VIP-X system. Individual Ikegami 17in camera monitors and 32in line/preview monitors by Penta complete the monitor wall.

Live graphics/lower thirds are generated by a dual-channel Chyron HyperX. Moving backgrounds and clips are managed by a four-channel Ross SMS server and a 12-channel Abekas Mira server.

Content for the Chyron and servers can be produced at the graphics workstations in the Columbus Avenue facility and transferred to these devices, as files, via the network linking the two spaces.

Audio

A 60-fader Studer Vista 9 audio console was selected as the centerpiece of the audio production facility. It is supported by a Soundcraft Si Compact 32 music/backup mixer and a Soundcraft Vi4 mixer for front of house.

The main console is equipped with 64 AES I/O, 56 analog line inputs, 64 analog line outputs and 24 mic inputs. Using MADI technology and the Evertz audio routing system described earlier, the setup provides an additional 128 MADI-based I/O.

An ENCO DAD TV central audio storage and playout system provides redundant storage of audio-only elements. The system is fully redundant, with a storage capacity of 2TB.

It is also networked to the Columbus Avenue post facilities, allowing audio clips to be prepared/edited and then transferred to the ENCO system for air.

The main EQX router is integrated with an Evertz EMR audio routing system. The EQX router I/O cards include de-embedding and re-embedding of audio, which is linked to the EMR router via TDM links. The EMR router provides I/O to the Vista 9 via redundant MADI paths.

This implementation allows flexible allocation of audio tracks to video sources. By using the virtual routing capability of the Evertz system, multiple audio tracks can be assigned to video sources, greatly simplifying the creation of camera ISOs with different audio track assignments.

A Riedel RockNet networked audio system provides connectivity from studio mics and return line channels for IFB, etc. One of the unique features of this redundant system is that it allows the FOH mixer and main Vista 9 mixer to independently control mic preamp gains via RockNet interfaces integrated into the mixers.

The show includes appearances by a variety of live musical acts. Most live performances are mixed on rental equipment that is brought in as required. Recent live music acts have used rental equipment that includes RockNet interfaces, reducing setup time significantly.

The audio production suite includes a space that houses the equipment and operating station for the communications system that links all of the spaces that comprise the production facility. The two existing RTS/Telex ADAM frames were upgraded and now include RVON capability.

Studio

TV-1 studio is a 7000sq-ft stage adjacent to the TV-7 control room. As part of the upgrade, the studio was fitted with SMPTE camera fiber. A basic complement of video, audio and intercom capability was provided at each of five broadcast service panels (BSP) located around the perimeter of the studio.

At the beginning of the design process, the layout of the show's set was not known, so the studio had to be provided with the flexibility required to accommodate any set design. Rather than install large amounts of copper for

The design team set aside a space within the former TV-1 control room for use as a media center. The media center is built around an EVS server system, and is responsible for the integration of national commercials.

Design team

ABC-Daytime/Times Square Studios: Dominick Nuzzi, Sr. VP, production and administration
"The Katie Show": James Tomlinson, Executive in Charge of Production; Bob Peterson, Creative Director; Joe Terry, Director
ABC (BO&E): Todd Donovan, Sr. VP, (BO&E); Kenneth Michel, VP Engineering; William Rego, GM, Live Production and Special Events; Ellen Zalk, Director, Client Services; David Linick, Manager, Broadcast Engineering; Robin Thomas, Group Director of Engineering; Chris Bauer, Director of Engineering; Phil Durante, Director, Technical Construction; Jay Katowitz, Manager, Technical Construction; Mike Zdyrko, General Manager, Media Systems
On-set displays: Videofilm Systems
Custom touch screen: Controlled Entropy
Systems Integration — production complex: The Systems Group, Hoboken, NJ
Columbus Avenue post facility: Bexel Broadcast Services

audio and video, roll-round stage boxes, which allow concentration of audio and video connectivity as needed by the final set design, were provided.

Audio connectivity is provided as part of the studio's RockNet network. There are 96 mic/line inputs and 48 line outputs available on the studio floor.

For floor video feeds, the team took advantage of the fiber-based capability of the router. Twelve of the router's fiber-based destinations are supplied to a custom-built optical splitter located on the studio floor. Splits appear on Opticon Quad connectors at each BSP. The stage boxes are equipped with O/E conversion, providing 12 routable video feeds at each stage box.

Six Ikegami HDK-725 cameras, in both studio and handheld configuration, provide the basic camera complement. Lenses range from 60x studio lenses to 11x4.7 wide-angle ENG style. One of these is mounted on a telescopic Techno-Jib 24.

On-set displays are important to the "look" of the set. Custom-built matrices of 60in LCD monitors in portrait mode, including an 8 x 2, 5 x 1 and 2 x 1, allow production to display graphics or incorporate video elements into the show.

Sources to these displays are processed by an Evertz DVT videowall processor. Inputs to the processor are derived from the main EQX router, so that any image, graphic or video element can be fed to these displays.

An 80in touch screen driven by custom software allows Couric to dynamically interact with graphics or live video as topics are discussed.

Media center

One of the original operating premises was that the show would air live at 2 p.m., with updates or fixes made during the 2 p.m. live broadcast for replay to the 3 p.m. affiliates. In addition, the capability to pre-record shows on a segment-by-segment basis and edit the individual segments into a complete show, ready for broadcast, was required.

Because it is a syndicated show, the integration of national commercials and playout of the show to DATG's uplink provider had to be incorporated into the workflow. To implement these requirements, a space within the former TV-1 control room was re-imagined as a media center.

The media center is built around an EVS system, consisting of three 6-channel XS servers and a single 4-channel XS server. Management of the main record and playout workflow is done at the main EVS workstation, which includes the routing and monitoring tools needed to manage this workflow. This workstation manages the recording of programming and ISOs, as well as playout of commercials and pre-recorded show elements.

A second operating position includes an EVS IP Edit workstation, designed to allow show fixes to be made on the spot. A live 2 p.m. broadcast can be updated as the show moves forward, to be ready for replay at 3 p.m.

An EVS IP Director provides the media management tools. There are also IP-Director-based media monitoring workstations for browsing or reviewing content in the production control room and in the Columbus Avenue facility. The media center is closely integrated with the Columbus Avenue facility, via file-based transfer, as well as baseband video. The file-based-transfer capability is a key ingredient in the show's workflow.

DATG has worked with All Mobile Video (AMV), which provides national commercials to the show via a Disney-managed media network called Media Monorail.

Commercials are ingested into the ISIS system at the Columbus Avenue edit facility, QC'ed and transferred, as files, to the EVS system for integration into the show. Commercials are played out on two EVS channels, on independent XS servers, to assure a high level of redundancy.

Program playout to AMV via redundant paths is controlled and monitored in the media center. When the show is pre-recorded, playout is accomplished using independent XS channels and fed to AMV via redundant paths.

Columbus Avenue facility

A pre/post-production facility is co-located with the show's Columbus Avenue production offices. This facility is integrated with the main production facility via network and baseband video via fiber. Its primary use is to produce pre-recorded show elements, which are then transferred as files to the EVS in the media center for playout. Commercial ingest and transfer to EVS for playout is also managed in this space.

The file-transfer-based workflow allows show elements to be transferred at 3X- to 4X-real time from the ISIS to EVS for playout. The Avid edit capabilities include a Symphony suite, four Media Composer suites, two Media Composer workstations and 12 Avid Assist kiosk workstations.

The edit suites run under Interplay and are networked to a 64TB ISIS online storage system and an HP 144TB near-line NAS storage system.

Graphics are composed on three graphics workstations running Cinema 4D and Adobe CS Master Suite. The network that links this facility to the production complex also allows file-based transfer of content from the graphics machines to the Chyron and Ross and Abekas servers, which in turn become sources to the on-set displays.

A Pro Tools AudioSuite can provide sweetening for edited pieces and also provides audio clips, via network, to the ENCO audio system in the control room.

Up and running

"Katie" premiered on Sept. 10, 2012, and as the production staff has "exercised" the facility, the flexibility that was one of the design goals of the project has allowed BO&E to quickly respond to requests for adjustments in routing, monitoring and studio-floor feeds.

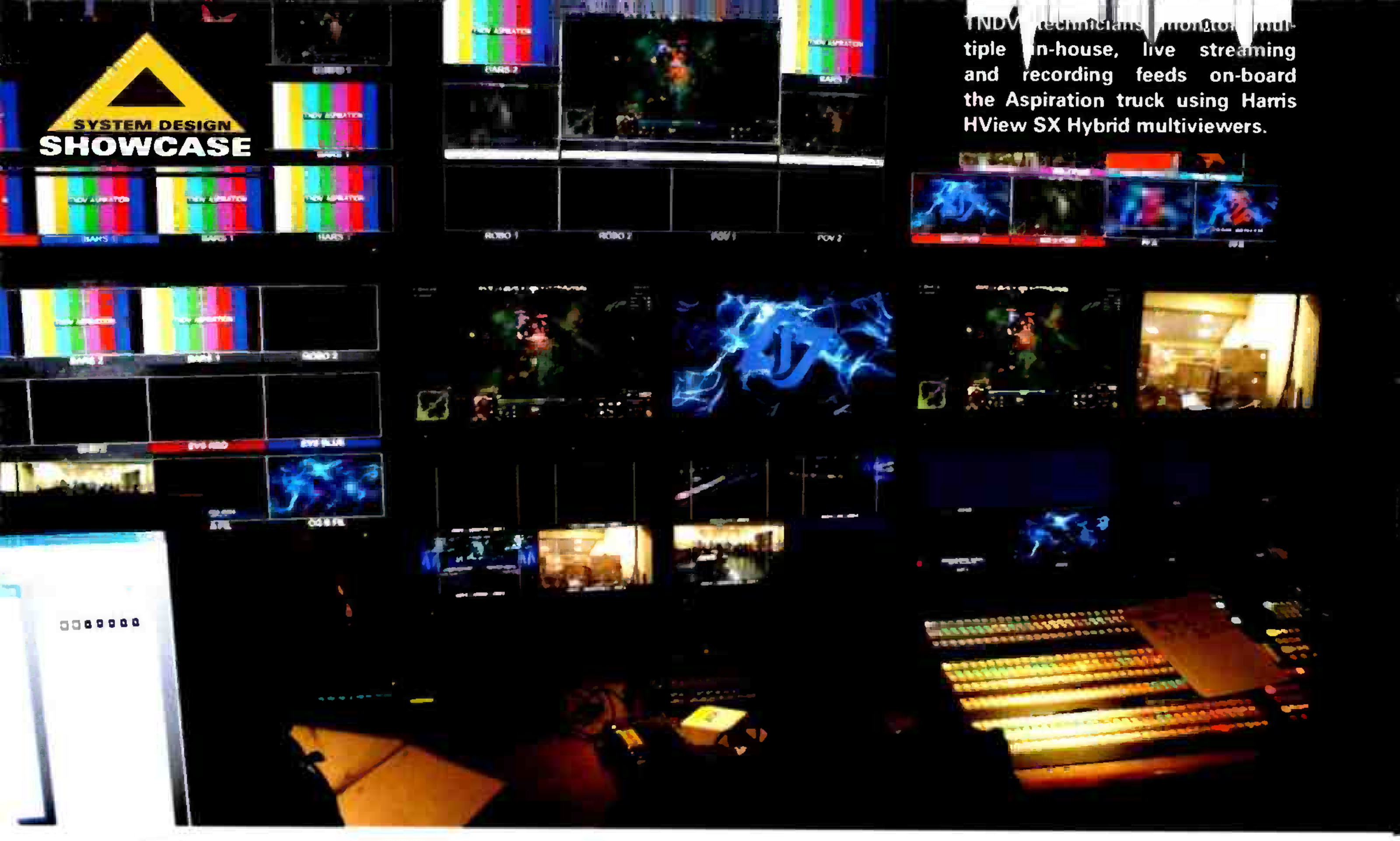
As the show has developed, the use of the file-based Avid-EVS interface has increased. Working with Avid and EVS, the workflow has been refined to improve file-transfer speed and clip management. BE

David Linick is manager, broadcast engineering for ABC broadcast operations and engineering.

Technology at work

Abekas: Mira servers
Avid: Symphony, Media Composer, Interplay media management, ISIS online storage, Pro Tools AudioSuite
Bosch: RTS ADAM intercom
Canon: 60X and 25X studio lenses, 17X handheld lenses, Telescopic Techno-Jib 24
Chyron: HyperX on-air graphics system
Cisco: Networking equipment
Cobalt Digital: Color corrector
DNF: Device control
ENCO: DAD TV networked audio record/playback system
Evertz: DVT display-wall processor, VIP-X multiviewer, EQX router, coax/fiber
EVS: XS servers, IP Edit, IP Director
HP: Near-line storage
Ikegami: HDK-725 and 725P cameras, camera monitors
NEC: Multiviewer monitors
Penta: Line/preview monitors
Riedel: RockNet mic/IFB distribution system
Ross: SMS server
Sony: MVS-7000X production switcher
Soundcraft: Compact 32 music mixer, Vi4 FOH mixer
Studer: Vista 9 audio console

SYSTEM DESIGN SHOWCASE



TNDV technicians monitor multiple in-house, live streaming and recording feeds on-board the Aspiration truck using Harris HView SX Hybrid multiviewers.

The International Dota 2 Championships

TNDV and Graystone Media joined forces for the three-day gaming event that was broadcast to three continents in three languages.

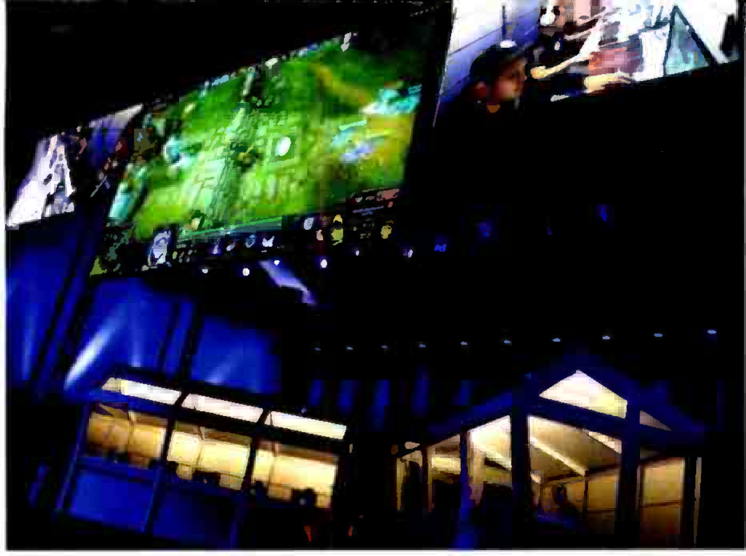
BY NIC DUGGER

The intensity of the gaming universe continues to reach new heights, with astonishing technical advances every year. The audiences who witnessed the early September events at Benaroya Hall in Seattle saw something truly special, as the broadcast and gaming worlds blended for a truly unique event.

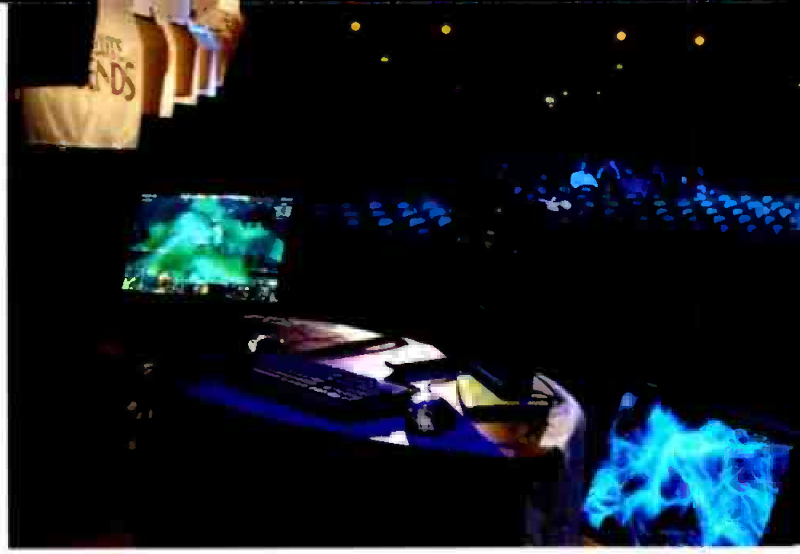
The venerable 2500-seat performance hall in the downtown area was host to "The International Dota 2 Championships," a three-day gaming event that brought 16 teams together to compete for the 2012 Championship Title — and a $1 million prize. Dota 2 is the follow-up to "Defense of the Ancients," a multiplayer online battle arena video game with global popularity.

Dota 2 game developer Valve Corporation hired Trifilm as the event producer, which turned to Graystone Media for its experience in sports-style TV production. Graystone Media contracted Nashville-based TNDV to bring its live mobile production experience and professional broadcast equipment arsenal to the show.

Together, the various arms married a broadcast-quality sports production model to this international gaming event — while juggling the creative complexities associated with



TNDV crew members captured on-stage game action for the in-house projection using Hitachi, Sony and Panasonic cameras, while Graystone Media worked with TNDV to deliver full-screen graphics with team information and 1080p-quality visuals. Barco ImagePRO-3G signal processors were used to scale and transcode video.



Trifilm editors were able to instantly receive a specific camera feed on request, fed over a Harris Platinum router, while communicating with TNDV technicians over the RTS Intercom system.

delivering both colorful, in-house HD projections and demanding live, multilingual broadcast streams for worldwide audiences. The days were also long, with live streams rolling from 8:30 a.m. to 1 a.m. for three straight days.

Setting the stage

TNDV drove its 40ft expanding side truck, Aspiration, to Seattle for the production. Aspiration is built to handle large entertainment events, with a complete HD (and 3D-ready) infrastructure ready-made for everything from live sports to major concerts and awards shows. The truck includes a large Harris Platinum routing solution (with integrated multiviewers), Vision production switcher, Soundcraft Vi4 audio console and a bank of AJA Ki Pro video recorders among other technology.

The presence of several commentator desks made the sports production model especially vital. The configuration replicated a sports network environment, with several host positions at each desk. The unusual aspect was play-by-play and color commentary in different languages — English, Chinese and Russian — which set the stage for a complex and challenging audio configuration.

TNDV first evaluated the venue to strategize the most effective acquisition plan for the live shoots. Multiple cameras were required: six Hitachi HD5000 cameras for fixed positions and handheld use; two Panasonic AW-HE120 robotic cameras, positioned and balanced on pods; and two roving Sony EX3 cameras to capture backstage action. Onstage, teams of five competed against each other within custom-built player pods, each outfitted with Sony HXR-MC1 POV cameras for close-ups of player reaction.

SMPTE fiber accommodated lengthier camera runs. Straight copper-based BNC connections worked for backstage and venue-to-pod runs under 280ft. Elsewhere, 1000ft, 12-fiber bundles were used, with AJA FiDO conversion bricks to convert fiber signals back to 1080i HD-SDI at the destination.

Sony PVM-1741 OLED monitors allowed the

production team to color-match the different camera models, providing a consistent look across all in-house and external broadcast signals. The Sony Ex3 cameras were specifically chosen for both outstanding image quality and the simplicity of color-matching to the Hitachi cameras. ChromaDuMonde color calibration charts from DSC Labs were employed to build custom theme files for every camera.

The various camera models and positions captured a lively and intense atmosphere for the in-house projection, while also giving external audiences more control. Viewers could choose which cameras they wanted to watch, allowing them to focus on the team or player they wanted, follow certain analysts, or check out the backstage action.

Viewers could also opt for a full-screen version of the player computers, enabling them to view the action as if they were playing the game. To accompany the video selections, viewers could choose from three audio streams covering the aforementioned languages.

Behind the scenes, Graystone Media operators followed a live Twitter feed from viewers around the world, making adjustments to sound and video based on immediate feedback. This integration of social media into the live monitoring process only served to enhance the viewer experience.

Quality viewing

TNDV's infrastructure typically produces 1080i HD broadcasts for televised events. The team quickly discovered that 1080i nearly equates with standard definition in the gaming world. It was clear that every pixel and graphic on that screen would be critiqued — all the more intimidating as that judgment would come from gaming experts who create pixels for a living.

Modern gaming offers very high resolutions, with an amazing amount of on-screen detail. We added several Barco ImagePRO-3G signal processors to scale and transcode video for 1080p-quality output. This translated the game's finer visual details well, with in-house attendees and viewers able to clearly see the flares, sparkles and flashes that take place when an on-screen character casts a spell.

Those seated in the venue were, therefore, treated to exceptional projections, with three distinct screens. Team A and Team B were seen at left and right, with a center screen switch of the various cameras and real-time computer-screen shots.

The Graystone Media team worked closely with TNDV on delivery of graphics, using Chyron HyperX systems on Aspiration to build a database of graphics packages for playout. Trifilm worked closely with Valve on graphics creation, providing head shots, team shots, player statistics and full-screen graphics with team information among other impressive visuals.

Graphics accompanying the live video were carefully balanced for required variances for live AV projection (big and robust) and web streaming (small yet legible). Graphics, however, were just one component where careful considerations were made to ensure a unique experience for both the venue and the broadcast.

Backstage at the championships, a row of busy technicians monitors the multiple servers processing the various vantage points of the live games in play. Many of these views were available as real-time sources on the Ross Vision switchers.

Signals everywhere

The multitude of video and audio signals crossing the venue was a lesson in intricacy. TNDV came treacherously close to fully populating the router and associated I/O panel as the connections mounted.

This was chiefly due to the fact that the team was, in actuality, producing three shows. The main show was the on-stage battle. The lobby, with the analyst desks and live game play breakdown, constituted a second show. Meanwhile, the backstage area represented a third show, complete with live post-game player interviews and strategic discussions.

The juggling act required a complex web of video and audio distribution, with signals racing between Aspiration and the three production locations. Meanwhile, front of house engineers tapped into the truck routing system for projection, while Trifilm and Graystone representatives traded signals with TNDV staff from live edit stations.

The complexity of the show required that TNDV use all 64 Platinum router inputs and outputs. The Vision switcher provided nearly 32 inputs (including four built-in still store channels), accommodating all 13 cameras among many other sources. These included Newtek 3Play instant replay servers (four channels), multiple Final Cut Pro editing systems, three gaming computers and two channels of graphics — all routed to AJA Ki Pro recorders, streaming servers and other destinations.

The recorders, in tandem with Final Cut Pro, supported ProRes 4:2:2 from capture to playback, offering an efficient HD workflow from start to finish. Blackmagic Design converters on the truck also figured into the editing workflow, connecting to Mac laptops via Thunderbolt. This allowed TNDV engineers to immediately play back recorded clips during breaks in the action.

The Harris Platinum router was critical in passing these signals between each location. Aspiration's technical director used LCD routing control panels to initiate feeds to and from the truck with ease, accuracy and

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reliability. A Trifilm editor, for example, would instantly receive a specific camera feed on request, communicating with a TNDV technician over the RTS Intercom system. The router panels also enabled multiviewer control, multi-route salvos and GPI event triggers.

Harris also provided an edge server as part of the router package, configured over single, truck-connected Wi-Fi drop. The server supported custom-creation of virtual router panels in HTTP-accessible web interfaces. This gave multiple operators their own router interfaces — ideal for the many editors asking for constant feed changes. It also saved an enormous amount of time and money, eliminating the need to rent physical panels and run control lines (and power) across the venue.

The router's integrated Harris HView SX Hybrid multiviewers were integral, allowing engineers to set one of the PiPs to follow the output of a router destination without needing to re-enter the signal into the router as a source.

Traditionally, monitoring resources are wasted when using non-integrated configurations if "confidence" of what the router outputs to a certain destination is desired. The integrated Platinum and HView configuration shares all sources and destinations, eliminating approximately one dozen router I/Os and distribution amplifiers. This is extremely useful when producing such a massive show on a 40ft production truck.

The multiviewers automatically displayed the name and type of signal, with embedded audio meters for each routed source. This gave the entire production team the confidence to stay on top of all feeds at the very end of the production chain.

The routing system also accommodated five in-house feeds for house projections and analyst stage monitors, as well as external multilingual audio feeds for the web streams. Three separate closed caption encoders were also keyed in live for interview translations to and from Russian and Chinese.

Design team

Valve Corporation: Dota 2 game developer
Trifilm: Event producer
Graystone Media: Sports-style TV production
TNDV: Aspiration 40ft mobile production truck

Technology at work

AJA: Ki Pro video recorders; FiDO conversion bricks
Barco: ImagePRO-3G signal processors
Blackmagic Design: Converters
Chyron: HyperX systems
DSC Labs: ChromaDuMonde color calibration charts
Final Cut Pro: Editing systems
Harris: Platinum routing solution with integrated multiviewers; HView SX hybrid multiviewers
Hitachi: HD5000 cameras
Mac: Laptops with Thunderbolt connectivity
Newtek: 3Play instant replay servers
Panasonic: AW-HE120 robotic cameras
Ross Video: Vision production switcher
RTS: Intercom system
Sennheiser: Headsets
Sony: EX3 cameras, HXR-MC1 POV cameras, PVM-1741 OLED monitors
Soundcraft: Vi4 audio console
Studio Technologies: Talent boxes

Multiple languages

Audio was perhaps the greatest challenge, from the sports desk commentary to the multilingual web streams. All of these mixes were switched at the truck and routed with their respective video feeds to their destinations.

The RTS Intercom system supports a total of 14 IFB feeds, each with a dedicated mix-minus feed, to the English, Chinese and Russian commentary desk. All commentators used Sennheiser headsets and talent boxes from Studio Technologies complete with microphones and talkback buttons.

TNDV ran four DT12 audio cable runs between the truck and the commentator desks, spanning from 100ft to 750ft. Analysts would typically go on the air for 20 to 30 minutes between brackets as the next teams prepared to compete. The English broadcast comprised four analysts in the lobby, with two additional analysts offering color commentary from the other side of the venue.

One of the Russian commentators, unable to gain access to the United States, remained home. A T1 phone line connection between the truck and the commentator's home allowed him to contribute to the live discussion. TNDV delivered the main program audio mix over this line, which the venue provided.

A second phone line was used for Chinese-to-English closed captioning. An on-site Chinese translator monitored the broadcast and translated the discussions to English. Meanwhile, an off-site closed caption operator monitored the phone line and typed captions using a special proprietary modem. This allowed TNDV to add captioning tags onto the screen.

Back on the truck, audio engineers used Aspiration's Soundcraft Vi4 console to pair auxiliary feeds and deliver the separate multi-lingual mixes as separate stereo auxiliary feeds. The Soundcraft design allows engineers to hear auxiliary solo mixes in stereo to ensure that the mixes arrive at their destination sounding great — an ideal confidence monitoring tool for live production. Most sends and some receives were distributed as embedded audio via the Platinum router.

TNDV and Graystone Media applied a sports production model to this gaming event, with several commentator desks offering play-by-play and color analysis in English, Chinese and Russian. Commentators used Sennheiser headsets and Studio Technologies talent boxes with mics and talkback buttons.

Overall, this layered production was a unique marriage of HD production and live streaming with broadcast integrity — and an innovative presentation of a gaming tournament within a traditional sports coverage model. The combined efforts of Valve, Trifilm, Graystone Media and TNDV turned a challenging and unusual production situation into an example from which we and others can learn and grow. **BE**

Nic Dugger is president of TNDV. Josh Echo-Hawk, vice president of business development for Graystone Media, contributed to this story.

Where is the industry headed?

BY ADRIAN DRURY

Events in 2012 such as the Olympics and the U.S. presidential debates have reaffirmed the value of event-based television programming as a core component of the global media services landscape. However, other ongoing changes in both audience and advertiser behavior continue to transform the media and broadcast industries. As the physical distribution networks change, the ways consumers consume broadcasts also are changing. This requires content production and delivery professionals to re-examine the capabilities and design of their system architectures.

In July and August 2012, in association with Avid, Ovum conducted an independent survey of 200 senior broadcast, pay-TV, studio technology and operations executives to better understand where these industry leaders see the industry going.

Customized viewing

The results are revealing. Seventy-eight percent of respondents say that over the next decade, most content will be customized for individuals. This represents an inversion of the existing broadcast business model. Rather than create a single stream of content for an undifferentiated mass audience, tomorrow's successful businesses are being challenged to create multiple orchestrated streams of media and deliver it across many different devices.

With this in mind, the survey asked, "What share of total television viewing, in terms of share of total viewing time, will be delivered via the web in 2017?" We provided ranges designed to give a neat bell curve. We got back a skew. (See Figure 1 on page 38.) As of Q4 2012, approximately 3.5 percent of average weekly viewing time per household was via the web. Yet, 44 percent of the survey respondents believe that the percentage of web-based viewing will rise above 20 percent by 2017 (about 29 minutes per day). An additional 27.5 percent of the respondents believe that 30 percent of household viewing time, or more than 44 minutes per day, will be web-based.

Despite this shift, the market remains bullish. Sixty percent of respondents believe that the broadcast market will strengthen over the next five years, with 28 percent neutral and 12 percent predicting contraction. This is a more positive outlook than Ovum has seen in comparable studies conducted in 2009

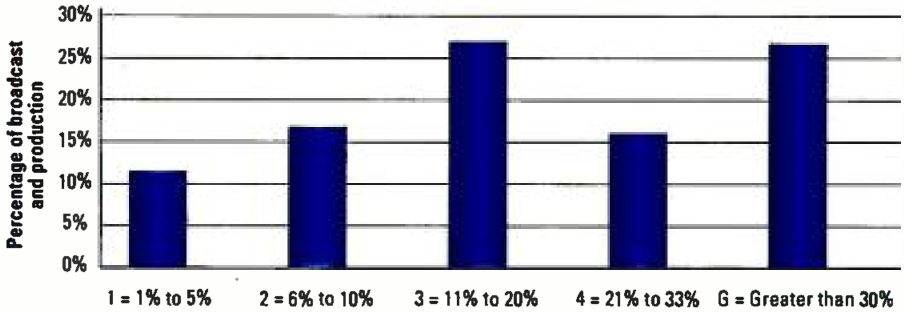


Figure 1. Forty-four percent of the survey respondents believe the percentage of web-based viewing will rise above 20 percent by 2017 (about 19 minutes per day). An additional 27.5 percent of the respondents believe that 30 percent of household viewing time, or more than 44 minutes per day, will be web-based.

and 2010. So, what is the source of this positivity, and what will drive it?

Conventional wisdom has held that multi-screen services will erode broadcaster revenues. Yet the data indicates that the market believes multi-screen services will be the primary source of growth, followed by increased linear audiences as a direct consequence of second-screen on-demand and companion services. Eighty-five percent of respondents state that getting their multi-platform distribution strategy right — content, marketing, pricing, operations and architecture — is critical for future growth opportunities.

Infrastructure changes

The data shows an understanding that an important component to enabling growth of multi-platform services are new approaches to media asset management. New workflows will require file-based solutions to help media producers orchestrate not just video and audio content, but also the media's associated metadata. It's this metadata that will enable a new level of workflow automation and optimization. Why is that important? Because automation will be required to achieve the scale necessary to produce the increasingly personalized content that audiences will demand. Respondents believe that such metadata-driven workflows will drive operational agility, create OPEX savings and ultimately lead to new business models.

While there are many new opportunities to monetize content, most media organizations admit that they cannot even access the programming they own. Survey respondents estimate that on average, more than 35 percent of their archives have the potential for profit but that those programs are inaccessible today — primarily because of technological reasons.

The cloud and metadata

The ability to profitably embrace new distribution and service personalization models will require cloud technology. Yet fewer than 25 percent of broadcasters are actually using cloud today. Even so, more than 75 percent are currently exploring future cloud deployments.

By systems component, multi-screen distribution is the most commonly deployed application in the cloud today. The next most popular cloud-based task is storage. However, the applications that will see the fastest transition to the cloud are editing and production systems.

This illustrates that the cloud is not just going to be driven by cost savings. Cloud-based collaboration platforms are a major enabler of new flexible ways of working. This, of course, has implications for the design of the broadcast and production facilities. Forty-eight percent of respondents believe that the production facility will become completely virtual with five years. That share rises to 72 percent over 10 years.

So what's next for workflow automation? The majority of respondents, 75.5 percent, said that automated metadata and title annotation will be where they look next for automation.

Beyond tomorrow

This study then asked respondents to think out to 2022. Looking at a set of core strategic issues, 74 percent believe that in 10 years, cloud-based regional content exchanges will have revolutionized the premium video supply chain. More than 81 percent of respondents believe that all premium video services, both live and non-live, will be delivered via the web. Even so, these professionals believe that the *schedule*, in some form, will continue to exist and that linear curation will still be the backbone of the industry. However, tomorrow's consumer viewing schedule will be customized, with 78 percent of respondents seeing broadcast services being fundamentally personalized by 2022.

So what is the underlying message? It is this: Multi-platform distribution, companion device use and adjacent technologies such as social media will force this industry to embrace a personalized content service model. This means broadcasters need to be prepared to deliver content on both traditional and non-traditional platforms and be prepared to quickly implement these changes.

If 2017 audiences will be watching 44 minutes per day of premium entertainment video via the web, then broadcasters need move quickly to build the system architecture and organizational model to position themselves to take advantage of these changes.

For a detailed report on the survey findings, go to: *http://apps.avid.com/ovumreport/*. BE

Adrian Drury is Lead Analyst, Media & Broadcast Technology & Services, Ovum Research.

+ ADDITIONAL RESOURCES +

The following are available on the *Broadcast Engineering* website:

- Realizing the benefits of cloud storage
- Second screens vulnerable to OTT takeover in Europe
- MPEG founder urging broadcasters to give up infrastructure, rally behind DASH

Managing audio LOUDNESS

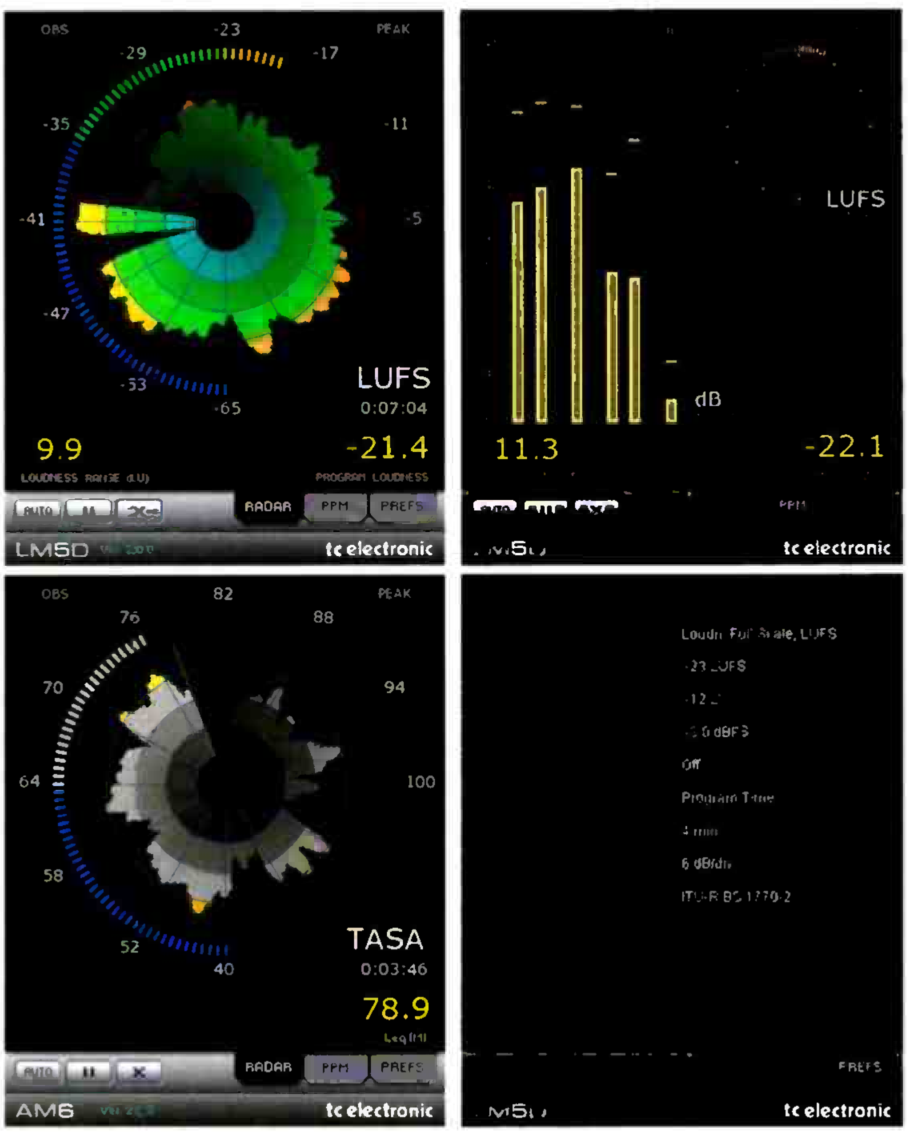
Uniform loudness across platforms is the goal.

BY THOMAS LUND

With the CALM Act now in effect, stations need strategies for managing audio loudness — preferably for a wide variety of broadcast platforms. This article details the loop spanning from production to multi-platform delivery, paving the way for high-quality audio across genres, platforms and borders.

As the number of listeners per stream goes down, and in combination with a more dynamic and less predictable consumer environment, it is important for broadcasters to consider five factors before committing to any change of station operating procedure: 1) Are we addressing listener concerns? 2) How well does a technique cater to the station's majority of programs? 3) Does it reduce content creation time? 4) How does any procedure facilitate cross-platform distribution? and 5) Will any decision limit potential options, or will we retain the freedom to maneuver in the future?

Because the same measurement may be applied in production, ingest, transmission and logging, a transparent loop can be established from production to multi-platform. The loop may even be closed, with feedback from logging used to improve step by step.



This radar shows loudness history in broadcast production, compliant with ITU-R BS.1771 (upper screen shots), or "annoyance" in movie trailers as defined by TASA (lower screen shots). Bar-graph meters show true peak.

To help this transparent loop, Loudness Range (LRA) is a statistical tool for making objective mixing and processing decisions. It quantifies the level variation with a time-varying loudness measurement. LRA is supplementary to the main audio measure, Program Loudness, of ITU BS.1770-3. LRA measures the variation of loudness on a macroscopic time-scale, in LU (loudness units).

Normally, broadcast should not be mixed like a cinema movie, nor like a pumped-up commercial, and LRA provides a simple value at which to aim. Figure 1 on page 40 shows loudness changes in a clip from the movie "Pulp Fiction": Relatively loud music plays until halfway through the clip, when the scene changes into dialogue. Both scenes sound even in loudness, but the first scene is noticeably louder than the second. The 3s time scale seems ideal for measuring the magnitude of that macro dynamic change; the 1s time scale shows the same tendency but more noisily, and the 10s time scale blurs the change unnecessarily. LRA catches this difference because it is tuned to time scales relevant to film, broadcast and music.

Used during ingest or on a broadcast server, LRA is an objective measure used for deciding when programs for delivery to certain platforms require range restriction. HD platforms may be set to tolerate any LRA value, though a limit such as 12-, 15- or 20LU, depending on genre, may be recommended in delivery guidelines. Downstream of production, LRA doesn't change as long as gain offsets only are applied (normalization), but the number reveals if any significant range processing has taken place between two points in the broadcast chain. LRA may also serve as a logging tool, verifying that no range processing has happened during distribution, or in a codec.

For programs shorter than 30s, LRA is not suitable. Short-term or Momentary loudness are the metrics to use for preventing such programs from becoming too loud.

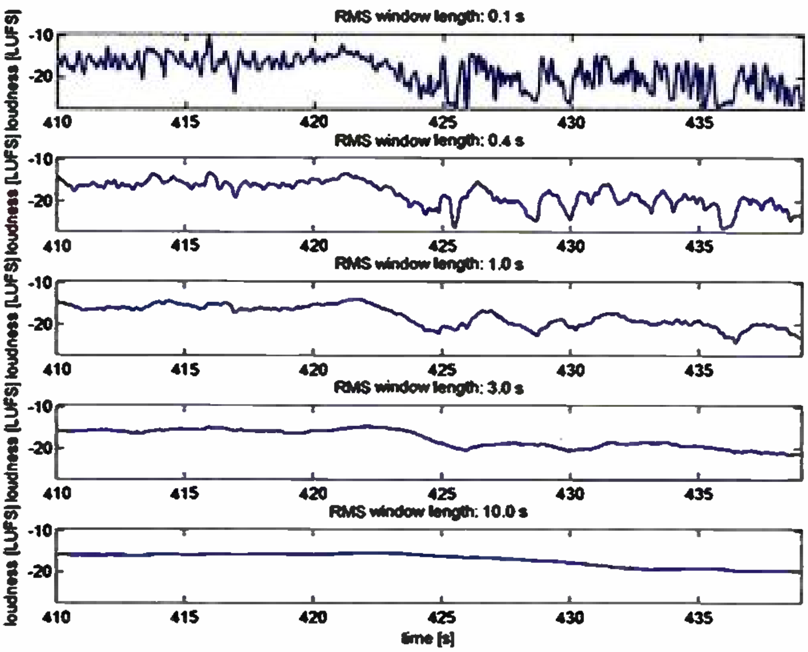


Figure 1. Shown here on different time scales is the absolute loudness of the movie "Pulp Fiction," from 00:06:50 to 00:07:20.

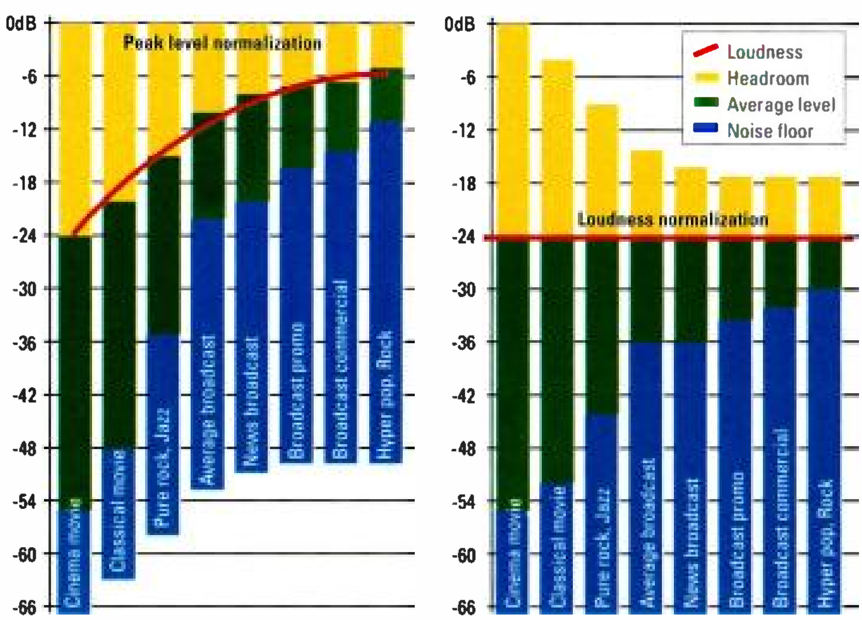


Figure 2. The headroom requirement is genre-dependent, ranging from 20db in cinema movies, to 6dB or even lower in commercials and pop/rock music.

iPod and mobile TV

Mobile and computer devices have a different gain structure and make use of different codecs than domestic AV devices such as television. Tests have been performed to determine the standard operating level on Apple devices. Based on 1250 music tracks and 210 broadcast programs, the Apple normalization number comes out as -16.2LKFS (Loudness, K-weighted, relative to Full Scale) on a BS.1770-3 scale. It is, therefore, suggested that when distributing podcast or Mobile TV, to use a target level no lower than -16LKFS. The easiest and best-sounding way to accomplish this is to: 1) Normalize to target level (-24LKFS); 2) Limit peaks to -9dBTP (Units for measurement of true peak audio level, relative to full scale); and 3) Apply a gain change of +8dB. Following this procedure, the distinction between foreground and background isn't blurred, even on low-headroom platforms.

Headroom in broadcast

The ratio between max peak level and average operating level is called headroom. Using BS.1770, headroom can be regarded as the ratio between true peak level and program loudness. The amount of headroom is genre-dependent, as is shown in Figure 2.

In commercials and pop/rock music, the headroom requirement can be 6dB or even lower, while a cinema movie may need more than 20dB. Furthermore, movies and classical music only need this headroom for a short period of time, while "beat music," in general, requires the same amount of headroom from start to end.

When a signal path offers less headroom than required for conveying a program, limiting or clipping will result.

Unfortunately, every part of the signal path may constitute a headroom bottleneck, so broadcast doesn't sound better than its weakest link. In analog broadcast, headroom is frequency-dependent, with less at high frequency because of transmission emphasis. Analog TV has a headroom of 10dB to 12dB, while FM radio is often operated with 8dB or less.

In digital broadcast, noise is generally lower, and emphasis is no longer part of the equation. Consequently, a lower average level in combination with a higher peak level is now a possibility. With target and peak level specified by ATSC A/85 (-24LKFS/ -2dBTP), a generous 22dB of headroom is available. This is more headroom than broadcast has ever had.

Used for stereo only, the AC-3 codec isn't more sensitive than other codecs at a similar bitrate with regard to the max true peak level it handles without clipping. If a typical pop/rock track is encoded without attenuation, AC-3 clips frequently, but if the same track is attenuated so peaks don't exceed -1dBTP, the problem is solved.

The real challenge with AC-3 and headroom is the way 5.1 is handled. The majority of consumers are listening in stereo, so if AC-3 is transmitted without an independent stereo stream, the decoder has to downmix every 5.1 program that comes along. This is where problems start. The decoder doesn't include a transparent downmix limiter, so one option is to use conservative mix coefficients to avoid stereo overloads: L, R: -6dB; center: -9dB; SL, SR: -12dB. Now there will be no mix overloads, but systematic level jumps will occur when switching from native 5.1 to native stereo.

The real peak level problem in AC-3 doesn't come from the data reduction itself, but from the downmix section in the decoder. If broadcasters could keep peak level low, decoder mix coefficients wouldn't have to be conservative. On the other hand, it would be a shame if a general restriction of headroom in broadcast was inflicted because of first-generation codecs with technical design issues.

Recent experiments have pointed to a solution more tolerable than using a general limit threshold at -6dBTP. In 5.1 action movies, the center channel generally uses more of its headroom than the other channels. The AC-3 downmix solution is, therefore, simple: Use -6dBTP limiting for all the lateral channels, but -3dBTP for center.

The future of loudness

Even today, stations need to serve different platforms, and in the future, that number may well increase. Also, each platform may have a unique target level to aim at; this scenario calls for a flexible technical setup that's able to handle this task.

In a perfect world, the average audio loudness would be even across a full day of broadcast and across all genres and channels, meaning that browsing dozens of TV channels wouldn't provoke a constant need to adjust the volume. But, even better, uniform loudness would also be the case — regardless of whether you turn on the TV, put on a video podcast or stream a YouTube video.

We may not be there yet, but technological breakthroughs, definitions of broadcast standards and legislation on loudness indicate that this is the direction in which we are headed. Station engineers should keep these practices in mind, along with the ever-changing need to support a variety of broadcast platforms — each with its own audio performance requirements.

Following the guidelines given here makes the distribution of quality audio to multiple platforms easy and codec-agnostic. BE

Thomas Lund is HD development manager at TC Electronic.

+ ADDITIONAL RESOURCES +

The following are available on the *Broadcast Engineering* website:

- Normalizing dialog
- Mitigating loud commercials
- High-level production values keep "The Voice" strong

JVC's GY-HMQ10

The 4K2K camcorder provides excellent HD exports.

BY STEVE MULLEN

The JVC GY-HMQ10 is the first handheld camcorder capable of capturing and recording 3840 x 2160 images at 24p, 50p and 60p. The camera employs an F2.8 to F4.5, 10X, f=6.7mm-67mm (42.4mm-424mm) zoom lens specifically designed for 4K imaging. The HMQ10 employs optical stabilization.

The GY-HMQ10 is capable of recording 1920 x 1080 at 50/60p or 50/60i onto a single memory card using the AVCHD format.

A high-speed 1/2.3in back-illuminated CMOS sensor with 8.3 million active photosites (3840 x 2160) captures progressive images at up to 60fps. Data from the sensor are processed using an array of custom JVC Falconbrid LSI chips that deBayer the image and provide image control, while simultaneously compressing four video streams that are recorded onto four solid-state memory cards. Two-channel 48kHz, 16-bit audio is recorded using AAC compression.

Each full HD (1920 x 1080) stream is compressed using AVC/H.264 (.MP4) at 36Mb/s for an aggregate data rate of 144Mb/s. Recordings up to two hours in length can be made using four 32GB SDHC cards.

The unit also functions as a full HD camcorder capable of recording 1920 x 1080 at 50/60p or 50/60i onto a single memory card using the AVCHD format. Two-channel 48kHz, 16-bit audio is recorded using AC3 compression. The recording maximum data rate is 24Mb/s.

Operation and form factor are similar to JVC's GY-HM150, with manual or auto focus, plus white balance, gain, shutter-speed and aperture controls. A pair of XLR jacks with 48V phantom power, manual audio level controls and audiometers are provided.

The camera has a 3.5in, 920,000-pixel LCD display with touch panel, as well as a 0.24in, 260,000-pixel LCOS viewfinder.

Quad HD technology

Every 1/24, 1/50 or 1/60 of a second, 8.3 million (3840 x 2160) photosites are read-out from the CMOS sensor. These data comprise four full HD quadrants. (See Figure 1.)

Each Falconbrid chip carries out the following actions on data from its quadrant: deBayering, necessary gamma and color matrix functions, and then it provides output to three paths. One path provides image data to the Falconbrid on-chip H.264/AVC encoder. After compression, each Falconbrid sends 36Mb/s of data to one of four SDHC card slots. The second path is to the HDMI output port for that quadrant. With four active HDMI ports, the HMQ10 can feed some, but not all, 4K2K monitors. (These four ports, during Quad HD playback, become a source for a 4K2K display.)

The camera has a 3.5in, 920,000-pixel LCD display with touch panel, as well as a 0.24in, 260,000-pixel LCOS viewfinder.

The third path feeds a quadrant of the image to the LCD, the viewfinder and one HDMI port. The image output by HDMI "A" port is full HD video. (During Quad HD playback, the camera can optionally output a user-positioned full HD crop.)

Shooting tips

The camera has two unusual characteristics for a modern HD camcorder. First, the small, high-density chip has a low sensitivity to light. Second, to limit diffraction, the minimum

Figure 1. Shown here are 1920 x 1080 images in the 8.3-megapixel CMOS sensor.

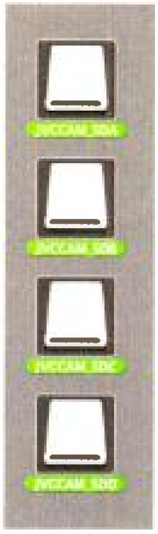


Figure 2. Four SDHC cards will be mounted on the OS X desktop.

aperture setting is f/5.6. Therefore, special steps are needed to obtain the best picture quality in both low-light and bright-light conditions.

Outdoors in open shade, or a well-lit area, the camera will be biased toward a 1/30 of a second shutter speed. Thus, wide open at f/2.8, when you set the shutter speed to 1/60 of a second, the picture may be too dark unless you add +6dB gain.

Special steps are needed to obtain the best picture quality in both low-light and bright-light conditions.

Conversely, in bright situations, you'll need to use either of the following tactics: Set the shutter speed to 1/120 of a second and mount a 2-stop ND filter; or, use a 4-stop ND filter with a 1/60 of a second shutter speed.

Quad HD ingest

When the camera is connected to a Mac using a USB cable, all four SDHC cards will be mounted on the desktop. (See Figure 2.)

Launch JVC's 4K Clip Manager utility (it ships with the camcorder). Select the clips you want to ingest and issue the File>Export… command. Next, select the desired version of ProRes 422 and select the export folder. Click the Export button. (See Figure 3.)

Once the clips have been exported, they can be edited using Final Cut Pro, Final Cut Pro X or Media Composer. (Editors working under Windows can move ProRes 422 files to their PC for editing with any NLE that imports ProRes 422, such as Media Composer.)

Quad HD edit — Final Cut Pro X

When a user opens a new project in Final Cut Pro X, define a custom 1080i59.94 (or 720p59.94) setting. (See Figure 4.) Of course, if a user is

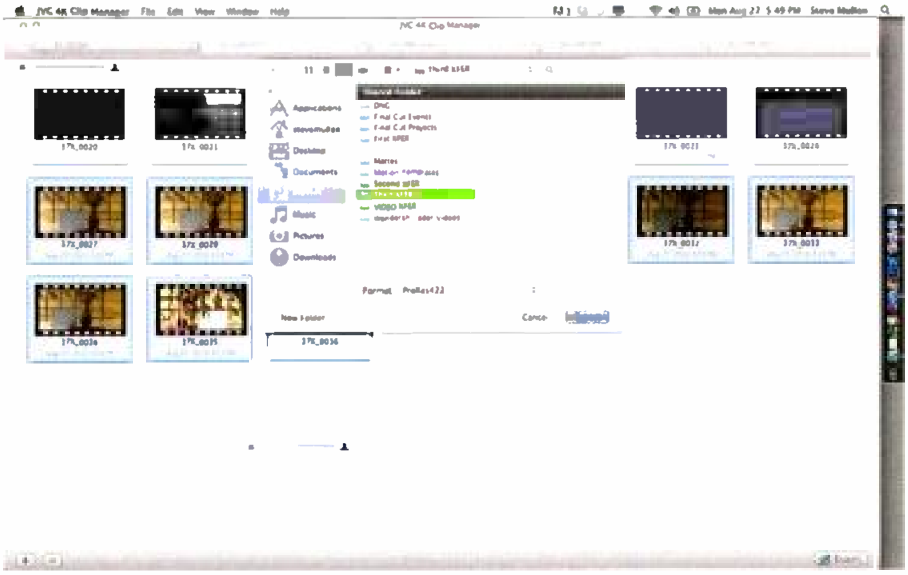


Figure 3. The JVC 4K Clip Manager allows users to export clips after they have been ingested and the desired version of ProRes 422 has been selected.

working with 2160p23.98 source files, he or she will want to create a 1080p23.98 project. For advanced projects, the user can export 1080p59.94 as well as 2160p23.98 and 2160p59.94. (In the latter two cases, 3840 pixels will be pillarboxed within 4096 pixels, and thereby provide a 4K2K export.)

When you import Quad HD source material, Final Cut Pro X can automatically make ProRes Proxy files that play well even on a MacBook Air. During file export, the original Quad HD source material will automatically be downscaled to HD.

For more about editing using Pro X, consult the "Shooting Quad HD for HD projects" article in the November 2012 issue of *Broadcast Engineering*.

Quad HD edit — Avid Media Composer V6

Though Media Composer cannot export video larger than full HD, it can import Quad HD files. ProRes files can be imported and converted to DNxHD files or be accessed for editing using Media Composer's AMA function.

Once a Sequence is created, apply static or dynamic crops to timeline clips. Then, apply the Resize filter that downscales 3840 x 2160 to 1920 x 1080. (See Figure 5.) To create a dynamic crop, at the point where a pan begins, set up Position parameters and click the Keyframe button. Move to the pan end. Set up Position parameters, and click the Keyframe button.

The HMQ10 is easy to use in well-illuminated situations and delivers a beautiful HD export. **BE**

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

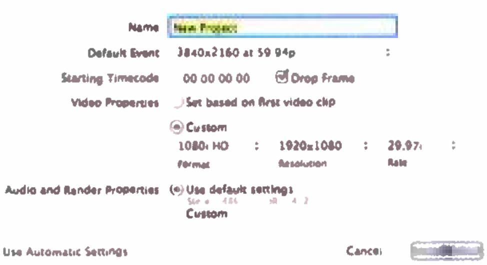


Figure 4. A user can create a 1080i or 720p project in Final Cut Pro X.

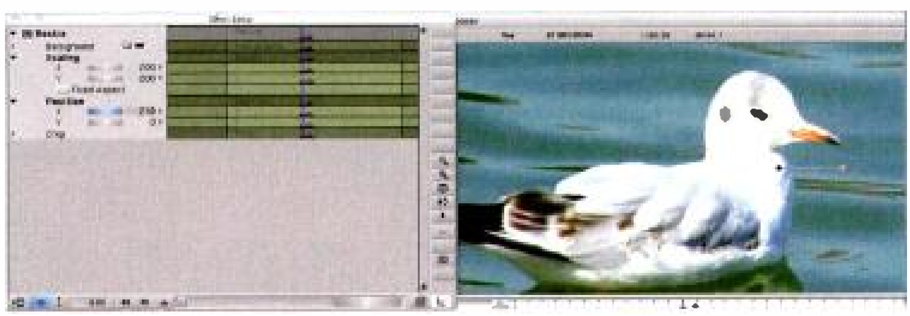


Figure 5. Scaling at 200 x 200 places a 1920 x 1080 window in a 3840 x 2160 frame.

NVerzion's CLASS

Traditional and IT automation systems square off.

BY PHILIP REID

As broadcasters evolve to completely file-based workflows, they increasingly rely on station-in-a-box (SIB) automation systems. SIB systems collapse many of the pieces that constitute a traditional master control and playout chain — including switchers, servers, graphics/channel branding, automation, and traffic/business service — into a single software platform powered by generic IT-based hardware. Although SIB systems provide simplicity and fast deployment, broadcasters are challenged to find a more robust solution that is capable of repurposing existing hardware in addition to offering easy scalability, a high level of reliability, full redundancy and guaranteed interoperability.

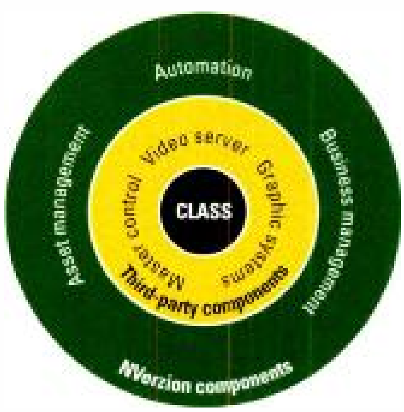


Figure 1. NVerzion's CLASS automation platform interfaces between a broadcaster's existing infrastructure and third-party hardware to allow the broadcaster to recover ROI on existing equipment.

Automation technology

The NVerzion CLASS (Component-Level Automation System Solutions) automation platform leverages partnerships with third-party companies in order to deliver a more seamless end-to-end broadcast experience for stations and viewers. Recognizing that a broadcaster relies on five key components (a router and/or master control, video server, graphics, automation and traffic/business service) to successfully transmit and manage its operations, CLASS offers all these products in one complete package. Alternatively, it works with a broadcaster's existing infrastructure and third-party hardware to offer a comprehensive platform, allowing broadcasters to capitalize on ROI for already purchased equipment, as shown in Figure 1.

Because the automation system can be easily implemented into an existing infrastructure, broadcasters have the flexibility to work with a variety of solutions, selecting the equipment that best meets their needs. Although many of today's SIB automation systems do not integrate with a station's business service or traffic system, the system has a central component related to sales and revenue. It also fully supports the Broadcast eXchange Format (BXF), therefore providing the full circle of continuity between the station's engineering and sales operations.

The automation system is based on a modular design that provides two key benefits to a broadcaster. First, there is no single point of failure. The flexible architecture enables a user to bypass any piece of equipment that isn't functioning correctly. If the graphics component fails, the station can bypass the graphics and still maintain the on-air signal.

Second, a station can determine how the automation is going to be used, down to the component level. A broadcaster can set up a single or multiple workstations dedicated to acquisition, preparation and distribution, and multiple users can simultaneously access the system. These workstations can be located anywhere in a facility, making the automation system easier to use and increasing a broadcaster's efficiencies.

The system is also scalable, an essential feature as today's broadcasters are increasingly adding and acquiring new channels. It allows a broadcaster to easily add new channels, without purchasing another workstation for each new channel. This means a broadcaster can control a large number of video servers from a single automation system, rather than operating a different automation box for each server.

The scalable architecture also enables a station to more efficiently manage its overall inventory, as media is recorded once played out once, and can easily be shared by all common platforms. By controlling a variety of components from one central platform, a broadcaster eliminates information overload, which decreases errors and increases reliability in delivering a high-quality television viewing experience.

As the broadcast industry continues to evolve, and new compression algorithms and technologies like 3-D graphics are introduced, it is even more important that stations deploy a reliable automation system capable of supporting these technologies and, in turn, generating revenue. Although IT-based automation systems are proficient at handling a specific task, they generally don't perform well when new processes are introduced. BE

Philip Reid is director of engineering at NVerzion.

CALMing audio quality

Content quality often pays the price for compliance.

BY TIM CARROLL

So, here we are, just on the other side of the start of enforcement of FCC rules concerning the loudness of commercials in digital television. Today, loudness issues are much better understood, and significant progress has been made with solving disparities. Things are noticeably better than before, except for one thing: Content quality largely pays the price for compliance.

Compliance is understood to mean a lack of regular complaints to the FCC by viewers. One technique is Automatic Gain Control (AGC), which raises or lowers gain on a sample-over-sample basis. This keeps audio loudness centered on a given static target. It is a relatively easy answer for compliance and is fully supported by both A/85 and the FCC Report and Order. However, AGC achieves its goal by more or less treating every shift similarly, correcting the bad — and the good. Everything gets a little something, whether it needs it or not. Sounds like a recipe for mediocrity.

Although there are sophisticated (and some unsophisticated) ways to accomplish AGC, no machine — regardless of manufacturer, topology or promise of magic outcome — can in real time know the difference between a good, intentional loudness shift and a bad, annoying loudness shift. Certainly, human-generated commands or automation can be used to change or bypass processing for content that is believed to be good, but thus far, this involves a great deal of effort and is uncommon.

Mix engineers have long resigned themselves to the fact that what was transmitted over analog television would be different from what they created. That was just the way it was. In today's digital world, there is not any technical reason why before and after cannot match. In general, this successfully occurs when films mixed for the big screen are transferred to DVD. Helpfully, the same audio coding system, Dolby Digital, is used for digital television.

Beyond average loudness

Looking more broadly at the program stream, loudness problems have to be considered both an issue of matching the average loudness of commercials and programs and one of inner-program consistency, also known as artistic dynamic range. Matching average loudness of different pieces of content does not solve the problem of jarring transitions. These occur at program boundaries and can be the result of a mismatch of dynamic range and/or the short-term loudness at the junction between the end of one piece of content and the beginning of the next.

Think of a program whose average loudness measures at one level and a commercial that measures at another level. If their averages are matched by scaling to a target, on average they will sound equally loud. However, if a dramatic program is ending with a quiet death scene (as they often do) and is quiet compared to the average of the 60 seconds leading up to the commercial, guess what is about to happen? Yep, the commercial will seem too loud. Guess what else? Meters will be totally happy, because they are looking at long-term averages. Viewers will not be so happy.

This is subtly different from intentional dynamic range variation, such as a loud train crash or gunfight in an action adventure movie, as it is an unexpected variation caused by automating disparate elements together, and it just sounds wrong. In fact, the difference in loudness in this case may be much less than the gunfight, but it is perceived as much worse.

Permanent AGC techniques can probably keep the passive couch potato happy, but the programming will be irreparably changed, and the producers probably will not be thrilled with the results.

The best producers know they must make programs dynamic and engaging for those viewing with surround systems, without going too far and alienating the core audience listening in stereo (estimated to be in excess of 70 percent of viewers), and all while remembering that there might be a dynamic commercial randomly inserted.

The "M" word

It turns out that transmission audio coding systems such as Dolby Digital (AC-3) and Dolby Digital Plus (E-AC-3) considered this issue long before it arrived into the consciousness of the industry. The thought was that by including additional data about the audio data, or metadata, the codecs could know more about the audio they carry and provide some features to help consumers better match the audio to their individual environment.

One such feature is a standardized loudness target referenced to what is arguably the most common feature in television programming: dialogue. Called dialnorm, it is intended to represent the average loudness of dialogue within a given program. The idea is that with dialogue as the "center point," variations above and below this average should be the dynamics of the audio — sometimes softer, such as background sounds or music, and sometimes louder, such as crashes.

For programs without dialogue, any anchor element can be chosen, and the dialnorm parameter provides simple scaling of the audio to match surrounding content. This process can also work the other way around, where dialnorm is set at a specific target, and the average loudness of all content is pre-scaled to match it.

Of course, the dynamics of programs may exceed a comfortable range, and so metadata also provides a rather sophisticated "distributed" dynamic range control (DRC) system. Audio is analyzed during encoding, and based on the reference loudness target (set by dialnorm), dynamic range control metadata values are generated. Instead of being applied to the audio, these are passed along as part of the metadata. At the decode side, the application of dynamic range control metadata is enabled by default, and programs can be delivered with a range more appropriate for a typical viewing environment.

However, and this is critically important, because the audio is untouched, dynamic range control metadata can also be ignored, and the original program will be delivered with no modifications for those who have the desire and the environment to support it.

But, there is currently a downside. By the very nature of how the content is preserved — separation of the audio and control data — things can easily go wrong with no warning.

Encoders are blissfully unaware of incorrect dialnorm values, but this can cause incorrect generation of the metadata dynamic range control words. Because these are applied by default in decoders, the audio will be impacted. Sometimes there will not be enough DRC, and sometimes it will be far too much. This makes upstream measurement and scaling critically important.

Dynamic range issues can step over regulatory targets, satisfy meters and still cause viewer complaints. The alternative of irreversible dynamic range control processing will lead to content that, although consistent, may be overly so. Like gravy without the occasional lump, the excitement of variance will be gone.

Can this be solved? Like using a hammer to install a screw, permanent dynamic range control gets the job done. However, there are better answers that are less destructive, less burdensome, and will preserve content (and your fingers). Stay tuned. **BE**

Tim Carroll is president and founder of Linear Acoustic.

+ ADDITIONAL RESOURCES +

The following are available on the *Broadcast Engineering* webs te:

- Normalizing dialog
- Mitigating loud commercials
- High-level production values keep "The Voice" strong

ONLINE For more information on these products, go to www.broadcastengineering.com.

SVP Broadcast Microwave — HDT-02

Multifunction transmitter accepts analog video, SD/HD-SDI and HDMI video input signals; analog, SDI embedded, HDMI embedded and AES audio inputs are available as standard; user data or GPS data can be transmitted over the data channel; an L band IF output is available, which enables users to use the transmitter as a satellite encoder and modular unit; allows terrestrial and satellite transmission simultaneously.

www.svpbm.com

Lawo — V_pro8

Compact video tool is designed for connecting different format video signals; delivers high-quality cross-format conversion and color correction; embeds and de-embeds audio; works as a flexible matrix system; with its 8 x 8 video matrix and 384 x 384 audio matrix, it's possible to switch any signal to any other signal.

www.lawo.de

DK-Technologies — DK4

Meter offers de-embedding of SDI 3G input channels; includes three AES and two analog inputs; adds FFT spectrum analysis, Screen Grabber and the MSD Meter Landscape View as standard features; is compliant with all known loudness recommendations, including EBU R 128, BCAP, ATSC A/85, ARIB, ABC, AGCOM 219 and ITU BS1770-2.

www.dk-technologies.com

Vizrt — OpenStreetMap integration

Viz World map and geographical animations tool now integrates with OpenStreetMap (OSM); with the new integration, Viz World users can access OSM community data from within the Viz World interface, effectively giving Vizrt users access to vector street data for most of the world.

www.vizrt.com

Ross Video — Carbonite 2

Two MLE switcher includes all the standard features of the Carbonite family; like the other switchers in the Carbonite range, the Carbonite 2 is available with 16 or 24 multi-definition SDI inputs and nine internally generated sources; can be configured with the new Carbonite+ and MultiMedia processing engines.

www.rossvideo.com

PAG — PAGlink

Battery reader enables users to display data stored in the microprocessor of PAGlink intelligent digital batteries; easy-to-understand alphanumeric display reveals the battery state of charge, as a percentage; up and down buttons can be used to reveal other categories.

www.paguk.com

FSR — Top Shelf

Provides an unobtrusive and secure enclosure for audio, video and network equipment; mounts to a wall close to the ceiling in locations without drop ceilings or where space above the drop ceiling is limited; holds up to 4RU of equipment with multiple mounting locations for power as well as signal connections for easy installation.

www.fsrinc.com

Christie — TVC-700

Display wall processor is PC-based and easy to use; is designed for the rigors of 24/7 control room environments; using PCIe bus architecture and state-of-the-art GPU technology, it provides ample graphics and processing power to support multiple inputs and outputs.

www.christiedigital.com

Schneider Optics — filter holder

Filter holder provides a sunshade that rotates independently; by allowing the sunshade and filter holder to rotate separately from each other, polarizing or graduated filters, which depend on maintaining precise orientation, can easily be used.

www.schneideroptics.com

Quicklink — contribution system

Developed with Blackmagic Design; lightweight, live broadcast system is designed for the journalist on the go; allows a journalist to shoot live video on a camcorder and connect it to the UltraStudio media encoder via an SDI or HDMI cable.

www.quicklink.tv

NUGEN Audio — ISL

True Peak limiter plug-in now supports the Avid AAX format; sound engineers using the ISL AAX plug-in have complete control over True Peak levels in audio signals, from mono to 5.1; ISL ensures compliance with loudness standards; protects against distortion that can be introduced when codes such as MP3 and AAC are applied downstream.

www.nugenaudio.com

Autodesk — Smoke 2013

Video editing software offers editing and effects within a single, efficient timeline-based workflow and a sleek user interface; runs on a wide variety of Apple MacBook Pro and Apple iMac computers.

www.autodesk.com

NewTek — Virtual Set Editor 2

The companion application to TriCaster allows for complete creation and customization of virtual studio environments and visual effects without the need for professional studio space; includes a switcher effects engine that allows the creation of complex transitions with full-color, full-motion overlays.

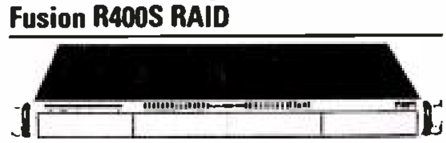
www.newtek.com

Broadpeak — C-CAS

Conditional Access System-Compliant Adaptive Streaming technology enables pay-TV operators to support adaptive streaming protocols while simultaneously remaining compliant with conditional-access systems on subscribers' existing set-top boxes.

www.broadpeak.tv

Sonnet Technologies Fusion R400S RAID



1RU, four-drive hardware RAID 5 storage system integrates a high-performance RAID controller for maximum versatility, critical data protection and speedy file transfers; its eSATA interface provides single-cable-to-host connectivity.

www.sonnettech.com

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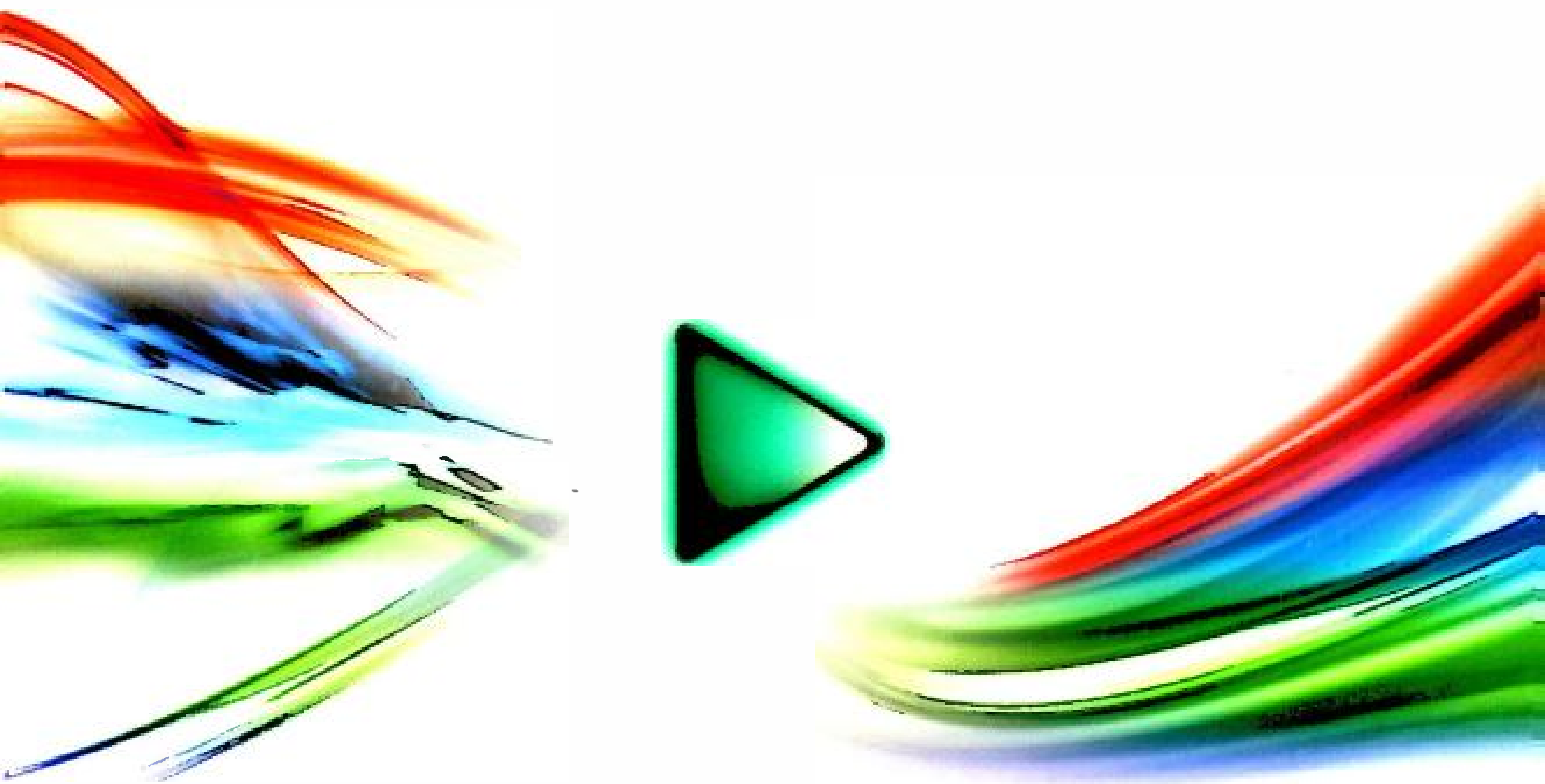

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