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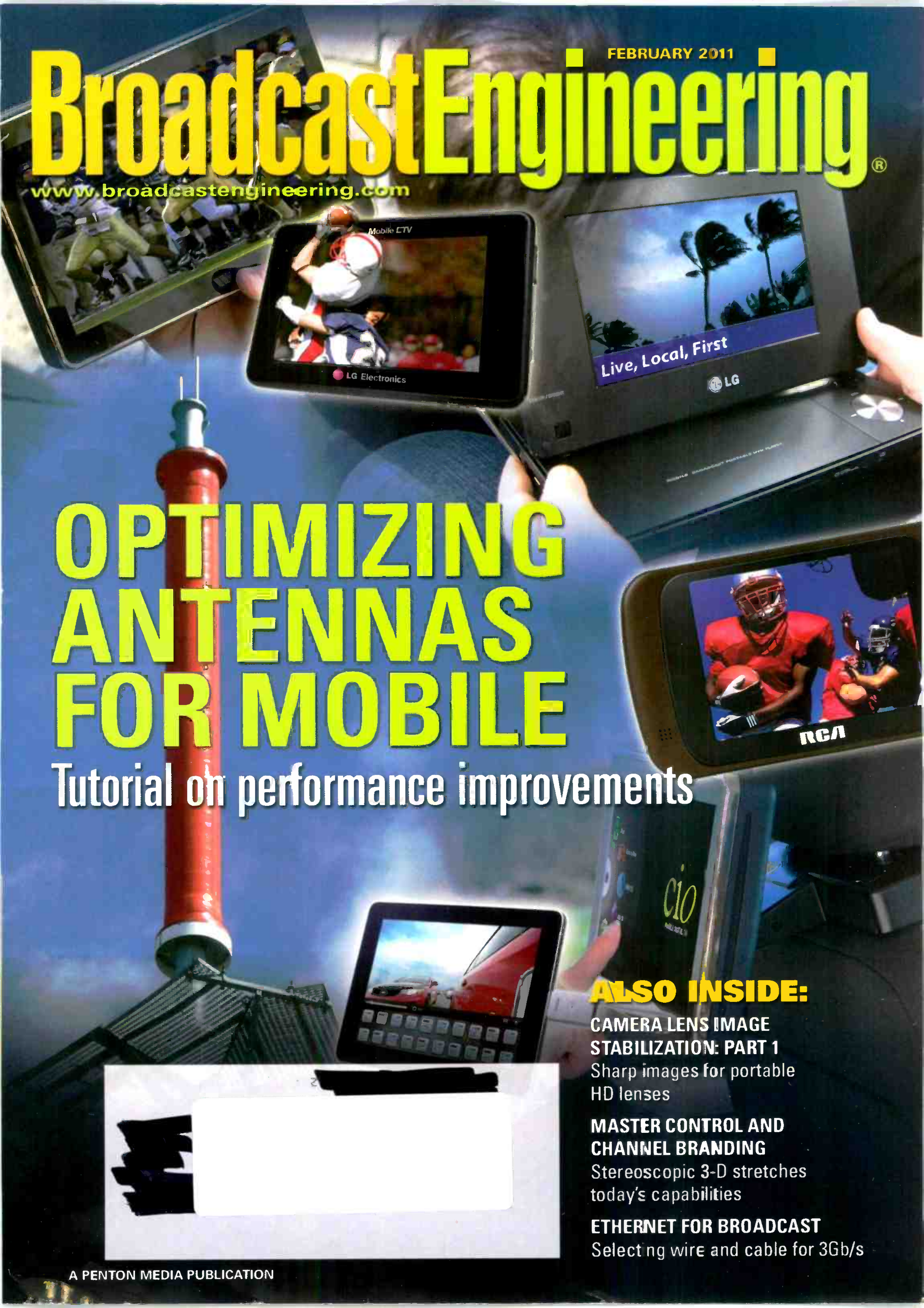

OPTIMIZING ANTENNAS FOR MOBILE

Tutorial on performance improvements

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Sharp images for portable HD lenses

MASTER CONTROL AND CHANNEL BRANDING
Stereoscopic 3-D stretches today's capabilities

ETHERNET FOR BROADCAST
Selecting wire and cable for 3Gb/s

[redacted]

A PENTON MEDIA PUBLICATION

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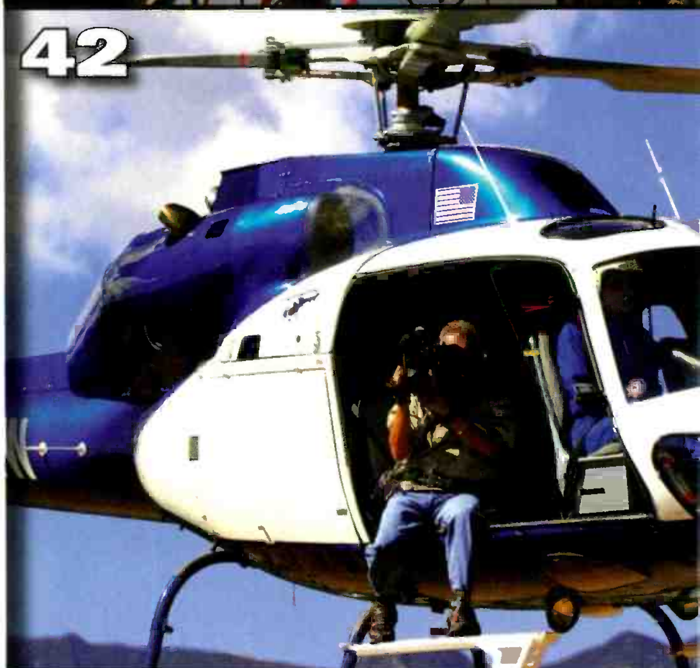
The introduction of ATSC-M/H mobile TV is going to be an exciting new chapter for many broadcasters. Antenna image courtesy KNMD-DT 8 in Albuquerque, NM/Dan Zillich. Mobile DTV images courtesy OMVC.



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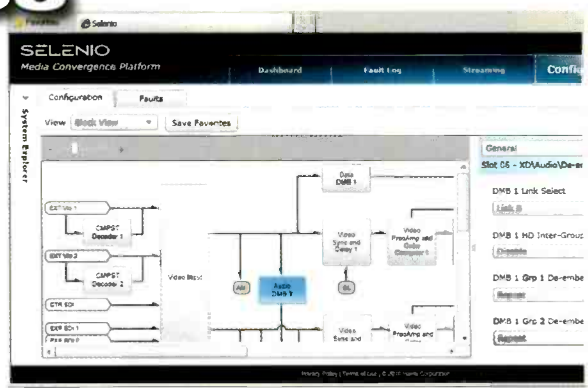

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It's all about the money

What if a technology was available that was developed, highly refined, widely established and could support the transmission of SD, HD and multichannel, as well as video for mobile? What if that technology also was less susceptible to multipath than 8-VSB? Suppose more than 330 cities were already using the technology with an estimated 20 million devices deployed, some of which could be purchased for $20? Wouldn't you be interested in at least testing the solution as a possible option for U.S. broadcasters?

The FCC isn't.

The advocacy group SpectrumEvolution.org applied for an experimental license in late 2010 to put a five-cell, four-channel, OFDM-based DTV system on the air in the Portland, OR, area. Unfortunately, instead of the license going through a process that would normally require just staff approval, it has been denied and forwarded to the chairman for further consideration. In other words, the request for what is normally a staff-level decision has been stonewalled.

Greg Herman, president of SpectrumEvolution.org, in mid-November went to the FCC's office and conducted a live OTA demonstration for representatives of the commission's Office of Engineering and Technology. The presentation included the transmission of seven video streams to some 20 working consumer devices via Converged Multimedia Mobile Broadcasting (CMMB).

Herman calls CMMB a significant improvement over the decade-old 8-VSB modulation scheme. According to Herman, CMMB is approximately four times more efficient in terms of digital throughput compared to ATSC-M/H for the delivery of mobile broadband-broadcast services. Yet despite what appear to be good reasons to move forward with tests, the FCC is saying no.

Could Chairman Julius Genachowski's hand be at work here?

Responding to an Oct. 20 op-ed article by Genachowski in *The Washington Post*, communications attorney Peter Tannenwald wrote, "But (Genachowski's) perceptions of the need for broadband and how to meet it are both misguided and backward-looking." Said Tannenwald, "That means promptly unleashing broadcasters from today's TV technical standards, which the FCC can do on its own with no congressional action. Freeing broadcasters from technical constraints will produce a much faster and more effective broadband result than the chairman's spectrum 'repurposing' plan. In other words, the question is not whether spectrum should be used for broadband OR broadcasting, but whether and when the FCC will allow it to be used for broadband AND broadcasting."

Some broadcasters might be eager to try out some new solutions in today's changing marketplace; however, the FCC appears focused on preventing the development of any new ideas that might delay Genachowski's goal of selling broadcast spectrum.

In a Jan. 14 interview with *Broadcast Engineering*, Herman said, "There can be no reason to deny (SpectrumEvolution.org) the ability to do the necessary field test work but for fear that we might succeed and/or a perception that the government will not profit as much from our technology as it might from incentive auctions that would shut down broadcast services. Success should never be feared."

Mr. Herman, your success is exactly what Genachowski does fear. His goal is to sell spectrum, reaping billions, and your ideas just might get in the way. From the chairman's viewpoint, it's better for you to just shut up and go away.

As is often the case, it's all about the money. BE

Brad Dick
EDITORIAL DIRECTOR
Send comments to: editor@broadcastengineering.com

Images Courtesy of NBA D-League

Optional TriCaster TCXD850 CS Hardware Control Surface

Mobile TV reception

Maximizing mobile reception requires that broadcast antennas have the proper amount of vertical polarization.

BY BILL AMMONS

The introduction of ATSC-M/H mobile TV is going to be an exciting new chapter for many broadcasters. The old model of only serving viewers in a fixed location is being tested as many viewers will be on the move, either on foot or using some form of transportation.

With ATSC-M/H in action, your viewers are on the move in dynamic reception environments. The antenna in most cases is not in a horizontal position to take advantage of the polarization that many stations transmit in.

The main reason for the desirability of circularly or elliptically-polarized transmit antennas is because with a linearly polarized transmit antenna, as the television signals propagate from the transmitting to the receiving site, the polarization can be rotated due to the influence of external magnetic fields from sources such as the earth itself or large metallic structures like buildings that may have a magnetic moment.

This is referred to as Faraday Rotation. If the signals arrive cross-polarized from the transmitting to the receive antenna, the attenuation can be severe enough to cause the loss of signal to your mobile viewers. Adding a vertical component to your signal can greatly enhance reception of the station.

Adding a vertical component to your signal can greatly enhance reception of the station.

Slot antennas

The slot antenna is a TEM-Mode coaxial structure. Coupling structures inside the pylon will distort and couple to the fields in this coaxial antenna, causing a voltage to be applied directly across each of the slots in the antenna. This voltage alternates from plus to minus and back again at the channel frequency of operation.

The length of the slots is adjusted so that the oscillating electric fields that develop across the gap that the slot creates will launch a radiating system of fields, propagating away from the antenna.

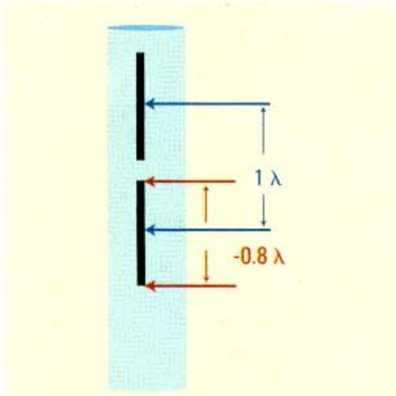


Figure 1. Shown here is a two-bay H-Pol slot antenna.

If the coaxial pylon antenna is oriented vertically, with the slots cut in the outer conductor oriented vertically as well, the electric fields across these slots will be oriented horizontally. Figure 1 depicts a two bay H-Pol slot antenna.

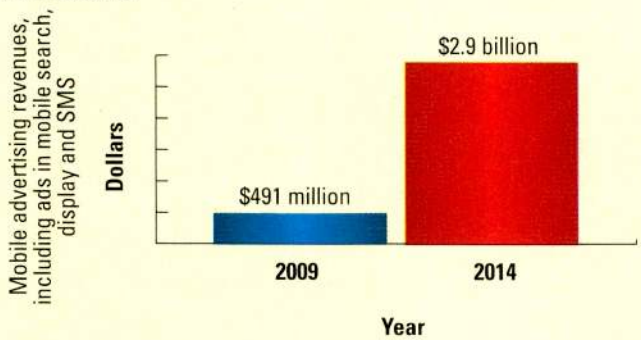
Polarizer elements are mounted on either side of the slot. The polarizers are about 1/8 λ each and launch a vertically polarized electromagnetic field one-quarter of a cycle or 90 degrees later than the horizontal field. When the axial ratio between the two fields is unity, we have circular polarization (C/P). When the horizontal field is stronger than the vertical, we have elliptical polarization. For ATSC-M/H, a 70/30 to 50/50 H to V ratio is ideal.

Figure 2 on page 14 shows the two-bay slot antenna with the added polarizers. The amount of vertical component is controlled by the

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

U.S. mobile ad revenues to skyrocket

Mobile advertising revenues will grow from $491 million in 2009 to $2.9 billion in 2014.



Source: BIA/Kelsey *www.bia.com*

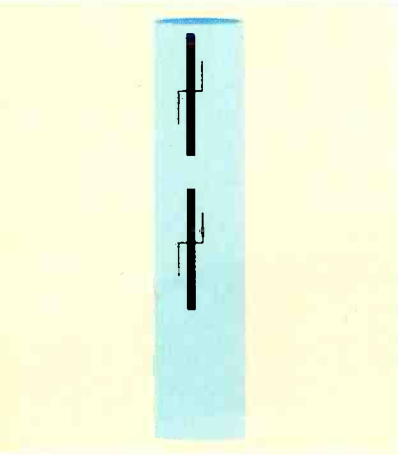


Figure 2. The amount of vertical compenent in this two-bay slot antenna is controlled by the placement and distance of the polarizers from the slot surface.

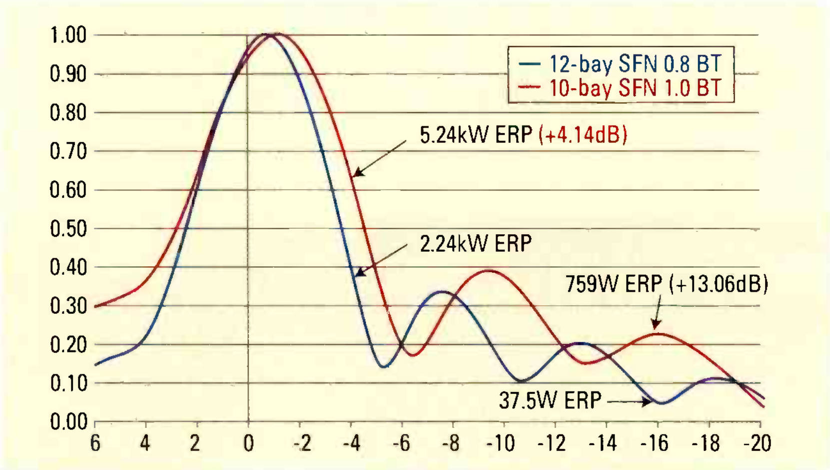


Figure 3. Shown here is a comparison of a 12-bay slot antenna and a 10-bay slot antenna. The 10-bay antenna produces a 4.14dB hotter signal downtown and a 13.06dB better signal at the base of the mountain.

placement and distance of the polarizers from the slot surface.

Fixed OTA and ATSC-M/H reception goals

Trying to cover a broad area for OTA reception is changing with the introduction of mobile TV. Depending on your market, there could be a large cluster of mobile TV viewers fairly close in to your transmitter site. These clusters could include a major university or an entertainment district like the Las Vegas strip. Let's look at a few examples of how some small changes in transmitting antenna design can make a big difference in how well your new mobile viewer will be able to watch.

Project number one is a new LD station that's 1800ft above a valley floor. The station needs to cover up to 40mi out to hit outlying cable heads and OTA viewers. At the same time, the closest population is only a few miles away at a depression angle of -16 degrees. The core downtown area is -4 degrees below the horizon and is a prime target for mobile TV viewing. Here, the station has plenty of transmitter power available and wants to shoot for C/P to ensure the best coverage from the close in foothills to downtown.

We looked at two antenna patterns, a 12-bay slot antenna and a 10-bay slot antenna. (See Figure 3.) In both cases, we want about 95 percent of peak field at the horizon to hit the distant viewers. For mobile TV, we have two targets to hit: saturate the downtown core at -4 degrees and ensure maximum coverage to the close-in area down to -16 degrees. In this case, the 10-bay antenna produces a 4.14dB hotter signal downtown, and a 13.06dB better signal at the base of the mountain. The ERP down to -18 degrees is always 15 percent of peak field or better, for a minimum ERP of 337W. For this application, we need 1.72kW of TPO. We have 1.8kW available, so this antenna is a perfect fit. This would be a good fit in a market like El Paso, TX; Phoenix; Boise, ID; or Vancouver, BC.

Trying to cover a broad area for OTA reception is changing with the introduction of mobile TV.

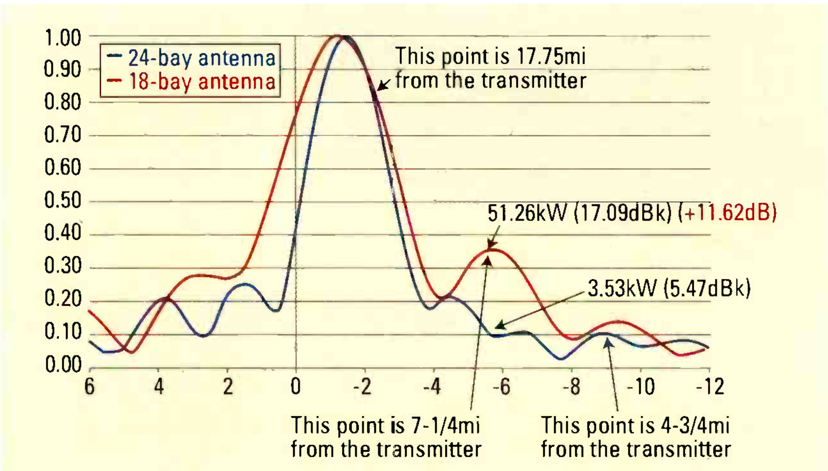


Figure 4. Shown here is a comparison of a 24-bay antenna (blue line) with a beam tilt of 1.5 degrees and an elevation gain of 22.3, and an 18-bay low RFR antenna (red line) with an elevation gain of 19.5.

The second project is a full-power UHF station that wants to replace its antenna with a new C/P model. The station sits on a 7700ft site overlooking the metropolitan area below.

The station has a couple of goals and constraints to guide this project. It needs to cover the valley and wants to put as much signal as possible over a large university located about 7mi from the transmitter. The farthest point in the metropolitan area is 17-3/4mi away, with nothing but mountains beyond that. Close to the transmitter site, new homes have crept to within 4-3/4mi of the site and are at a depression angle of -9 degrees. In addition to the metropolitan area, the transmitter feeds a number of translators and CATV headends that are between 1/2 and two degrees below the horizon.

The old antenna (depicted by the blue line in Figure 4 on page 14) is a 24-bay antenna with a beam tilt of 1.5 degrees and an elevation gain of 22.3. There is a lot of headroom in the transmitter, so going to a lower gain antenna might help increase field strength. Looking at several options brought us down to an 18-bay low RFR antenna (depicted by a red line in Figure 4) with an elevation gain of 19.5. The secondary lobe of the antenna is at six degrees below the horizon and is aimed at the university. Compared to the old antenna, the new antenna will deliver a signal that is 11.6dB stronger there. In most other places, there will a 1dB or 2dB increase in signal strength — pulling some viewers back from the "digital cliff edge."

Mobile TV will be an important part of TV broadcasting. How successful it will be depends on how well the station can deliver a reliable product to the viewers.

Conclusion

Mobile TV will be an important part of TV broadcasting. How successful it will be depends on how well the station can deliver a reliable product to the viewers. Some additional planning and analysis of your antenna options can go a long way to make that happen. BE

Bill Ammons is manager of marketing and sales for Micronetixx Communications.

New law bans loud commercials

The CALM Act would be effective by Christmas 2012.

BY HARRY C. MARTIN

The CALM Act (S. 2847) — aimed at preventing loud commercials — was signed into law by President Obama on Dec. 15. By voice vote a few days before, the House passed the bill with an amendment to make it compatible with the Senate version, which passed in October.

While the Act has now made it through the legislative process, that means only that Congress and the White House have passed the issue of loud commercials to the FCC. It is now up to the agency to adopt rules to implement the Act, and then it will be up to video providers to comply with whatever the FCC adopts.

Public support for the measure has been substantial. Broadcasters and multichannel video programming distributors subject to its requirements may not be as pleased, though. The new law will require them to comply with standards approved by the Advanced Television Systems Committee. Those standards have, up to this point, been characterized as mere "recommended practices." Now that the president has signed the CALM Act (and once the FCC gets around to implementing it), those standards will be legally mandated.

Complying with the new law may entail acquisition and installation of potentially costly new equipment. But the Act specifically provides for "financial hardship" waivers. The fact that the concept of "financial hardship" shows up as a consideration this early in the process may be cause for alarm.

The Act requires the FCC to have its rules amended consistently with the Act within one year of its enactment. The new rules in turn will become effective one year after their adoption by the commission. So we can expect all to be "CALM" by Christmas 2012.

Spectrum sharing

In an obscure and largely overlooked Notice of Inquiry, the FCC has begun to overhaul the foundations of radio communications by encouraging, or looking to require, spectrum sharing. The commission is still in the beginning stages of this initiative, however. To build a record, the agency is seeking ideas from the technical community on the following topics:

- *The state of spectrum-sharing radios.* Techniques for spectrum sharing include detecting and identifying other users' transmitters, exchanging information among users to determine whether a frequency is vacant, and detecting changes in the noise floor to see if there is room for additional traffic.
- *Use of geolocation and real-time database for checking frequencies.* The white-space proceeding will test this idea once the FCC solves the problem of database design. However, geolocation usually relies on GPS, which does not work well indoors.
- *Building interference suppression into radios.* Most experts would agree that good receivers are a key element of efficient spectrum use. Yet the FCC earlier considered but later dropped the idea of imposing standards on receivers.
- *Improving interference prediction.* Spectrum-flexible radios will have to avoid causing interference to other users. Effective technical rules must rest on good predictions of how radio signals at various frequencies behave in different environments.
- *Policy radios.* This is the next step beyond cognitive radios — i.e., transmitters programmed with broad policy constraints on spectrum usage. The concept is still in its early stages.

Under this plan, transmitters would automatically hop among frequencies, stepping into vacant channels temporarily and then moving on.

Correction

Last month's item on BAS policy changes implied that the requirement for frequency coordination for minor change modifications to fixed-link aural and TV BAS stations above 2.1GHz was a new FCC requirement. That is not the case. Frequency coordination has been required for new, major change and minor change BAS fixed-link applications since 2003. BE

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

Dateline

- Noncommercial TV stations in Indiana, Kentucky and Tennessee must file their biennial ownership reports by April 1.
- By April 1, TV and Class A TV stations in the following locations must place their 2011 EEO reports in their public files and post them on their websites: Delaware, Indiana, Kentucky, Pennsylvania, Tennessee and Texas.
- April 1 is the deadline for TV stations in Delaware and Pennsylvania to electronically file their broadcast EEO midterm reports (Form 397) with the FCC.

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

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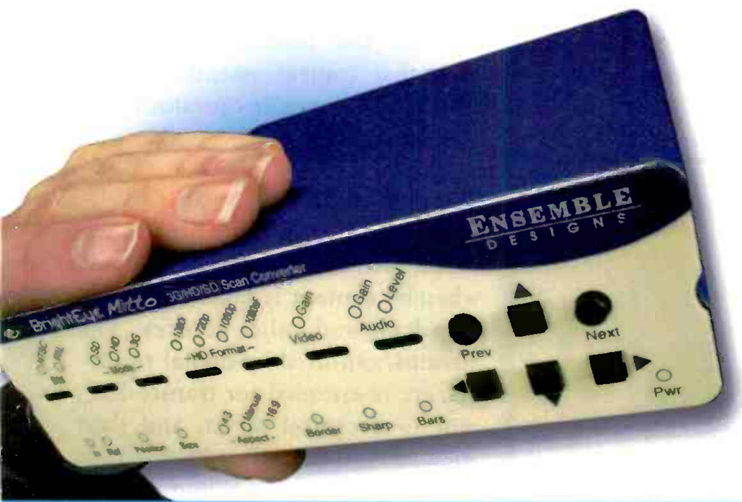

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Internet TV

Here's a look at the technologies behind content distribution over the Internet.

BY ALDO CUGNINI

Content distribution over the Internet is not a new technology. However, various forms of content delivery to PCs and Internet-connected TVs, using the Internet or Internet mechanisms, have emerged and have created a confusing landscape. At the same time, standards organizations such as the ATSC are investigating schemes to interoperate new consumer devices with terrestrial broadcasting. This month, we'll look at the technologies behind these services, and we'll look to the future as to where these are headed.

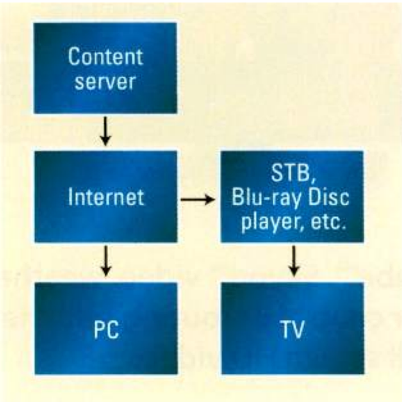


Figure 1. Online video distribution is possible through devices such as Blu-Ray-linked TVs, handheld devices, gaming consoles and set-top boxes.

Online video

The emerging alternate delivery mechanisms can be classified into different categories, depending on the different delivery paths and business models. Online video is perhaps the simplest mechanism, whereby content providers such as Hulu and Netflix serve up streaming or downloaded video on demand from Internet websites. Video content is prestored on servers and delivered to consumer devices as streamed files; the experience can be PC- or STB-based. The content is sent over a TCP-IP connection to the user, much the same way as web pages are sent to an Internet browser.

When displaying exclusively on a PC, any of various streaming video codecs is typically used, such as Adobe Flash or Windows Media Video. Playback is also possible on other Internet-connected devices, such as Blu-ray-linked TVs, handheld devices, gaming consoles, and set-top boxes, as shown in Figure 1. An interesting dilemma that online video has caused is that of over-the-top (OTT) content, such as when a cable-TV operator also provides Internet access; viewers can then access video through the Internet connection, with that content essentially competing with the cable operator's own video service.

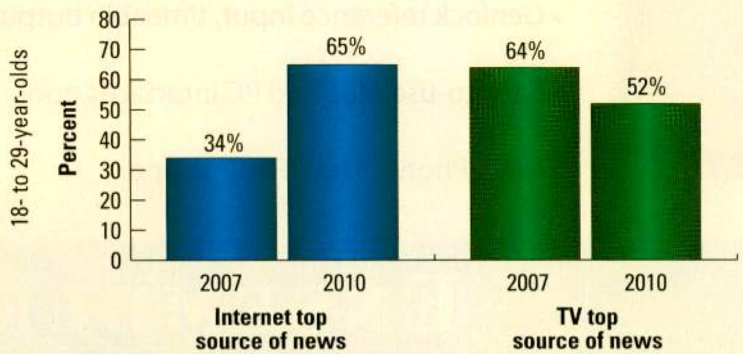
An interesting dilemma that online video has caused is that of OTT content, such as when a cable-TV operator also provides Internet access.

FRAME GRAB

A look at tomorrow's technology

Internet top source of news among young people

In 2010, for the first time, the Internet surpassed television as the main source of news for people younger than 30.



Source: Pew Research Center for the People & the Press *http://people-press.org*

Retransmission

Retransmission is a form of online video, such as iviTV and FilmOnTV, whereby content is taken live from broadcast and other sources. The streams, captured by digital receivers, are re-encoded (or transcoded), sent to a central server, and then streamed out as an IP multicast. (See Figure 2 on page 22.) Without direct access to the content, off-air (or cable or satellite) receivers must be set up in every market from which the content is accessed. (While the actual mechanisms have not been publicly disclosed and could deviate from the

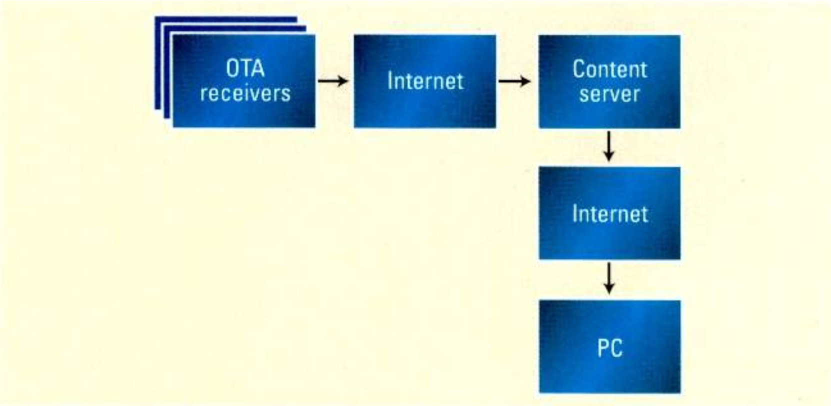


Figure 2. With retransmission, streams are captured by digital receivers, re-encoded (or transcoded), sent to a central server, and then streamed out as an IP multicast.

mechanism described here, they are likely to be conceptually the same.)

This type of service is currently under litigation, as the service providers do not have explicit licensing arrangements with the content providers, who have balked at the service providers' interpretation of an implied license to broadcast content. NAB, CEA and a startup company are currently investigating a broadcaster-supportable scheme that addresses the out-of-market coverage issues regarding Internet carriage of local content.

IPTV

IPTV, or Internet-Protocol TV, is a scheme such as AT&T U-verse, whereby video content is streamed to a STB by means of a subscribed telephone connection, usually twisted pair or fiber-to-the-home. A telco operator will typically use a Digital Subscriber Line Access Multiplexer (DSLAM) at the central office to supply a one-to-one high-bandwidth connection to each subscriber's customer premises equipment (STB). (See Figure 3.)

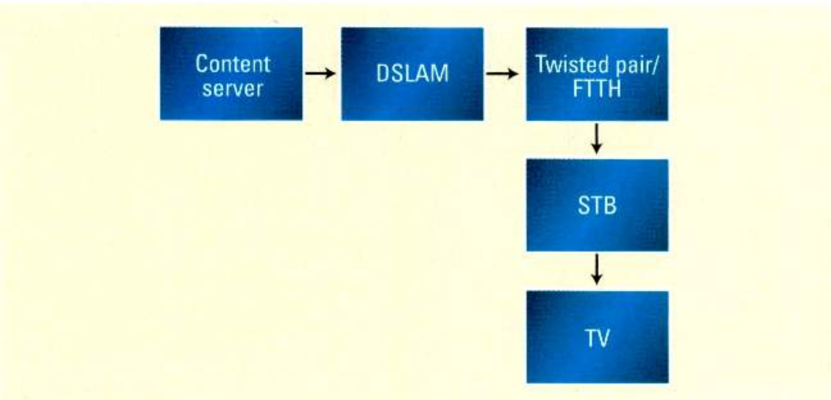


Figure 3. With IPTV, a telco operator will typically use a DSLAM at the central office to supply a one-to-one high-bandwidth connection to each subscriber's customer premises equipment (STB).

While this mechanism does not actually use the Internet, it does encapsulate the video data into IP packets similar to those used to relay data over the Internet. With this type of service, the access to content is completely within a "walled garden," including a service provider-provided EPG that is used to access content. Although an IP connection is used, each subscriber has a dedicated line to the central office; hence, a full packet-switched network is not needed, lowering complexity and bandwidth, and guaranteeing a specific level of quality-of-service.

Hybrid broadcasting

Hybrid broadcasting, shown in Figure 4, is a technology whereby broadcasters use a combination of OTA and Internet paths to send coordinated content to Internet-connected TVs or STBs. Groups developing services in Europe, Japan and South Korea have described different forms of hybrid broadcasting. Perhaps the most visible of these is a European consortium, operating in concert with the DVB organization under the name Hybrid Broadcast Broadband TV (HbbTV). Among the services demonstrated by the group are "catch-up" TV, video on demand (VoD) and interactive advertising. A specification for HbbTV has been released by ETSI, and some STBs meeting this spec have been shown.

Web-TV

With Web-TV, Internet content is served up to a TV by means of a STB or specially-equipped TV, as shown in Figure 5. Web-like pages, browsing and apps are directly available to TV viewers. Though similar to online video and hybrid broadcast, the experience is not directed at PC delivery and display; the services rely on an improved user interface with which to navigate content, often integrating a proprietary cross-resource search engine that can locate content from both broadcast and Internet sources.

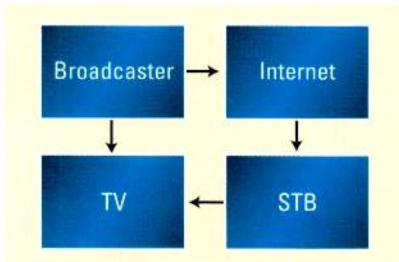


Figure 4. Hybrid broadcasting involves broadcasters using a combination of OTA and Internet paths to send coordinated content to Internet-connected TVs or STBs.

The TV applications can also potentially integrate Internet, OTA, cable or satellite content, forming a rich media experience. In practice, however, the TV or STB merely provides a "seamless" switch between Internet-delivered and OTA-delivered content. A true hybrid broadcast experience, where content from these different sources is synchronized and integrated by the content owners, is not believed to exist on currently deployed devices.

Widget TV

With Widget TV, small applications, such as Intel widgets and Yahoo! widgets, run on a Web TV, bringing content, information and community features from the Internet to the TV. These widgets, which

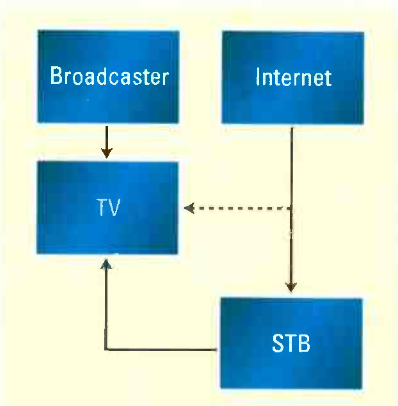


Figure 5. With Web TV, Internet content is served up to a TV by means of a STB or specially-equipped TV. The STB is also replaceable with newer Internet-capable TVs.

can be pre-installed or downloaded, offer users a way to customize their TV viewing and information access experience. In their simplest form, widgets might pop up an "app" that runs a local process, such as a trivia game; of greater interest to service providers are widgets that redirect the TV to an online website sourcing other content.

One of the issues of concern to broadcasters is the consistent behavior of these widgets across different devices. For this reason, a number of different "widget frameworks" have emerged, but these are currently driven by the developers of the graphics hardware or user interface middleware (such as the browser, often supplied by a separate content distributor). Ideally, broadcasters would like to provide widgets themselves, but this raises the issue of how to make the user experience — and content accessed by the widgets — consistent to users, across different broadcasters. The OTT issue is similarly problematic with Widget TV.

A look ahead

Various committees have studied the topic of enhanced television delivery, going back to the formative days of DTV. One such effort led to the Advanced TV Enhancement Forum (ATVEF) specification, which defined methods to create enhanced content to be delivered over a variety of media, including analog NTSC and digital ATSC. Around the same time, the ATSC developed the DTV Application Software Environment (DASE), which offered overlapping functionality.

For a combination of reasons, including timing and business issues, neither spec took off as an implemented framework. More recently, the ATSC has formed a new Internet Enhanced Television Planning Team (PT-3) to investigate the opportunities brought about by Internet-connected broadcast receivers, and to lay the foundation for future technologies and standards.

As content owners change their businesses to include a greater dependence on the Internet, it is reasonable to expect that broadcasting will evolve in the direction of integrating several forms of content delivery into a seamless experience for both fixed and mobile viewers. Exciting times are ahead! **BE**

Aldo Cugnini is a consultant in the digital television industry.

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

Media network hardware

Choosing the right hardware is critical to reliable operations.

BY BRAD GILMER

Last month, I talked about media network design, primarily from an architectural point of view. This month, we will look at hardware to support professional media networks.

Hardware for professional media networks

Let's start by looking at Figure 1, a more complete version of the diagram from last month's article.

As Figure 1 shows, the typical media facility has several distinct areas: the business office area, media production and on-air core. Typically, the majority of network traffic flows between computers in the same department, or between the computers and the Internet. But some traffic also flows between departments. Let's take a look at some of the key network components in this high-level diagram.

Three hardware devices are typically used to connect computers together: hubs, switches and routers. Hubs echo whatever comes in on one port to all the other ports on the device. The hub makes no attempt to read the source or destination addresses of the packets. Hubs have largely been replaced by switches and routers. Switches are used to connect computers together into a network. A switch looks at the destination address of a packet and switches that packet to the appropriate port. It does not send all incoming traffic to all ports as a hub does. Also, a switch can send traffic across several ports at the same time, making them faster than hubs.

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You may recall that when using IP over Ethernet, packets contain two addresses. The first is the Ethernet network interface card (NIC) address, and the second is the computer's IP address. Switches that operate based on NIC addresses are called Layer 2

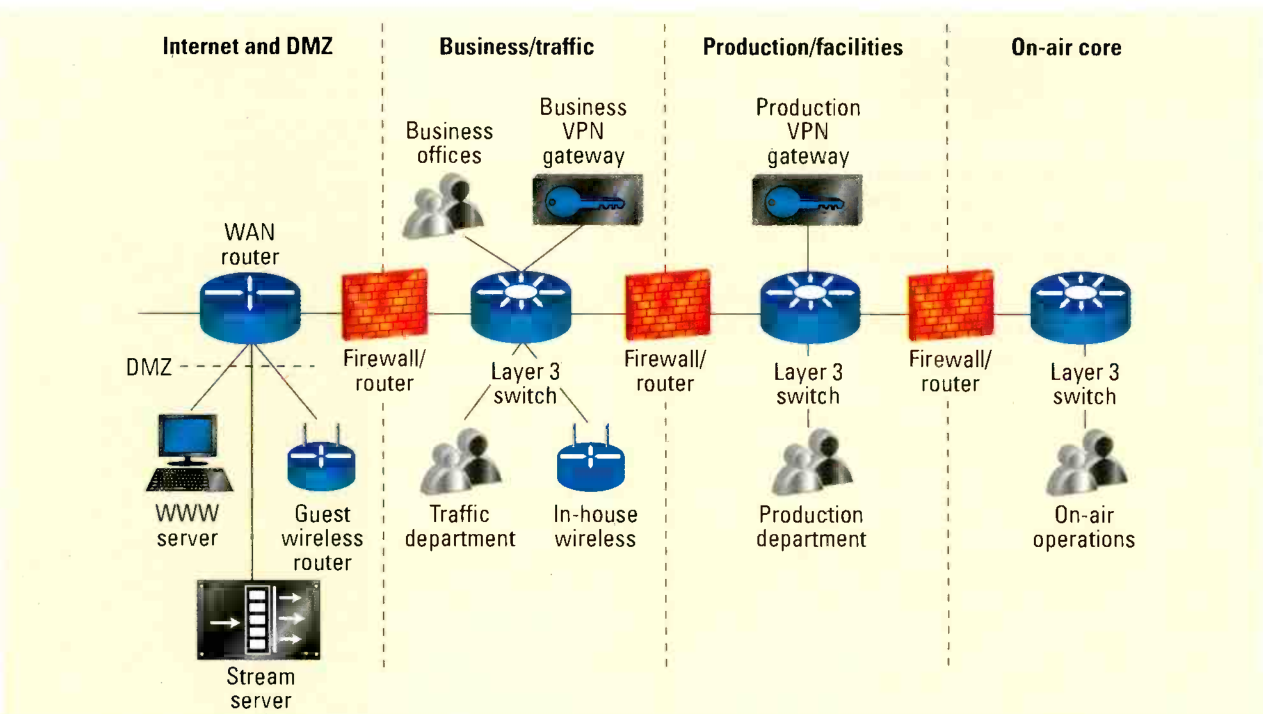

Figure 1. This high-level network block diagram of a typical media facility shows how router/firewalls are used to contain network traffic types within network segments and how core switches ensure adequate network capacity.

switches. Ethernet operates at Layer 2 of the Open Systems Interconnect (OSI) seven layer data model. Switches that operate based on IP addresses are called Layer 3 switches. (See Figure 2.)

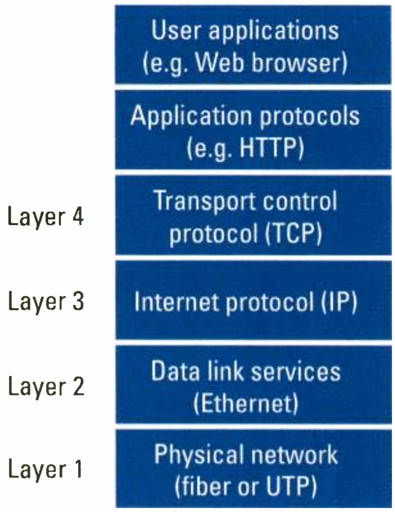

Figure 2. Switches typically operate either at Layer 2 (Ethernet) or Layer 3 (IP).

Switches can direct packets to computers on the same logical network, but they cannot direct packets across networks. For example, if you have two computers connected to a single switch, and one computer has an IP address of 192.168.0.2 and the other has an IP address of 192.168.1.3 (given a netmask of 255.255.255.0), the two computers will not be able to communicate with each other. This is by design. The two computers are on separate logical networks, even if they are connected together through the switch. The only way to get two computers on different networks to communicate is to use a router.

Routers connect networks together. For example, a router allows a computer in the facility to access the Internet. In fact, that is exactly what the wide area network (WAN) router at the right of Figure 1 does.

Firewalls keep undesirable network traffic from passing through the device. Firewalls are frequently combined with routers in a single device. It is important to note that the default configuration for commercial firewalls is that all traffic is blocked, and that during configuration, the network engineer specifies exactly which type of traffic is allowed to cross.

Another device that figures prominently in the facility diagram is the virtual private network (VPN) gateway. The VPN gateway allows remote hosts to connect to the network, just as if they were physically present in the facility. In this case, there are two VPNs: one used for business office people operating remotely and another used by remote production houses to exchange content with the facility. In this drawing, the VPN gateways are shown to be connected to the switches in the respective departments, but in actuality, these VPNs would typically be configured as part of the WAN router.

Finally, Figure 1 shows two wireless routers. One provides wireless connectivity for guests, and one is used for in-house business network connectivity. Note that these are also combination devices, combining the functionality of a wireless access point (the radio-to-computer device) and a router.

Network configuration

There are a couple of guiding principles we covered in last month's article that will help explain the network design:

- Media networks and business networks should not be mixed.
- Careful attention should be paid to routers to ensure that network traffic goes where it should and does not go where it should not.

Moving from left to right in the network diagram, you go from the Internet, to the office environment, to the media environment. In the business environment, the network traffic is generated almost exclusively by conventional office applications. Web browsing, office document exchange and database lookups are encountered here. Moving to the production environment, you see still, motion video file transfers and audio file transfers predominate. By the time you move into on-air operations, playlist transfers, program logs, automation commands and video file transfers become the norm. Increasingly, real-time messaging from media services are traversing these networks. It is clear that the network traffic in on-air operations is vastly different from the office environment.

The network in Figure 1 is configured to segment network traffic, keeping office traffic in the office network and critical on-air network traffic in the on-air network. Core switches are in each operational area, providing fast switching speeds for departmental traffic. Firewall routers are configured at each departmental boundary, allowing

Having several firewall routers allows the network engineers to carefully control the traffic traversing each network boundary.

connectivity between departments. However, security becomes more tightly controlled as you move to the right in the diagram. Having several firewall routers allows the network engineers to carefully control the traffic traversing each network boundary. In a worst-case scenario, the on-air network can be physically disconnected from all other networks in the facility.

The demilitarized zone (DMZ) shown at the lower right of Figure 1 is an area effectively outside of the corporate firewall. This provides Internet connectivity for Web and streaming servers that are likely to be attractive to hackers. Keeping these servers outside of the corporate firewall provides a degree of security in the event that these servers are compromised. In many cases, guests visiting a facility require unrestricted wireless access to the Internet. Having these unsecured computers inside the corporate firewall represents a security risk, so these wireless routers are typically located in a DMZ. Normally, a second secure in-house wireless router is provided for employee access to the local network. Also, typically a firewall would be incorporated between the WAN router and the DMZ, but this has been omitted to simplify the drawing. **BE**

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Backup power

Find out what type of UPS system is best for your facility.

BY PAUL HEILIGENBERG, EE

Facility AC power is often taken for granted. Unfortunately, when it fails, or when it becomes noisy or intermittent, the problems those issues cause may become serious.

The primary reason to install UPS systems is to protect against power outages. The key point to remember is that UPS systems are not designed to supply long-term power. A UPS should be considered a *bridge* to an alternative power source, typically a generator or secondary AC mains. Unless the UPS system has a huge stack of batteries, backup power may last from two to perhaps 15 minutes.

UPS systems come in a wide range of sizes, with many features and functions. The bottom line for engineering managers should not be: Do I need UPS protection? Rather, it should be: What type of UPS system is best for my application?

Let's look at some options.

Types of UPS solutions

There are three basic types of UPS technology: passive-standby (offline), line-interactive and double-conversion (online). Each of these three technologies do basically the same thing — provide back-up power long enough to safely shut down systems or get a generator started. However, the differences in how they operate and the performance level offered need to be examined in light of user goals.

A *standby UPS*, sometimes called an *offline UPS*, is the least expensive of the three technologies. (See Figure 1.) The key differentiating component is the transfer switch. It routes primary AC to the load during normal operation. If the AC mains fail, the relay switches to the output of the inverter, which is powered by the battery.

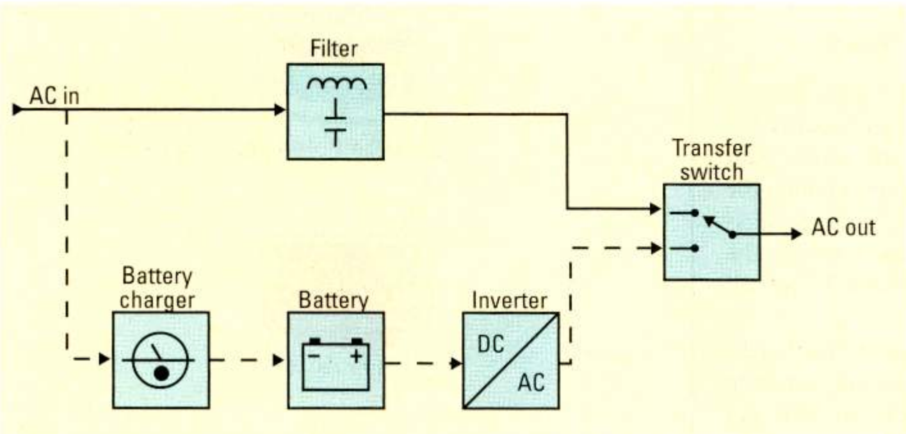

Figure 1. The least expensive backup solution is the passive-standby (offline) UPS. However, unless your equipment can endure the outage time of the transfer switch, it may not be the best solution.

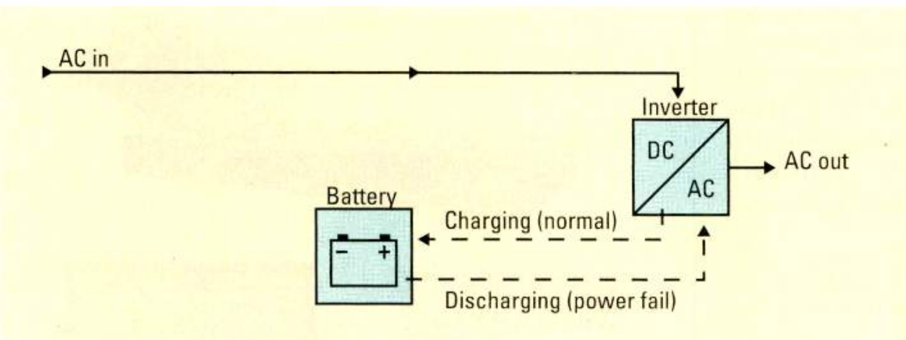

Figure 2. Line interactive UPS solutions are commonly used for 0.5kVA to 5kVA loads. Because the inverter is always on, loads are provided with additional filtering and lower switching transients compared to the standby UPS solution.

A key drawback of this design is the time it takes for the mechanical transfer relay to operate. Switching times of 1.5ms to 6ms are common. Older, analog equipment often faired quite well if a power blip was sufficiently short. An analog TBC might perk along without notable interruption. But with digital technology, a power drop — even for a few milliseconds — can result in any number of scenarios, most of which are not career enhancing.

If the power supply of the downstream device can ride out periods of AC interruption, this technology provides a cost-effective solution. If, however, key downstream digital devices cannot handle even brief power outages, consider an alternative.

A *line-interactive* UPS, shown in Figure 2, monitors the incoming line voltage and supplements it with battery power when the voltage drops below a certain level. Line interactive designs may include a tap-changing transformer, which adds voltage regulation by adjusting transformer taps as the input voltage varies.

This solution does not suffer from the outage problem of a transfer switch like the standby UPS. The DC-to-AC inverter is always connected to the load. And this solution provides some degree of line noise filtering and conditioning, so it is better in that respect than a standby solution.

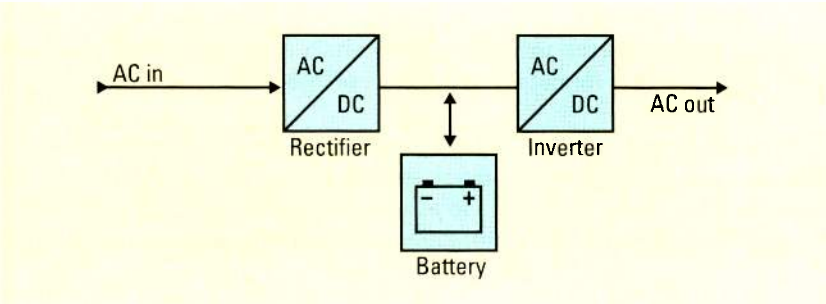

Figure 3. A key advantage of a line-interactive, double conversion UPS is that the load never sees a primary AC interruption.

One potential issue with this design is that if your facility suffers from low voltage (sags, which are described below), the batteries are continually in use. This may result in shorter battery life.

The *double-conversion, online UPS technology* shown in Figure 3 totally isolates the load from the primary AC line. Noise, sags, swells and outright power failure issues never reach the load.

The supply takes the incoming utility AC power and converts it to DC. The DC voltage is used to both charge the batteries and, more importantly, provide all of the downstream power. This process of converting AC to DC and then back to AC is called *double conversion*. These UPS systems can power 10kVA and larger loads.

The output voltage of this type of online UPS is not interrupted if the main power fails because it is continually producing output AC power through the DC/AC inverter. When the power fails, the batteries feed the inverter, and the output power continues uninterrupted.

The output of a double-conversion, online UPS is typically cleaner than line interactive devices because the double-conversion process removes any noise that may be on the incoming AC lines. The output is a regenerated clean and noise-free sine wave output.

Power quality

A second, and often less well-understood, issue about selecting backup power systems concerns voltage stability. Any power swell (increase) or sag (decrease) that exceeds +20 percent or -30 percent of the nominal voltage for more than 20ms (1.2 cycles) is likely to cause some digital equipment to fail outright, or generate errors.

If sags or swells are reflected through a device's power supply, they can play havoc with performance. For example, equipment designed to initialize upon startup may re-initialize after a severe sag. It confuses the sag with the turn off and turn on of power. Other equipment may simply shut down and stay that way if the voltage drops below a certain value for more than a few milliseconds.

If devices come back online in errant order, a 3ms power blip could turn into an engineering nightmare.

Particularly disruptive situations may occur if a sag causes some devices in an integrated system to shut down and then restart after recovery, but the balance of the equipment does not. Consider that IP routers and modems require a specific boot-up sequence to reliably initialize themselves. If devices come back online in errant order, a 3ms power blip could turn into an engineering nightmare.

The opposite of a voltage sag is a voltage swell. Most consumer power runs a nominal 120VAC. If the AC mains swell by 10 percent, that means 132VA is being fed to every device. While most laptop power supplies can handle anything from 120VAC to 240VAC without problems, the same cannot be said about rack-mounted broadcast gear.

Over voltage can shorten the life of equipment, cause device failures and cause overheating. If equipment power supplies run hotter than normal, capacitors may dry out faster. Also, the extra heat generated places an additional load on a facility's HVAC and may stress nearby, rack-mounted equipment. The bottom line is that UPS that provides proper voltage regulation is a plus.

Battery life

The last aspect of UPS operation we'll discuss is that of batteries. Each UPS technology affects the life of its batteries differently. One point should be obvious: The more a battery is used or the hotter it gets, the shorter its lifespan. See Figure 4.

In a fluctuating voltage scenario, a single-conversion (line interactive) UPS will switch to battery power often, sometimes for less than a second. Even such brief operations deplete the battery power and shorten their service life. More critically, depleted batteries have less energy available for the true power outages.

Online double-conversion UPS technology, when faced with a fluctuating voltage scenario, can supply the desired voltage without reverting to battery power. That means that the batteries stay fully charged and are ready for use during an emergency.

Because the batteries stay charged, they provide full power during power outages. They also tend to last for the stated service life, driving down operating costs while still providing a stable voltage output.

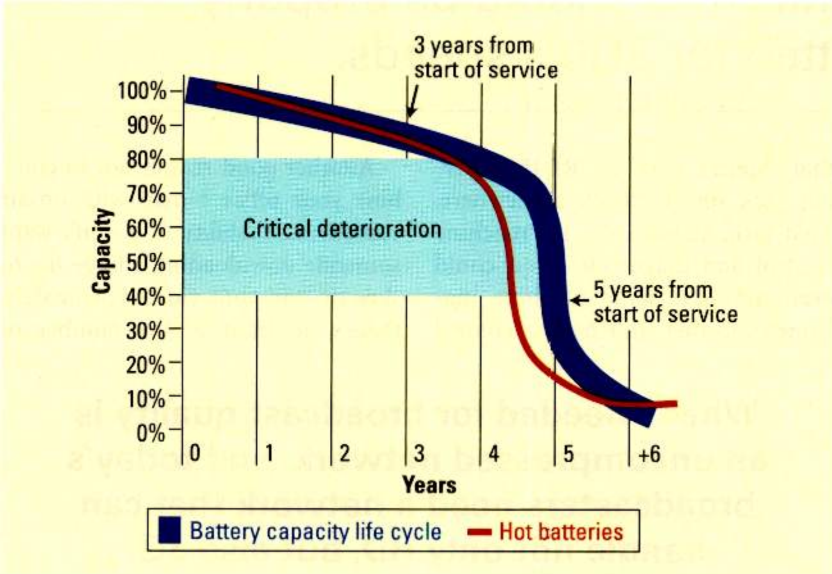

Figure 4. The IEEE recommends battery replacement within one year if its capacity is determined to be below 80 percent of the manufacturer's rating. Figure courtesy IEEE.

Finally, and not to be understated, batteries are classified as hazardous waste. Federal law requires that all used lead-acid [Pb] batteries be managed as Universal Waste under the CFR, Title 40 – Protection of Environment, Part 273 – Standards for Universal Waste Management. For this reason alone, facilities with a large number of Pb valve regulated or wet cell/flooded batteries often hire approved firms to handle all battery installation/maintenance and replacement. The potential for spills, improper disposal and resulting liability are just too great. Anyone recall the days of PCB disposal?

Fortunately, today's UPS technology is mature, reliable and cost-effective. If your facility needs this type of short-term bridging backup, you have many options from which to choose. BE

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Ethernet in broadcast

Broadcast facilities should be properly outfitted for 3Gb/s speeds.

BY STEVE LAMPEN

I remember getting a job at a parts distributor back in 1988. The new owner decided that the only way to keep track of inventory was to put in one of these newfangled computers. When this was announced, half of the sales force resigned or retired. They had been used to doing inventory by hand for more than 50 years, and the fear of this "new technology" was palpable.

The fear of the unknown is one of the main brakes on implementing any new technology. So when someone says, "We're moving to Ethernet," expect a lot of people to retire. Plus, Ethernet is taking over the known world, so changing jobs and moving to a different industry probably won't help. Obviously, the data world has embraced Ethernet; the factory floor is Ethernet; theater lighting is going to Ethernet; and homes are moving in the same direction. The best bet, then, is to double down on understanding the technology.

Ethernet

Why is Ethernet use so ubiquitous today? Ethernet was invented by Bob Metcalf and David Boggs in 1973 when they worked for Xerox. It turns out Xerox didn't want to be the next big computer company and gave Ethernet lock, stock and barrel to the IEEE. Thus, Ethernet became a "free" standard. Because free is a good deal, the Ethernet solution became hard to resist.

But you're reading a broadcast magazine. Are broadcaster's going to use Ethernet? Well, they've already moved in that direction, in case you haven't noticed. Certainly, office management, traffic, billing and similar applications rely on Ethernet, and you almost can't find a machine that doesn't have an RJ-45 Ethernet jack on the back somewhere. That jack, at first, was for machine control and diagnostics. You could even network many of these machines together and have a control network. Put that on the Internet with a password or two, and a manufacturer could look at its machine, update software and fix bugs. But these were control functions; none of this was on-air.

Now, we're talking about content, including audio and video. A video server is first and foremost a *server*. That data going in and out is *data*. The fact that it is video might require a certain data rate and bandwidth, but it's just a different kind of data.

Video on a twisted pair

Does that mean you can just put video on your existing Ethernet network? That depends on what kind of video you are talking about: compressed or uncompressed? Some boxes out there will take your HD video and turn it into a 150kb/s stream that can be carried on the network. While the picture at the other end might look pretty good, it would not be broadcast-quality. What's needed for broadcast quality is an uncompressed network, and today's broadcasters need a network that can handle not only HD (with a data rate 1.5Gb/s), but also 1080p/60, also called 3G or 3G-SDI (3Gb/s).

Another good reason not to combine your office e-mail with on-air content is reliability. You don't want someone downloading a huge file to slow or stop your video. Fortunately, there's no limit to the number of networks you can install. All mission-critical applications use dedicated networks, and they can be configured with redundant rings, so network failures are extremely rare.

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Of course, at the mere mention of a separate dedicated network, your IT person will be at your office door protesting. Data networks are their territory, not yours. But, you argue, you are talking about content, i.e., on-air content. This data isn't just some spreadsheet or Word document. This is an argument that continued in many facilities until the two jobs became one.

What kind of Ethernet network can carry 3Gb/s? Certainly not the 10Mb/s of yesterday or a 100Mb/s network, made popular by Cat 5 data cable. Not even a 1Gb/s network could handle HD or 3G. Sure, these networks could carry compressed versions, and those compressed versions are easy to send anywhere or to record and play back. You can already get servers for the newsroom that ingest, edit and output compressed formats on 1Gb/s networks. But uncompressed HD and 3G require something more, the next level of data networking: 10Gb/s networking.

Hollywood clearly saw this coming, so SMPTE set up a committee, DC-28, to research this. One of its conclusions was the need for a 10Gb/s network. The technology initially required a fiber infrastructure, but it's now possible to handle 10Gb/s on twisted-pair copper. This is called 10GBASE-T, which simply means 10Gb/s networking on twisted pairs.

The copper version requires four data pairs, and each pair carries 500MHz. All four pairs send and receive data at the same time in duplex mode, so there's some pretty amazing number crunching going on to get those 10Gb/s on only 2GHz (total) of the four pairs. This is accomplished by complex coding called pulse-amplitude modulation (PAM)-16, which means that there are 16 levels from zero to one. This provides a data rate of 10Gb/s that theoretically carry six HD bit streams, or three 3Gb/s bit streams. The only thing missing is the box to convert from uncompressed HD or 3G to Ethernet.

This need for speed means that your video network is going to be a dedicated, broadcast-only network, and a redundant ring or two might be a good idea to increase reliability. The real problem is the installation of the network.

Physical connections

Back in the day of 10Mb/s networks (10BASE-T), almost anything would work as long as you got the right wire order. By the time the industry reached 100Mb/s (100BASE-T), the cable and connectors became more critical. At 1000BASE-T (1GBASE-T), the physical connectivity demands became much greater.

At a gigabit, Cat 5e cable was measured differently because all four pairs were working, not just two pairs as before. Cat 5e cable was the same as Cat 5 cable (100MHz per pair) but measured differently for this higher data rate. Cat 6 extended the bandwidth to 250MHz per pair to reduce the complexity of the boxes. We're now at 500MHz per pair with 10GBASE-T.

The need for speed means your network is going to be a dedicated, broadcast-only one. The real problem is installation.

But as bandwidth goes up, so do the demands placed on the physical path. For instance, connectors, which were a nonissue at 10BASE-T, became important at 100BASE-T and critical at 1000BASE-T. You could easily put a male plug on a 10BASE-T network (Cat 3), but you had to be a bit more careful with 100BASE-T (Cat 5). By the time you get to 1000BASE-T (Cat 6), some odd things often happened with connectors. Many of those simple connectors would no longer function correctly. Male RJ-45 plugs had up to a 70 percent failure rate when used for Cat 6 GigE.

Why is that? There are a number of reasons, including simple things like the untwisting of the twisted pairs. At high frequencies, the impedance of the pair is a critical value. The cable has a native impedance of 100Ω. When the pairs are untwisted and separated, the impedance changes: It's no longer 100Ω. Signals going down those pairs see an impedance mismatch, something other than 100Ω. And as RF engineers understand, mismatched impedances produce reflections. The result is that signals reflect back to the source and even radiate from the cable at that point, and crosstalk between pairs in the connector increases, perhaps causing the network to fail.

This is why, in the networking world, installers can put punching wires on the back of a *jack* to make it work, but not on a *male plug*. Instead, factory-made patch cords must be used. But broadcast engineers don't install jacks and patch cords to route audio and video. If your audio and video were on Ethernet, a broadcaster might simply wire point-to-point.

It's no wonder that the worst data installations I have ever seen were in broadcast stations: These engineers aren't data installers; they're broadcast installers. These people simply did not understand the issues behind Ethernet and proper installation techniques.

Once a network's speed exceeds 10GBASE-T, it's time to think about a different solution. One could buy a handheld tester to test everything, but that may cost almost $10,000. One possible solution is to let a manufacturer build your network before it is installed, called preterm. The engineer provides the manufacturer a CAD and tells the vendor how many and low long the cables should be.

Cables can then be built in the factory and often packaged in groups of six, bundled in mesh with a pulling eye on each end. This solution uses a patch panel with feed-through, female-to-female jacks. All you have to do is pull in the cables and plug them in. The entire network is then prebuilt and pretested, with verified test results. The labor savings for installation and testing can be dramatic. When employing this tactic, don't let a vendor tell you that a 10Gb/s network "has to be shielded." That just adds the potential for ground loops. There are plenty of unshielded, ungrounded installations that work just fine.

Once a network's speed exceeds 10GBASE-T, it's time to think about a different solution, such as a manufacturer building your network before it's installed.

Don't fear this plug-and-play network. It doesn't mean you're going to be out of a job for lack of things to do. The cable in a network installation accounts for about 3 percent of the total cost. You'll still have the other 97 percent to keep you busy and gainfully employed. **BE**

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Real-time transport of 3-D from the camera to the screen

BY NIGEL SETH-SMITH

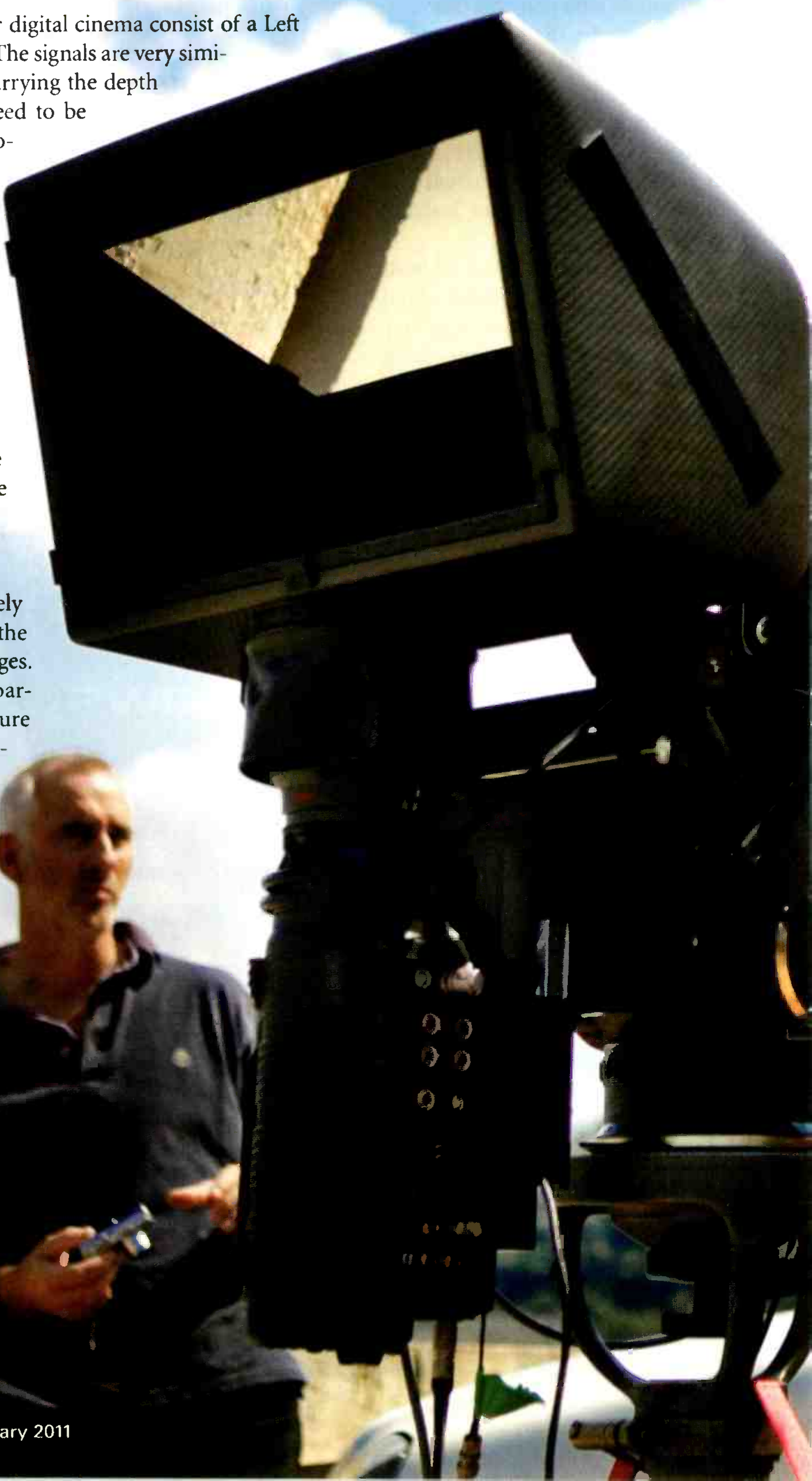
3-D stereoscopic signals for TV or digital cinema consist of a Left eye (Le) and Right eye (Re) pair. The signals are very similar, with the subtle differences carrying the depth information. The two signals need to be captured, transported, recorded, synchronized, processed, coded, decoded and displayed in a way that is as close as possible to identical. If they are not, the differences induced in the signals will create artificial and distorted depth cues, with disturbing results for the viewer.

Existing standards and procedures for video signal processing do not take into account this important requirement. They deal only with single streams, without regard for relative performance between pairs. Special equipment will be needed to address this issue.

Depth information

Depth information is coded as relatively small horizontal differences between the positions of objects in the Le and Re images. Much of the depth information has a disparity of no more than 1 percent of the picture width. Perceived depth is, therefore, sensitive to small errors in position, from whatever source.

This is in contrast to the relative insensitivity of the viewer to geometry errors. The widespread acceptance of incorrect aspect ratio settings, with a geometric error of 33 percent, is an extreme example of this insensitivity. Even within



professional environments, the common use until recently of scanning electron beams for capture and display meant that geometric accuracy of better than 1 percent was difficult to achieve, and no great distress was caused by such errors. So a parameter of the broadcast chain that is insensitive to absolute error has become highly sensitive to matching error between 3-D Le and Re channels.

3-D capture

A 3-D camera typically consists of a pair of identical camera bodies and lenses, mounted with a controllable horizontal offset. They also have a variable relative angle, so that the plane at which their fields of view converge is controllable. For all but the smallest cameras, the horizontal offset required for good stereoscopy is smaller than the width of each camera, so they cannot simply be set side-by-side on a jig. The smaller intra-ocular distance is obtained by setting a half-silvered mirror at 45 degrees, with one camera viewing the scene through the mirror and the other viewing the reflected scene. This process inverts the image into the second camera. The image is then flipped electronically to correct its orientation. (See Figure 1.)

For side-by-side camera setups, the cameras must be accurately matched for geometry.

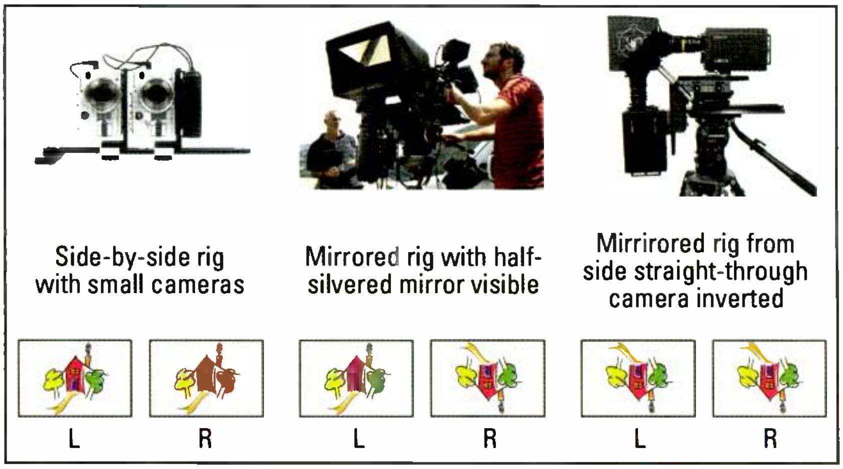


Figure 1: 3-D camera configurations and their different output formats

Figure 2. One channel of a 3-D signal

Figure 3. Artificial depth introduced by a small lens distortion in one channel

Camera matching

For side-by-side camera setups, the cameras must be accurately matched for geometry. This requires lens matching across all zoom settings. Figures 2 and 3 show the artificial depth information that will be introduced if there are geometric differences between the two cameras, even if they are nominally co-sited (i.e. with the intra-lens distance set to zero).

For mirror rig cameras, any asymmetrical distortions, even if they are the same for both cameras, will cause mismatch after one image is flipped. (See Figure 4.)

There is also the risk of timing disparity caused by a vertical image flip in one camera signal. (See Figure 5.)

Figure 4. Artificial depth introduced by identical horizontal nonlinearity in both cameras, with one camera inverted

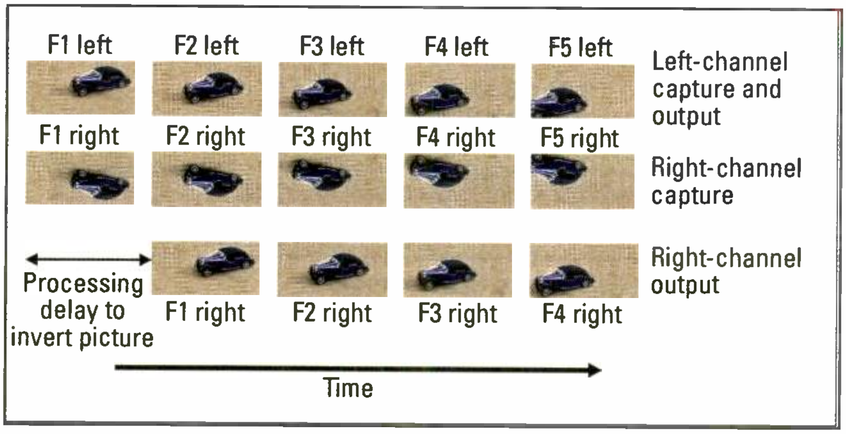


Figure 5: Processing delay introduced into one channel as the signal is inverted electronically to correct for optical inversion in the camera

Horizontal keystoning from converged cameras

As the cameras' convergence (toe-in) is increased to bring close objects to the neutral depth plane, there will be differential keystone distortion between the channels. This will create vertical differences between objects in the Le and Re channels, which are particularly disturbing to viewers as there is no natural mechanism for such differences. (See Figure 6.)

3-D over a 3G link

The 3-D signal consists of a pair of co-timed video signals with audio, metadata, etc. 3G SDI allows the transport of two separate co-timed HD signals over a single link. As SMPTE standard ST 425 describes, all 3G signals consist of a pair of virtual streams. When the 3-D signal consists of a pair of 1.5Gb/s HD signals, it is necessary only to define which stream carries which of the Le and Re channels, and where the audio and metadata should be carried. SMPTE is currently defining just this

Figure 6. Keystone distortion from toe-in (exaggerated)

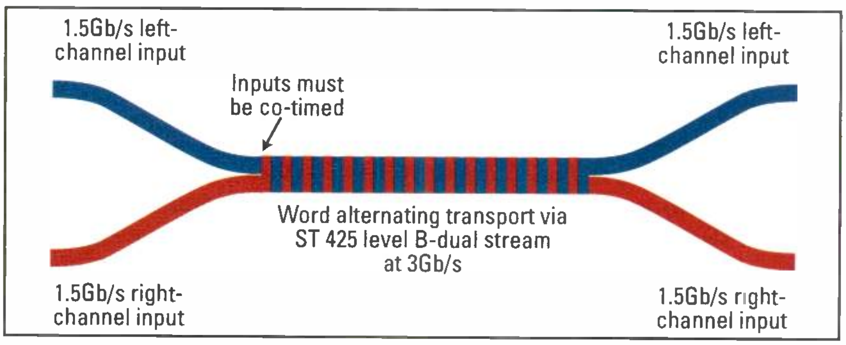


Figure 7. Dual 1.5Gb/s signals over a single 3Gb/s link

set of parameters for a 3-D signal, and also a new ST 352 signal identifier code to specifically identify a 3-D pair. (See Figure 7.)

3-D over multiple 3G links for 1080p production

The arguments for producing and archiving at the highest possible signal quality are equally strong for 3-D as they are for 2D. Indeed, the potential for mismatching in de-interlacers makes the argument for the use of 1080p/60 or 1080p/50 even stronger for 3-D. However, each 1080p signal needs a data capacity of 3Gb/s, with a 3-D stereo pair needing a total of 6Gb/s.

Standards are being generated for multilink 3G SDI, with new ST 352 signal identifier codes, data transport formats and timings. (See Figure 8.)

Frame synchronization

A frame synchronizer is essentially a flexible buffer that writes the input data to a store as it arrives based on the input timing and reads it back at the correct time for the desired output timing. At some point, the input and output timings start to overlap, and the synchronizer drops a frame from the input or repeats a frame, depending on whether the buffer is full or empty. The timing for this frame drop or repeat is not critically defined.

If two independent frame synchronizers were used for a 3-D stereo signal, it is practically certain that they would make their drop/repeat decisions at different times, leaving a potentially long period with a frame difference in timing between the Le and Re images. A 3-D optimized synchronizer needs to have a communication channel between the control circuits for the two channels. (See Figure 9.)

Standards conversion

A standards converter creates new fields and frames by combining information from several input fields. The quality of the conversion is dependent on proprietary algorithms, which are of considerable value to the individual manufacturers and so are not published.

Even with identical converters, the exact decisions made by the conversion process will not be the same. Standards converters depend on a combination of linear and nonlinear decisions as to which input data to use to construct each output pixel. These decisions are dependent on many pixels from many input fields and may have history going back several frames.

As with frame synchronizers, the decision-making processes for frame rate conversion need to be synchronized between the Le and Re signals.

If the video format is interlaced, there is an implicit de-interlacer in the standards converter. If the de-interlacer uses any nonlinear decision making, for example to improve the performance with near-horizontal diagonal lines, the control circuits should be matched between the two channels.

Even the relatively simple process of aspect-ratio conversion has similar risks, as it includes a de-interlacer function.

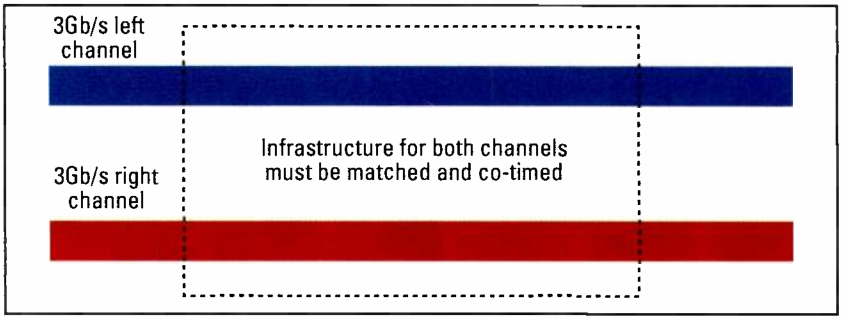


Figure 8. Dual 3Gb/s signals using dual-link transport

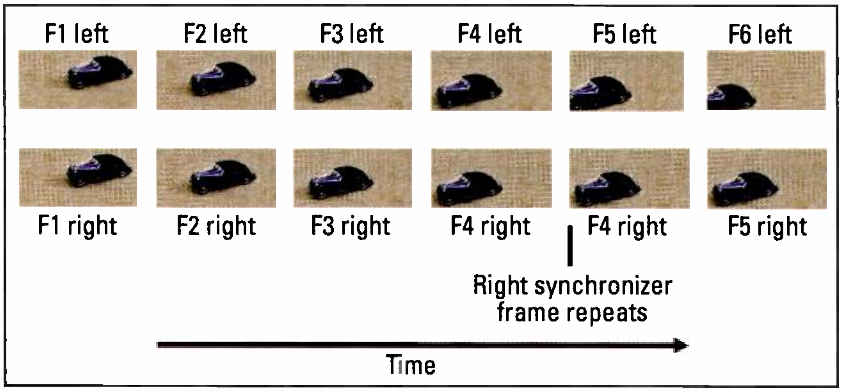


Figure 9: Independent synchronizers make separate frame repeat decisions.

Compression

3-D storage and recording is dependent on compression. Video compression works by transforming the video signal to a coding domain where different parts of the coded signal have very different sensitivities to distortion. The less sensitive parts are then heavily quantized and reordered to allow efficient run-length coding. The transform and the run-length coding are essentially transparent, but the quantizing is not. To minimize the visibility of the quantization process, many aspects of the signal are examined and used to drive the coding decisions. As with standards converters, these decision processes are highly proprietary and differ between manufacturers, as well as between equipment models. In the case of long-GOP compression, the phasing of the GOP sequence is essentially arbitrary, and there is no reason for two long-GOP encoders to use the same GOP sequence. (See Figure 10.) If long GOP compression is used for 3-D signal pairs, the GOP sequences should be synchronized. (See Figure 11.)

Conclusion

There are many processes in the passage of an image from the origination scene to the final display with the potential to alter the position or timing of an object in the image. For 2D images, viewers are relatively insensitive to small

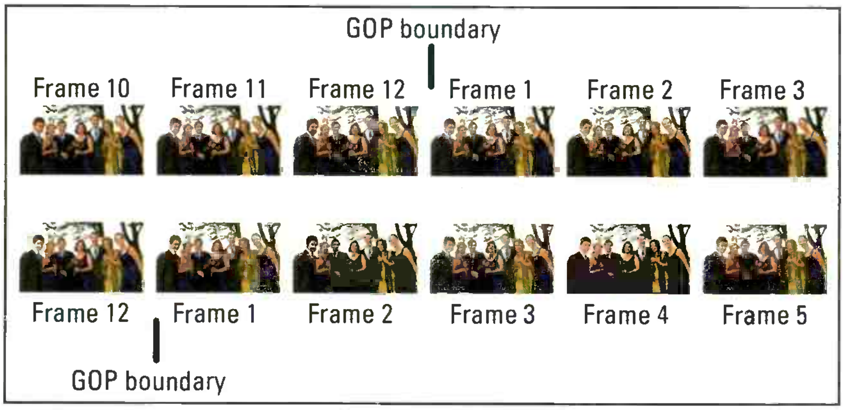


Figure 10. Independent compressors with arbitrary GOP sequences

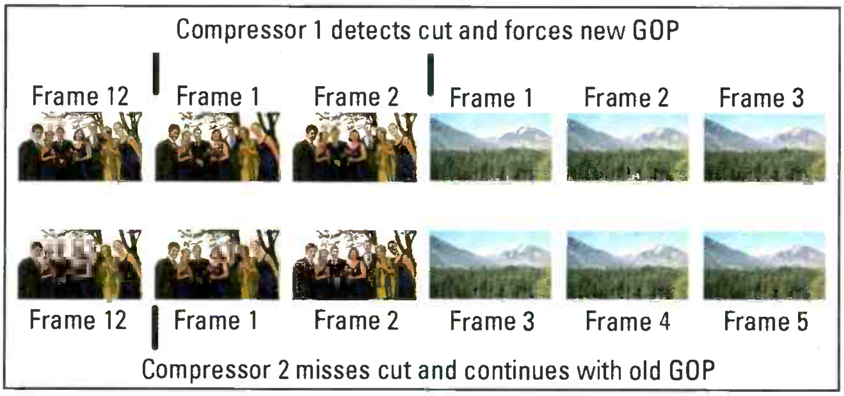


Figure 11. Compressors start GOP aligned but make independent cut-detection decisions.

alterations, but for 3-D stereoscopic images, any differential distortions between the two channels can cause disturbing depth anomalies.

In some cases, such as optical distortion or time-code based recording and editing, careful use of high-quality equipment will minimize the risks. In the case of equipment that manipulates the geometry and timing of the signal, such as synchronizers, aspect-ratio converters, format converters and standards converters, significant errors can occur unless the equipment is specifically designed for 3-D signals.

For 3-D stereoscopic images, any differential distortions between the two channels can cause disturbing depth anomalies.

When the function of the equipment is lossy compression, the decision-making circuits that choose which aspects of the image to keep and which to discard need to be tuned to the viewer's need for adequate depth information, as well as the spatial and temporal information that has been considered for 2D images.

Many of these processes operate with a higher level of quality and consistency when the source material is progressive.

A key element of the signal path is the transport through the production and post-production environment. Matched transport of a pair of 1.5Gb/s signals is enabled using a single 3Gb/s link. Transport of dual 1080p signals requires a method of matching a pair of 3Gb/s links. SMPTE ad-hoc group TC-32NF20 AHG Multi-link 3G is currently defining the standards for this and other uses of multiple 3Gb/s links. BE

Nigel Seth-Smith is strategic technology manager for Gennum.

Camera lens image stabilization: Part 1

Vari-angle prism image stabilization delivers sharp images in portable HD lenses.

BY LARRY THORPE

Creating stable and sharp images with an HD camera/lens combination requires that the optical image projected on the camera-image sensor remain spatially stable during exposure. Shooting video with a handheld or shoulder-mounted camera/lens can easily produce shaky pictures due to any number of inadvertent physical factors (i.e., shooting while walking or running, being jostled by a crowd, shooting from a motor vehicle, etc.). Shaky video can also result from plain old fatigue by the camera operator as well.

These visible tremors typically manifest themselves as a vibration frequency in the neighborhood of 1Hz. They will be compounded in amplitude, and extended in frequency, if the camera operator is walking or running while shooting. Even a tripod-mounted camera/lens can produce a shaky image if it's mounted on flooring, or a tower, that is subject to vibration, or if the lens-camera system is subject to a blowing wind. Shooting handheld while riding on a motorcycle's back seat, from within an automobile or from within aircraft or boats, can all introduce variations in vibration amplitudes and frequencies.

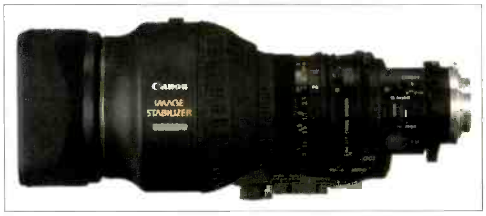
The basis of image stabilization is to restore the image — in real-time — to its correct spatial location on the camera image sensor system. Today, one can find three basic approaches to this: mechanical gyro-stabilized housings for the lens-camera system; electronic systems within the camera that move sensor readout or digital sampling of the video to counter the inadvertent displacement of the

Videographer Sam Allen used the Canon HJ15 image-stabilization lens to shoot the Pikes Peak International Hill Climb, an annual automobile and motorcycle hillclimb to the summit of Pikes Peak in Colorado. Photo courtesy Kevin Koszlowski.

optical image on the camera sensor; and optical correction within the lens itself.

Optical stabilization for a portable HDTV lens

There were three motivations behind Canon's consideration of incorporating a built-in optical stabilization



The new HJ15ex8.5B portable HDTV lens features an enlarged front-end barrel that houses a complete VAP-IS system, including optics, controller and electronics.

system into a portable HDTV production lens:

- The very nature of HDTV — namely, large-screen portrayal of high-resolution imagery — will benefit from elimination of even a small degree of image shake that can blur that imagery.
- The 2/3in HDTV image format is an internationally standardized lens-camera interface. Thus, any 2/3in HD lens can mount on any of the 2/3in HD cameras made by all of the world's professional camera manufacturers. A 2/3in HD lens with built-in image stabilization will remove image unsteadiness from any associated camera regardless of manufacturer. Using appropriate lens mount converters, the same 2/3in lens can also benefit the professional 1/2in and 1/3in camcorders.
- By making the correction in the lens, both the main camera video output and the separate video portrayed in the camera viewfinder are stabilized.

The company has pioneered two primary approaches to built-in optical stabilization in a lens. In both, special sensors detect any physical motion of the lens, and, in turn,

By making the correction in the lens, both the main camera video output and the separate video portrayed in the camera viewfinder are stabilized.

this electronic information is used to control an optical element so placed that it introduces a counter deflection to the original disturbed light rays, thereby restoring the lens output optical image to its intended spatial location on the camera image sensors.

The two optical technologies are quite different and are respectively known as vari-angle prism image stabilization (VAP-IS) and shift-lens image stabilization (Shift-IS).

The new 2/3in HJ15ex8.5B portable HDTV lens incorporates optical stabilization based upon vari-angle prism technology. This article describes that technology.

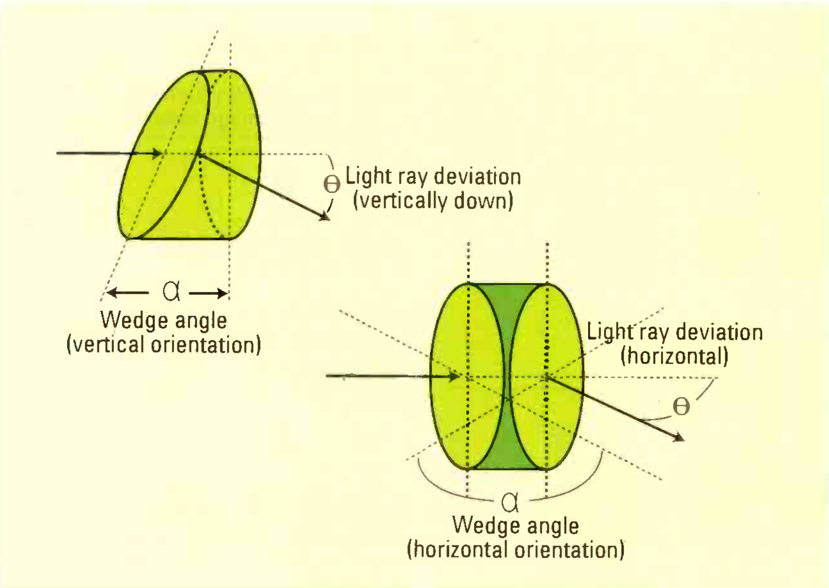


Figure 1. Shown here are the optical principles of a classic fixed glass wedge prism.

Principle of vari-angle prism optical stabilization

The central concept underlying in-lens optical stabilization entails the placement of an optical element within the main light path of the overall lens system. This optical element has the ability to dynamically deflect light rays in a manner that counters the inadvertent deflection of those light rays caused by physical disturbances and vibrations. A wedge prism constitutes such an optical element.

Wedge prisms come in many forms. Figure 1 shows two classic variants on a fixed wedge prism.

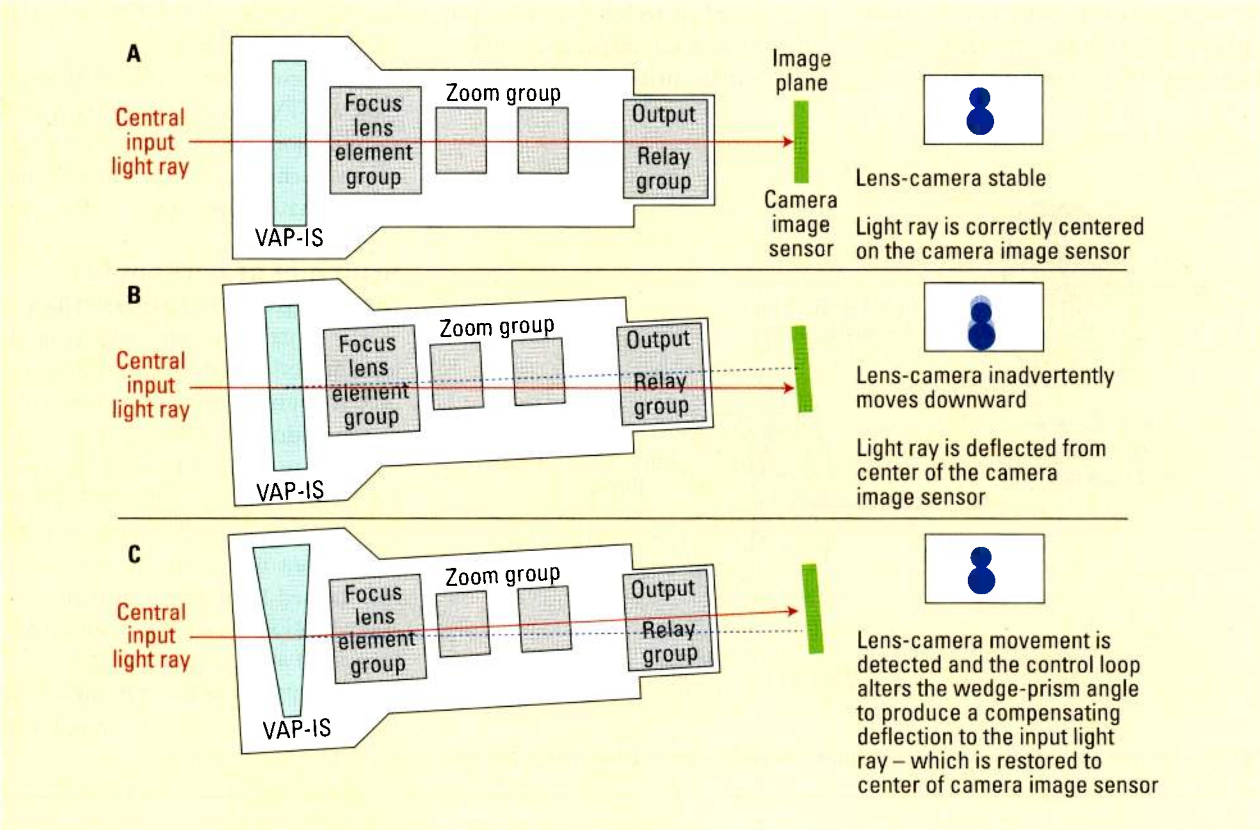


Figure 2. Outlined here are the sequential actions from: (a) stable lens-camera status, to (b) moment of a physical perturbance, followed by (c) the correcting counter action of the VAP-IS system.

A light ray passing through these glass prisms incurs a deflection of amount Theta degrees, which is proportional to the wedge angle Alpha. At the top of the figure, the design is such that the entrant light ray will be deflected down by a fixed angle Theta. The bottom shows a horizontally-oriented wedge prism that will deflect the light ray in the horizontal direction.

If the angle Alpha can be made variable — in both the horizontal and vertical directions — then a dynamic control of the main light ray deflection can be implemented. Designing a wedge prism that can be adjusted both horizontally and vertically in real time constituted the core design task in the development of the VAP-IS system. Before examining details of the entailed technologies, it is useful to first understand the basic correction mechanism offered by a variable wedge prism.

Designing a wedge prism that can be adjusted both horizontally and vertically in real time constituted the core design task in the development of the VAP-IS system.

The correcting action of the VAP-IS system

The implementation of VAP-IS technology places the variable wedge prism at the optical input port of the lens system — directly in front of the focusing element group. Thus, the prism directly intercepts all of the light rays passing through the "entry pupil" of the lens. The manner in which the prism corrects for image shake or vibration is simply explained with reference to three sequential steps outlined in Figure 2.

The top image illustrates conditions when the lens-camera system is stable in terms of any physical motion. The Vari-Angle Prism is not moving, so it imparts zero deflection to these light rays. Thus, all of the light rays entering the lens system are focused and accurately positioned on the camera image sensor. The drawing shows the central light ray correctly positioned on the center of the imager.

The center drawing in Figure 2 shows the momentary condition at the instant there is a physical jolt, jiggle, or vibration to the lens-camera system. Immediately, the light rays projecting from the lens are displaced on the image sensor. Compensating for this displacement, however, are three core miniature electronic components that are built into the lens itself. They include motion detectors, a microcomputer and actuators. All are central to the VAP-IS control system.

When the light rays are bent, the motion detectors in the lens instantaneously signal the microcomputer that

When the light rays are bent, the motion detectors in the lens instantaneously signal the microcomputer that such a physical disturbance has taken place.

such a physical disturbance has taken place, and between them, they describe the nature of that disturbance. The microcomputer, in turn, makes high-speed calculations under control of a sophisticated algorithm and transmits a related control signal (via driver circuits) to a pair of actuators that are gripping the vari-angle prism.

As indicated in the bottom drawing of Figure 2, these actuators physically "squeeze" the variable prism with high rapidity. This action implements the desired variation in the prism wedge angle that introduces the instantaneous adjustment of the angle of refraction of the light rays passing through the prism. Optical position sensors continuously sense and report back to the microcomputer on the correction angle of the prism, thus closing a feedback loop that drives toward zero error. BE

Larry Thorpe is the national marketing executive of the broadcast and communications division of Canon.

Master control and channel branding

Stereoscopic 3-D is stretching the requirements of today's master control.

BY JAMES GILBERT

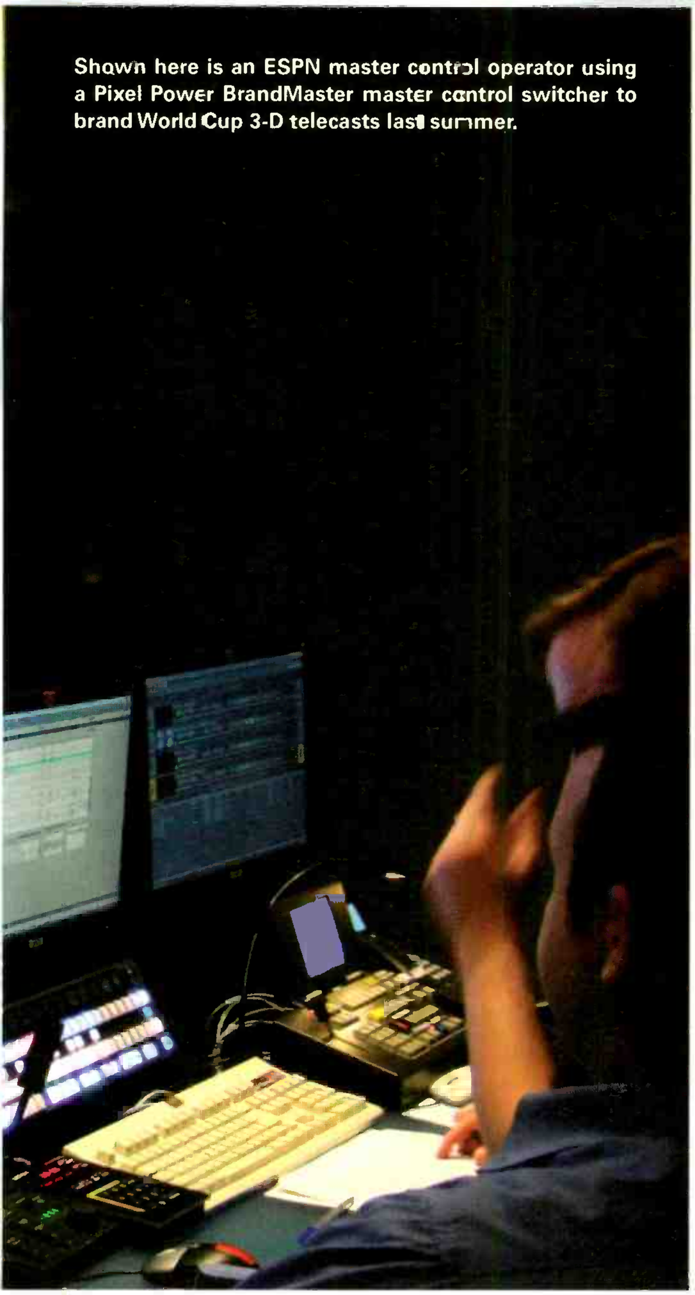
Master control technology has changed significantly over the last few years to support the ever-increasing demands being placed on master control operators. Switching itself has been an area of extensive development in automation technology yielding advanced devices that automate routing changes and require little or no operator intervention. With the exception of live events, most master control functionality is driven by automation. In most master control environments, one or two operators are busy 24 hours a day to guarantee the uninterrupted operation of channels. They are faced with the often daunting task of monitoring the quality and accuracy of each channel, which can number from one to hundreds, ensuring that the transmission conforms to regulations, overseeing the operations' response to equipment problems and preparing content for future distribution.

This article will look at the issues surrounding stereoscopic 3-D playout in relation to master control — particularly the positioning of stereoscopic graphics and the real-time possibilities. It will examine these concerns in the wider context of the relationship between modern master control technologies and channel branding.

With the increasing proliferation of new TV channels, master control technology must fulfill a new role: allowing all that is mentioned above plus the ability to facilitate the cost-effective increase of channel count even for small broadcasters. In order to satisfy this new brief while also allowing cost-effective yet highly dynamic channel branding, master control units must be able to provide this branding across those channels without requiring separate devices.

Early adopters

Added to all this is the more recent arrival of stereoscopic 3-D. Stereoscopic 3-D is an interesting proposition for the broadcast industry, particularly arriving as it has against a backdrop of only slowly improving overall economics. On the one hand, it is to be celebrated as genuine innovation; on the other, a realistic approach has to be taken in terms of market penetration and short-



Shown here is an ESPN master control operator using a Pixel Power BrandMaster master control switcher to brand World Cup 3-D telecasts last summer.

to-medium term revenues throughout the chain. It would be extremely rude not to celebrate the market-leading efforts of ESPN and BSkyB, but at the same time it was refreshing to see a more realistic overall market approach being adopted at IBC2010.

Stereoscopic television is currently much tried but not really tested. Stereoscopic must be viewed alongside a raft of other real changes in playout demands and workflows — particularly the need to reduce cost while increasing capabilities per rack unit.

The most obvious advantage is that stereoscopic television can be deployed throughout the playout chain with minimal technology upgrades. This is because it may be implemented by two signals being carried through the same HD chain rather than a single 2-D feed, though this can have ramifications with compression. But that's not the whole story. While the core technical challenges appear manageable based on what we know so far, from a creative perspective, there are some subjects that continue to need exploration and development.

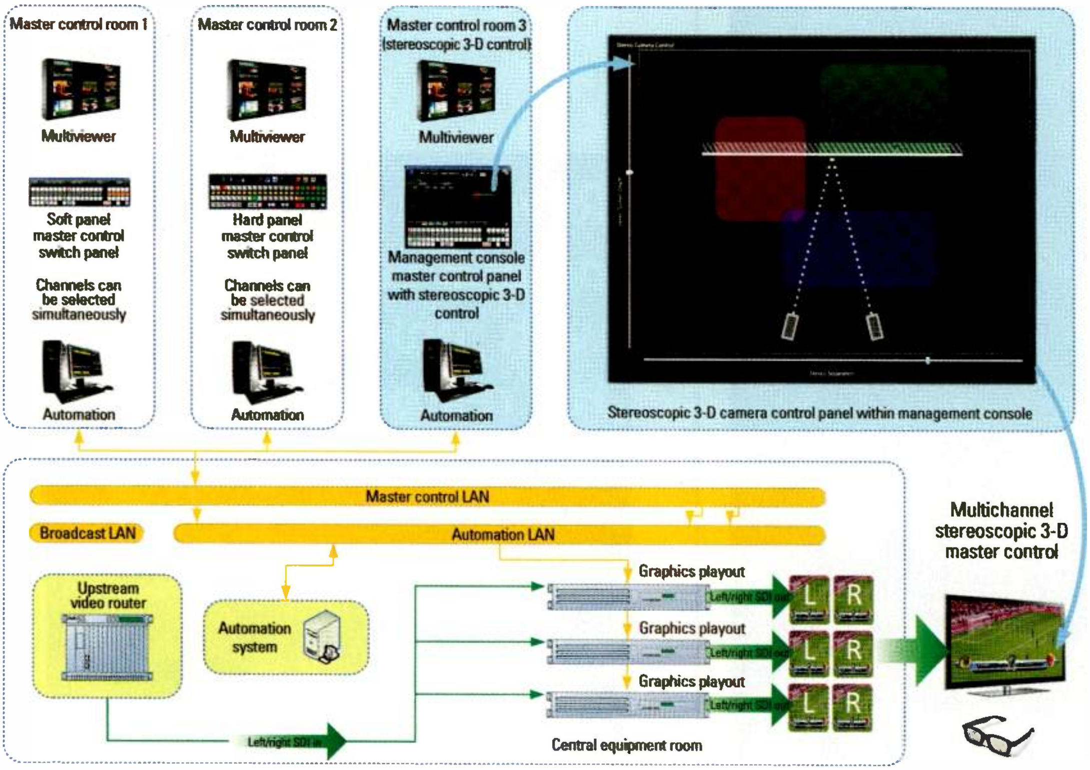


Figure 1. Stereoscopic playout channels may need additional control to manage depth.

Once you move from 2-D to 3-D, anything else that appears on-screen is also affected. In a prerecorded environment, this is not an issue for obvious reasons, but during a live broadcast, the situation is very different.

How to manage the Z-plane

While many of the issues and solutions lie at the production end of the spectrum, the introduction of dynamic/live graphics is not one of them. This poses a real challenge for broadcasters and playout providers as they are dealing with Z-plane positioning, a new and black art. So what does stereoscopic mean for the positioning of graphics both during a show/event or for branding purposes? How can broadcasters prevent clashes between 3-D on-screen "furniture" and video, and therefore significant disturbance to viewers?

There is an acknowledgement and understanding among graphics suppliers and broadcasters that overlay graphics — which are generally used in real time and are not those created in post production, though the same is true of those graphics created in post — have to be positioned so that they don't upset the live action, film or whatever the content happens to be. It's vital that they don't cause visual disturbance to the brain. In basic terms, less is more. Graphics need to be sympathetic to underlying content. Stereoscopic 3-D is not about flying saucers coming out of the screen; it has to be subtler than that, as broadcasters have recognized.

When broadcasting in 3-D, graphics have to be correctly placed in the Z-plane, and this can be a significant problem. The issue comes to the fore as the action moves from shot to shot, therefore altering the depth of field and the stereoscopic scope. Taking golf coverage as an example, if the operator doesn't position the graphics far enough forward, then during the long flight of the ball, it could end up in front of the graphics in the Z-space. But the viewer wouldn't actually see it in front of the graphics because they have been laid over the top. This would be disconcerting for the brain, as it would be seeing something that it has never seen in real life. For sports fans, losing sight of the ball would be annoying. So as the video image moves in the Z-plane, the graphics must either move too or be in a fixed position that will allow the flight of the ball to be captured undisturbed. It's going to take some innovative thinking to make the best use of graphics as an overlay in this environment.

3D graphics

3D graphics in a 2-D broadcast have been possible for a long time now, but in a stereoscopic 3-D space, the issues are different. When a graphics artist designs and animates a 3D strap for some football scores, for example, where that is positioned in the Z-plane hasn't mattered at all in a 2-D broadcast. Whether you have the object a long, long way away and zoom in or very close and zoom out, the result for the viewer is similar. But when broadcasters start working in a 3-D stereoscopic world, where that "furniture" is placed in the Z-plane is important in relation to stereoscopic effect on the video that the graphics operator is placing the graphics over.

So how can broadcasters cope? Here are three possible ways that catering for this potential shot-by-shot variation can be achieved.

First, introduce some form of metadata into the broadcast stream — or as a separate file, a bit like a subtitle file — that has depth information. The graphics device can then use that depth information to position the graphics in the Z-plane so they don't look unsuitable. For this to be truly widespread and economic, there would need to be a global standardization effort, and that will take time. SMPTE is continuing work on its 3D Home Contents Master Standard project.

Second, analyze the incoming feed in real time and then make automatic adjustments based on that. Technology can achieve this, but it's expensive to incorporate into a graphics device and may well require a separate unit. This runs counter to another imperative across the industry: the reduction of the number of devices in the playout chain.

Finally — and this is likely to remain the most feasible solution for some time — operators will have to manually adjust the graphics in a master control environment on a shot-by-shot basis. (See Figure 1.) Technology available today allows operators to adjust the graphics shot-by-shot in the Z-plane. Master control operators will need to be trained to do this, something that as a manufacturer we recognize. While it is a cost, it is also necessary to achieve the benefits of stereoscopic coverage.

There is another aspect to this that most people are only just beginning to think about, and that is the relationship between audio and stereoscopic 3-D. If the illusion of depth is being created, then the audio has to tie in with that illusion. If there are more distant objects, any associated audio will need to be quieter than that for objects further forward in order to enhance that depth of field. A typical example is a now-and-next graphic on-screen with an associated voice-over; that audio has to be in the same space as the graphic because it is the graphic that is "talking" to you. If there's then a graphic that flies in and a sound effect that goes with it, then that sound effect has to track the graphic in the Z-plane; otherwise, the viewer could be confused.

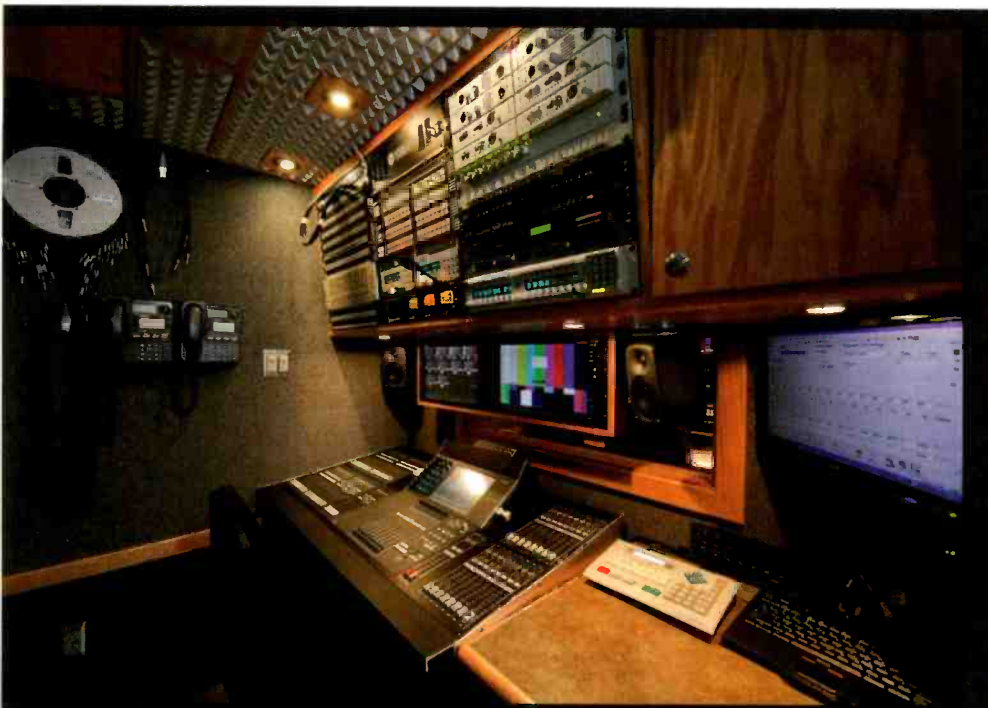
There are two consequences that spring from the necessary increase in the complexity of master control systems. Master control must support an even wider range of functionality — switching, graphics, stereoscopic, audio — while not increasing operational or capital costs. The control of this increased level of functionality needs to be available to operators in a familiar yet flexible form, allowing them to seamlessly incorporate new operations and tailor the control options to meet their requirements.

With the advent of stereoscopic broadcasting, the requirements of master control are being stretched ever further. In today's broadcast environment, multifaceted functionality, high levels of integration and flexible control are essential ingredients of a modern master control system. BE

James Gilbert is joint managing director of Pixel Power.

SYSTEM DESIGN SHOWCASE

For Canada's



size

In the world of mobile production vehicles, bigger is not always better. While the typical state-of-the-art 53ft tractor trailer certainly makes for a roomy work environment that can accommodate a large number of sources for a multicamera production, there are times when they aren't a good fit — either due to limited available space onsite or limited budgets.

Proshow, a Canadian equipment rental and production services company in Vancouver, B.C., has built a new HD 38ft rig that is proving its 30,000lb weight in gold. Using a Peterbuilt chassis, the truck was built by Gerling Associates as part of its Stallion series of production truck offerings.

The smaller truck is about recognizing an unfulfilled market niche.

Cost was certainly a factor in deciding the size and equipment complement of the truck, but Tim Lewis, president of Proshow, said it was also about recognizing an unfulfilled market niche and listening to what its broadcast clients needed most.

Proshow got its start as an audio equipment rental and service company, where it worked with many broadcasters in Canada. The company then expanded to include fly packs complete with a full complement of video gear (cameras, switcher, etc.) to help broadcasters like Global Television produce their annual telethons and other news segments. (The recent Winter Olympics in Vancouver made heavy use of its equipment during the month-long games last February.)

Smaller is (sometimes) better

The issue of a smaller truck came up time and again in conversations with current and prospective clients looking for an economical way to

Proshow, matters

Left: The audio control area, complete with a Yamaha digital audio mixing console. Center: The new Prodigy truck parked outside Autzen Stadium, home to the University of Oregon Ducks. Right: The truck's production control area, which serves as the nerve center of most live productions.

BY MICHAEL GROTTICELLI

produce a live multicamera event without compromising on quality. Those discussions soon led to the design and build of Proshow's first truck, dubbed Prodigy. It was built in 2008 and designed for SD productions, with the expectation that an upgrade to HD was inevitable.

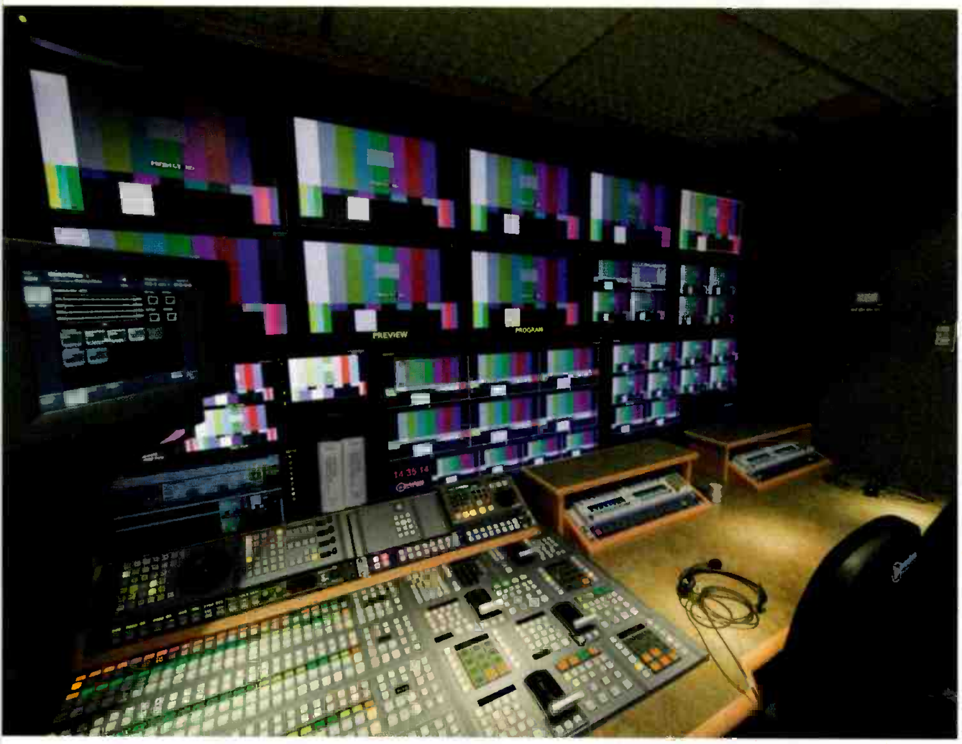
Sure enough, in the fall of 2009, Prodigy was upgraded to HD capability and began working on events like the WHL finals in the spring of 2010. The summer saw the signing of a new contract with Graystone Media for broadcasts of the University of Oregon Ducks football team. Proshow began covering every home game and some away games in 2010. As the team went forward winning all of its games and moving into contention for college football's national title, ABC and ESPN were also on hand undertaking national broadcasts. The OSN games appeared on Comcast throughout the northwest United States

> **For each Ducks home game, Proshow's truck helps produce a live pre-show, the actual game and a post-game show.**

For each Ducks home game, Proshow's truck helped Graystone produce a live pre-show, the actual game and often a post-game show. Graystone produces the game for the Oregon Sports Network (OSN) to provide Ducks sports coverage. If ABC/ESPN were carrying the game, OSN's production was rebroadcast up two hours later on Comcast.

Larger productions with smaller gear

To accommodate the more complex live sports telecasts, some additional equipment, including new Canon 86X HD telephoto lenses, a second EVS replay server (for a total



The main production area features a new Sony MVS 8000 GSF HD video switcher and reconfigurable monitor wall complete with Marshall displays running Miranda Kaleido-Alto multiviewer software.

of 12 channels) and a Blackmagic Design Videohub (72 x 144 I/O) router, were installed on-board the newly refit ProdigyHD. A Sony MVS-8000GSF 2.5 M/E HD production switcher, eight Sony HXC-100 HD cameras on triax, a Yamaha digital audio console and an expanded number of Blackmagic mini signal converters were also added to increase its flexibility and ability to handle a variety of SD or HD projects.

The miniconverters are used to handle any of the numerous formats they work with at the different venues throughout Canada and the U.S. These include Blackmagic's new up/down/crossconverters that are used to downconvert HD signals for displays on producer and program monitors outside the truck.

Always on the lookout for new, more efficient (and lighter) ways of doing things, the Proshow engineering crew controls the Videohub router via a new (free) app on an Apple iPad,

Proshow handles all types of live HD production with its new Prodigy truck. Here, the truck stopped in Chicago to capture a re-enactment of a historic college basketball game. Setup and take down time was greatly reduced due to the truck's smaller size and reduced crew.

which allows them to fully program the monitor wall and reroute sources as necessary from the tablet touch screen.

Because the inside of the truck is more crowded than larger trucks,

The company was careful to choose compact yet highly dense equipment that offered as many features as possible.

space efficiency was certainly an issue when installing the equipment. Lewis and Mark Fisher, Proshow's vice president of engineering (who led the

The engineering area of the truck features a Blackmagic Design Videohub HD-SDI router, numerous VTRs, RTS ADAM digital intercom platform and EVS XT[2] slow-motion replay systems.

In the tape ops and Sony camera shading area, multiple feeds are iso recorded and archived for future storage by the client.

Shown here are the OCP panels for the Sony HXC-100 HD cameras, where shading and camera matching are completed prior to each production with a Sony BVM-L170 HD color grading monitor.

installation), were careful to choose compact yet highly dense equipment that offered as many features as possible. The truck includes only two 6ft high racks of terminal gear. The Videohub is used for all of the monitoring of the truck (including a battery of Marshall LCD monitors at the front of the Production area and elsewhere displaying different sized sources with Miranda Kaleido-Alto multiviewers). A separate Nevion Sublime (64 x 64) router handles the live production sources.

Filling in the gaps

Lewis said the goal for Prodigy was always to fill in the gaps left by the larger production companies, not compete with them. The OSN/University of Oregon wanted to go HD this year for the first time, but didn't want to incur the expense of a larger rig and all that comes with it. The price and availability of Prodigy provided the perfect fit.

The Prodigy HD truck is now contracted to do a dozen Oregon Ducks basketball games this winter and the 2011 Ducks baseball season starting this spring, as well as this spring's track and field season. Graystone Media has also secured the truck for its coverage of the WHL on Fox Sports Northwest. The truck also is sometimes used as a "B" rig for larger production by companies like Dome

Productions (Canada) and Trio Video (Chicago).

Another benefit of a smaller truck, according to Lewis, is that Proshow doesn't have to have it working 200+ days a year (like the multimillion dollar large trucks) to make the business model work; they can arrive at a venue and be ready for crew call (referred to as "park and power") in only 30 minutes, about a third of the time it takes the larger trucks to do. After the game, the Proshow crew usually drives away about 90 minutes after the buzzer. As a result, the cost (fuel and crew expenses) to run the ProdigyHD truck is far less than its larger brethren.

Since after the Winter Olympics, the phone has not stopped ringing. Lewis chalks up the incredible interest to regional HD truck availability and having the right truck for the right price. BE

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

Design team

Proshow
Tim Lewis, president
Mark Fisher, vice president of engineering

Technology at work

Abekas HD ClipStoreMXc with four-hour drives
AJA Video
- Ki Pro HD ProRes DDR
- FS1 frame syncs

Blackmagic Design
- Videohub HD-SDI router
- Mini converters

Canon HD lenses
Chyron Duet HyperX^2 HD graphics system
EVS XT[2] slow-motion servers
Lance TDC-100 DDR controller
Marshall Electronics
- 37in HD LCD multiviewer displays
- 20in HD monitors
- 17in quad-split monitors

Miranda Technologies Kaleido-Alto HD multiviewers
Nevion
- Sublime router
- X/Y programmable panels

RTS ADAM-CS intercom
Sachtler tripods
Sony
- HXC-100 HD triax cameras
- BVM-L170 HD color grading monitor
- MVS-8000GSF multiformat HD production switcher

Tektronix WFM5000 waveform/vectorscope
Yamaha M7CL digital audio console

Harris Selenio

The media convergence platform simplifies mulitdistribution workflows.

BY STAN MOOTE AND JOHN MAILHOT

Broadcasters are in the midst of a giant transition — from creating and distributing one version of one channel to one delivery system, to delivering multiple versions of multiple channels through many delivery systems. The simple days of a single analog channel are gone forever.

Today's viewers expect their content over every delivery platform — appropriately branded, edited and conformed. This puts broadcasters in the curious position of having to determine the best formats and distribution techniques for each channel on each delivery system. Call it multiplatform or multiscreen delivery, today's broadcasters are challenged with the same moving targets

The Selenio media convergence platform combines traditional baseband video and audio processing, compression and IP networking features — all in a single, space-saving 3RU frame.

of providing more and more different types of program feeds all in different formats.

Additionally, there is the challenge of fitting these new tasks into existing workflows. Technology aside, broadcast operations typically are governed by strict organizational and management responsibility domains. Which department holds the responsibility for reformatting and distributing in all these different formats?

Problem solved

To address these new challenges, Harris has developed a media convergence platform that simplifies your multidistribution workflows and signal flows. The Selenio media convergence platform combines traditional baseband video and audio processing, compression and IP networking features — all in a single, space-saving 3RU frame. A GUI based on Microsoft Silverlight technology simplifies

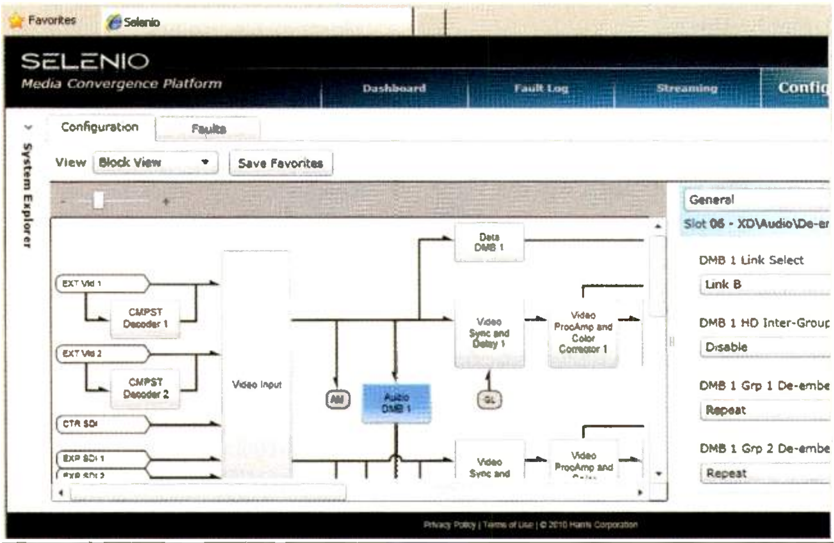


Figure 1. Selenio's web-based GUI uses Silverlight technology to simplify monitoring and configuration.

the management and monitoring aspects, and keeps the configuration process workflow-oriented by following a series of graphical block diagrams instead of being weighed down with user manuals and bespoke commands. (See Figure 1.)

The media convergence platform quickly aligns broadcasters with the moving targets of the multimedia explosion for audio/video, analog/digital, baseband/broadband and, most importantly, the high-quality signal processing and compression for which Harris is well known.

Case study

Let's look at an example application in more detail. A broadcaster has three programming channels prepared for distribution: two HD entertainment channels and an SD news/weather channel. Outputs are required for an ATSC terrestrial transmitter, local cable headends, IP mobile feed for the ATSC M/H system, internal monitoring IP feeds and Internet distribution feeds. To complicate things further, various audio configurations exist for the different feeds.

Using traditional equipment, with a degree of redundancy, 45 separate functional items are required. This includes frame syncs, video format/aspect convertors, Dolby E decoders, MultiMerge processors, loudness processing, and a variety of video and audio compression encoders and multiplexers. IP processors, Ethernet switches and redundancy management controllers round out the rack infrastructure. A total of 25 rack units, more than 130 cables and around 2500W of power are

typical for this approach. Configuration, management and monitoring of all this equipment present an additional operational challenge.

Taking the functional convergence mindset of Selenio, all these functions are consolidated into a high-density integration platform, as shown in Figure 2. Space, power, cabling and operational complexity are reduced by 75 percent. There is no reason to waste the equipment cost, real estate and doubling of functions when the sensible alternative is finally at hand.

Benefits

Looking at the complex requirements for each delivery platform illustrates the advantages of taking the convergence-platform approach:

• *Signal preparation preparation:* Video and audio signals from the plant arrive as HD-SDI but over fiber due to the distance involved. The fiber needs to be terminated, the signals synchronized to plant timing and static delay adjustment applied to the audio to compensate for the plant. The video requires format conversion and ARC for some delivery systems, as well as the associated reformatting of the captions and other ancillary information in the video signal.

• *Audio preparation:* HD network programming typically has 5.1 audio; the local newsroom produces stereo only, and syndicated content is all over the map. Playout and master control use Dolby E to facilitate the multichannel audio. At this end of the chain, the Dolby E must be decoded to PCM. A MultiMerge algorithm is used to create a consistent 5.1 upmix of the audio, and also a stereo downmixed version; these are each subsequently loudness-managed for CALM-act compliance. Visual Description Service audio is also processed for each program.

• *OTA transmitter feed:* A heavily compressed statistical multiplex is used to fit the two HD signals and one SD signal into the ATSC modulator, while leaving room for a mobile service. The HD programs for the OTA transmission are crossconverted to 720p to optimize picture quality at this high-compression ratio. MPEG-2 encoding with Dolby Digital audio is used.

• *OTA mobile transmission feed:* The mobile feed is also created, including downconversion of the source video and downmixing of the 5.1 audio into stereo. CALM-compliant loudness control is applied on all audio signals

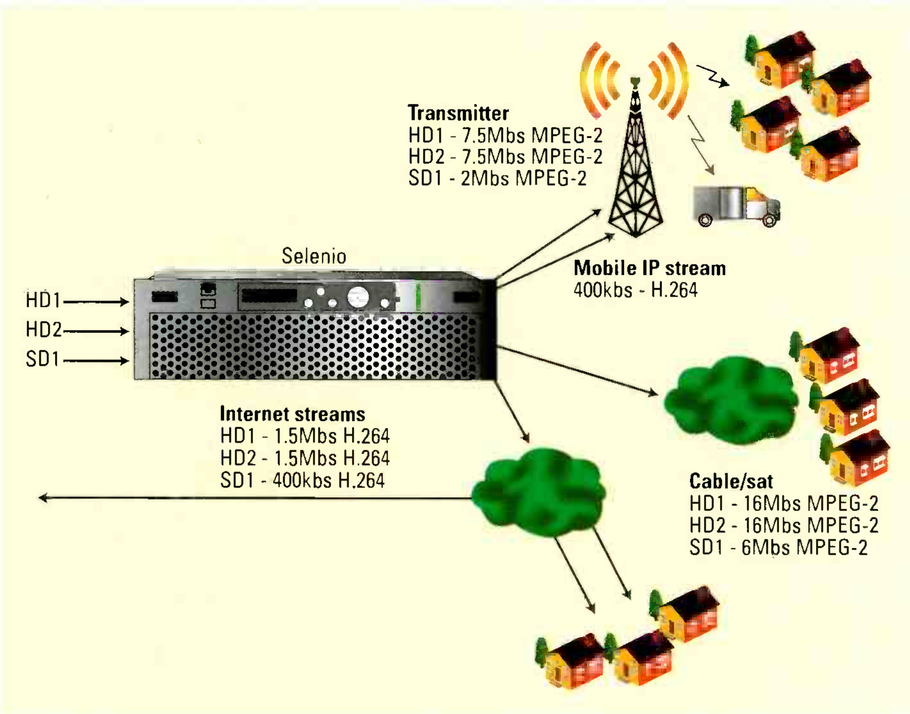


Figure 2. Using the Harris Selenio media convergence platform, a typical multiplatform system is reduced from 25RU to 3RU.

in this transmission multiplex. This feed uses H.264 video encoding and AAC audio.

- *CATV headend feed:* The delivery to the local cable operator is not constrained by the same bandwidth limitations as the OTA transmitter. Many stations today create an alternative multiplex for delivery to cable headends, with a lower compression ratio. In our example, while the HD programming on the OTA channels is in 720p, the cable delivery is in 1080i format.
- *In-plant monitoring feed:* In the old days, an analog in-house CATV was used so everybody in the building could watch the air signals. Now that PCs and LANs have invaded the facility, an IP version of the feed, suitable for decoding on desktop PCs, is another version to be generated from the TX room.
- *Internet distribution feed:* Increasingly, a live feed of the station is streamed for online viewers. H.264 video with AAC audio also is used for this feed.

A complete redundancy architecture is enabled by consolidating all of the processing into the media convergence platform. Every element of the air chain can be backed up 1:1 or 1:N as appropriate, and management of redundancy changeovers is accomplished through the convergence platform. Further, the media convergence platform exports a unified management interface, including a unified dashboard suitable for operations monitoring. Alarms and alerts are clearly displayed, identified down to interfaces and modules.

A tool for the 22nd century

The media convergence platform provides savings of space, power, cabling and operations monitoring/management complexity. This example clearly illustrates the TCO savings of the convergence platform mindset: 2500W to 600, 25RU to 3RU, and 131 cables to 14.

Similar savings are documented at other workflows in the plant, including content acquisition/prep and signal processing for newsrooms and remote feeds. The Selenio media convergence platform is designed to be the next generation of infrastructure for the 22nd century television operation. **BE**

Stan Moote is vice president of business development, and John Mailhot is director product architecture at Harris Broadcast.

RadiantGrid Platform

The system integrates file processing into an efficient and automated workflow.

BY KIRK MARPLE

Today broadcasters are challenged more than ever before when it comes to handling file-based content. They are faced with dispensing it to various distribution formats such as on-demand, online and for purchase on iTunes, all with less staff. This makes it difficult when trying to ensure that content is consistent with the appropriate file format and to identify problems when they arise.

The current solution that many broadcast outlets employ involves different hardware and software pieces linked together as needed with each working independently of one another instead of as one cohesive unit. This setup makes it hard to troubleshoot when issues arise because it is hard to identify where in the chain the problem started. It also affects the processing power of the server farm because multiple software programs are competing for the processing power of the workflow's servers, which slows down process of each.

Integrated new media automation

RadiantGrid has developed an integrated new media automation platform that will take a file through all the processing required from when it leaves the nonlinear editor (NLE) up to the broadcast trafficking system. This latest version of the RadiantGrid Platform offers quality control modules, as well as video processing by Cinnafilm and audio processing by Linear Acoustic, which are integrated into the platform and controlled from one central GUI.

Incorporating multiple processes under one platform interface helps eliminate inefficient workflow and automate the process. Because multiple processes are handled concurrently and the GUI visually illustrates what stage of the workflow a file is in, less staff involvement is required.

Integrated quality control

At ingest, files are arranged into a form that is optimal for the transcoding stage. Files are broken down or demuxed into essence formats. Mezzanine streams are created from the source media, which are optimal for transcoding. Prior to being transcoded into the desired formats, the platform's quality control module checks the file for A/V issues before moving it on to the transcoding queue. If there is a problem with the file, it is quarantined for user interaction. This helps to further automate the process in that those files with issues are placed aside, allowing the rest to pass through the queue. Quarantining questionable files allows users to prioritize those files for manual processing.

Because Cinnafilm and Linear Acoustic are part of the process, audio and video processing are now integrated into the platform. If there is a problem (for example, with the frame rate or audio levels), it can immediately be rectified without having to take the file out of the workflow. A similar quality control and quarantine process is performed post transcode to ensure issues did not arise during the transcoding process.

Optimized resource management

The RadiantGrid solution is able to provide faster processing because it uses its server farm. It allows users to customize how many servers are being used for preparation processing (quality control, audio and video processing), transcoding and metadata indexing.

In a typical workflow, there are usually more files coming in than need to be transcoded at one time. Broadcasters could, for example, designate five of their nine servers to handle all quality control and preparation processing while the rest would handle transcoding. The server sees these processes as separate queues and handles them independently so neither process is slowed down.

Integrated video and audio processing

Some users may want to continue using A/V processing offered by other vendors. RadiantGrid has been working with several manufacturers to integrate their processing into its platform. Cinnafilm's Dark Energy can perform grain and noise management, pulldown removal and frame rate conversion. The Linear Acoustic solution lets users correct for loudness, upmix and downmix audio files, and transcode to a variety of file formats. This helps broadcasters maintain proper audio levels and visual elements without having to move a file in and out of different software programs.

As content volumes grow larger, old-fashioned architectures can no longer efficiently manage the workload. Yesterday's solutions require more staff involvement, which increases both delay and cost. The RadiantGrid solution integrates file processing into an efficient and automated workflow, which increases throughput and maintains high quality, all while lowering staffing costs. BE

Kirk Marple is president and chief software architect of RadiantGrid Technologies.

Elemental Server

ABC launches an iPad news application using the file-based video processing system.

BY LISA EPSTEIN

The ABC Player for the iPad launched with much fanfare and success. Building on this success, ABC set out to develop a dedicated ABC News application for the iPad, designed to provide a rich, interactive end-user experience in which text and video work together to inform and entertain. The free application's debut targeted an installed base of more than 3 million iPad users.

Background: ABC'S expansive video assets

As new media platforms proliferate, content producers like ABC are increasingly challenged to supply archived and first-run video for playback in a variety of formats on a wide range of devices over bandwidth-constrained networks. When a new device like the iPad is introduced into the market, large content providers must be prepared to convert video assets for compatible format and display. But formatting and display are only part of the equation.

Today, multiple copies, and therefore multiple transcodes of the same content, are needed to deliver the highest possible quality experience on a wide array of devices.

Smart video delivery

Adaptive bit-rate streaming is literally seamless in that the video consumer does not need to adjust settings to cope with variability in network conditions. Bit-rate changes occur as both network and client resources fluctuate while maintaining smooth delivery of streaming video without buffering or other interruption.

Adaptive bit-rate streaming to the iPad, therefore, requires not only conversion of existing content to a variety of display resolutions and bit rates optimized for the device, but also requires a mix of files to be available for real-time stream switching. To achieve this, content providers must convert video assets to new file formats across a range of settings rather than relying on a single encoded file to address all network and client conditions before delivering to a CDN.

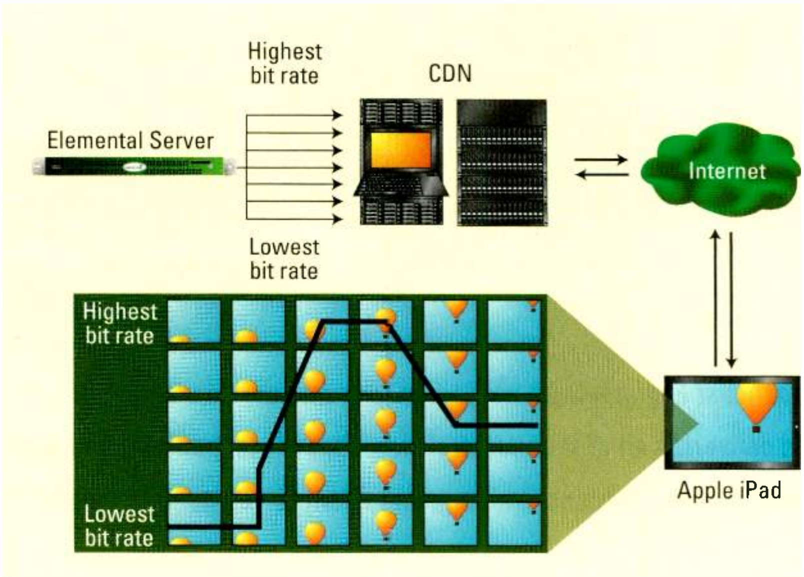


Figure 1. Dynamic stream switching improves the user experience when network bandwidth is constrained.

Under the hood

In the case of the iPad, ABC must encode and segment years of video into the fragments required for Apple's HTTP adaptive streaming protocol. To meet this challenge, ABC deployed Elemental Technologies' Elemental Server into its production workflow. (See Figure 1.)

Elemental Server is a file-based video processing system that performs high-speed video transcoding for multiscreen video applications. At the heart of the system is patent-pending software that harnesses the power and programmability of modern graphics processing units (GPUs). By harnessing the power of the GPU, the time required for video processing and conversion is greatly reduced.

The Linux-based system is designed to perform transcoding. The key functions include decoding, video processing and conversion, and file formatting. It offers universal input support and can accept a broad range of incoming file formats and core codecs, including Apple ProRes 422, MPEG-2, VC-1 and MPEG-4. It provides advanced preprocessing, including inverse telecine and motion-adaptive deinterlacing, noise reduction, and color correction. Image insertion is also available. Other video processing functions include antialias scaling, scene change detection, MPEG-2 deblocking and temporal frame rate conversion. Video conversion can be performed using a variable, average or constant bit rate with options for single or multi-pass encoding.

Supported codecs include H.264, VC-1 and MPEG-2. Converted files can be wrapped in a variety of containers for Flash or Windows Media, or in an MPEG-2 transport stream. Media can also be formatted for adaptive bit-rate protocols, including ISMV for Smooth Streaming, F4V for Flash Media Server, or m3u8 for Apple Adaptive. CableLabs-compliant streams are also an available option.

Elemental Server also addresses the Apple App Store requirement to use the m3u8 file extension as well as to provide a 64kb/s bit stream for all video apps. Files are generally either 640 x 360 or 480 x 360, 24fps, with a 48 GOP size and incremented in 10-second segments. Each input file is formatted to five outputs — 700k: 652k video + 48k audio; 500k: 452k video + 48k audio; 300k: 252k video + 48k audio; 150k: 118k video + 32k audio; and 64k: 36k video + 24k audio (JPEG overlay + audio).

The system significantly streamlines content conversion for the iPad with a substantial increase in transcoding efficiency compared with existing solutions. Built-in presets for the iPad eliminate the need for customized encoding settings and save operator time. The performance available with a single encoding system reduces the number of units required for large-scale transcoding, therefore lowering operations cost and overhead.

The system's flexibility allows effective conversion of video for the iPad today and ensures support for video delivery standards and protocols such as HTML5 and WebM in the future.

In addition, the system's flexibility allows effective conversion of video for the iPad today and ensures support for video delivery standards and protocols such as HTML5 and WebM in the future. Its massively parallel architecture can easily handle the processing required to transcode simultaneous inputs and outputs in real time. With Elemental Server, ABC can convert more than 20 640 x 360 or 480 x 360 files in real time for on-demand adaptive bit rate streaming.

Elemental Server merges the performance benefits of a massively parallel hardware platform with the versatility and forward compatibility of intelligent software to give video publishers and distributors unmatched price/performance for video compression. By harnessing the power of graphics processors, it offers greater density and throughput than other solutions. The system delivers simultaneous, faster-than-real-time conversion of multiple HD and SD video streams across an array of devices, including TVs, PCs, tablets and mobile phones. BE

Lisa Epstein is senior marketing manager of Elemental Technologies.

MPEG-2, MPEG-4 and JPEG 2000 encoding

JPEG 2000 offers advantages, but at high bit rates.

BY JOHN LUFF

MPEG and JPEG encoding of video content have been around for a long time now. It seems hard to believe, but the first product tests for MPEG-2 encoding began in the mid-1990s, with the standard adopted in 1996.

MPEG-2 is sometimes misunderstood in fundamental ways. It is both a compression system and a description of the transport stream that carries the content. MPEG-2 was developed to overcome some of the shortcomings of the MPEG-1 standard, which included limitations in audio to two channels, no support and poor results with interlaced signals, and support only for 4:2:0 encoding. Each of these limitations proved critical to enabling professional use and to a degree affected deployment of consumer applications as well. And MPEG-1 was developed to deliver narrowband content to fit in a T-1 link, or within the bandwidth of a CD-ROM. We moved beyond those requirements a long time ago, so a review is necessary. For a comparison of compression standards, see Table 1.

MPEG-2 is sometimes misunderstood in fundamental ways. It is both a compression system and a description of the transport stream that carries the content.

Review of MPEG

MPEG-1 and MPEG-2 make use of discrete cosine transform (DCT) to compress the content. By converting from the spatial to the frequency domain using DCT, and then normalizing and quantizing the coefficients that result, the considerable redundancy in video content can be squeezed to allow lower bit rates. Other techniques are also used, including run length encoding to further improve performance.

The most important point is that what is thrown away is hopefully content we don't miss. The analysis of the content is based on good science that is founded on the psychophysics of human vision. For instance, we don't see detail as well in the presence of motion, so we can eliminate that redundant information. Compression choices are made by hardware designers based on tests done with expert viewers in a controlled environment and increasingly with automated test equipment that replicates the results that expert testing returns. The standard defines the bit stream a decoder must be able to decode, but in fact doesn't talk about how to achieve the bit stream.

The MPEG-2 transport stream provides a method of transmission of single or multiple programs, each with multiple audios, closed captions and other data types. The ATSC standard is based strongly on MPEG-2 for compression and transmission, with extensions that customize it for the needs of terrestrial transmission.

It is important to remember what the system was designed to do "a priori." Compression is expensive, so decoders can be cheap and easy to deploy. Early HD encoders for

	Compression	Precision	Color coding	Latency	GOP	Motion	Uses	
MPEG-2	DCT	8 bit	4:2:0-4:2:2	Low to long	One to many	Motion-compensated	Broadcast/ production	Consumer/ professional
AVC	DCT	8-12 bit	4:2:0-4:4:4	Long	One to many	Motion-compensated	Mobile ATSC/ production	Consumer/ professional
JPEG 2000	Wavelet (DWT)	8-14 bit	4:2:2	Low	One	N/A	Transmission/ digital cinema/stills	Professional
Dirac	Wavelet (DWT)	10 bit	4:2:2	Low	One	N/A	Production	Professional

Table 1. Compression comparison

the ATSC system cost $250,000. Now consumer camcorders have MPEG-2 (or AVC) HD compression built into devices, costing 25 percent of the price 15 years ago.

High-quality encoding is still more expensive, but keep in mind that the results are short of astounding. We routinely send SD content in less than 2Mb/s and HD in less than 12Mb/s for end-user applications. Equally important, the transport stream developed in the 1990s is just as good today, serving MPEG-4 and JPEG 2000 applications as well. With suitable error correction, we now send MPEG content through noisy RF environments; IP networks; and over fiber, copper and WiFi, successfully. Many people entering the production industry are more comfortable with MPEG video than baseband signals, which seem almost arcane.

Though not a subject for quick review, it is worthwhile to note that none of this comes for free. The MPEG-LA (Licensing Authority), a patent pool, holds more than 600 patents from more than 20 companies and universities, many of which have expired. The negotiations over the patents took longer than the development of the technology. Today, MPEG-2/4 (H.264/MPEG-4 Part 10/AVC) covers transmission and storage of bit rates from well below 1Mb/s to over 400Mb/s.

Though using MPEG-2 can produce great results, the technology is much older than the standard adopted 15 years ago. The MPEG-4 standard, and particularly Part 10 (also known as AVC, Advanced Video Coding and H.264 for the ITU standard number) offers all that MPEG-2 does, plus many additional tools that can further improve the coding efficiency and reduce bit rates for equivalent quality.

MPEG-4 Part 10, in which we are primarily interested in broadcast systems, still uses DCT compression, but allows variable block sizes, multiple reference frames for motion prediction, and the ability to code single blocks as intra (I) or predictive (P) data. Other significant improvements developed after MPEG-2 were loaded into the standard, like increased precision in motion prediction (one-quarter picture element, or PEL), more effective entry coding using context-adaptive binary arithmetic coding (CABAC) and context-adaptive variable-length coding (CAVLC).

At the high end, JPEG 2000 is quite a different beast. It does not use the same tools as any of the MPEG flavors, but instead uses wavelet compression.

In an important way, AVC supports the modern needs of the industry for increased quality at higher bit rates. Support of better pictures; 4:2:0, 4:2:2 and 4:4:4 chroma subsampling; and increased sample precision ranging from 8 bits to 14 bits per sample were added, which has extended the application space to include production for a wide range of uses and archival storage. The results can be astounding, with decoded pictures indistinguishable from original material.

Of course, higher quality is also available at low bit rates, and much of the content we watch on the Internet is H.264 coded as well. Like MPEG-2, AVC has long latency, which is problematic for many live broadcast uses. Latency can be reduced substantially by using higher bit rates and I-frame only coding, but with higher transmission bandwidth.

JPEG 2000

At the high end, JPEG 2000 is quite a different beast. It does not use the same tools as any of the MPEG flavors, but instead uses wavelet compression. This offers interesting advantages, but not low bit rates. Wavelets can allow lower resolution outputs to be extracted from a higher bit rate stream without recoding. The need to have a separate system generate and store thumbnails may not be necessary. Similarly, an HD stream can be used to directly extract an SD output.

In general, errors are less visible because by the nature of the compression, they are spread across the image rather than being evident in small areas of the screen. JPEG 2000 offers high bit rates for high-quality applications, as much as 960Mb/s; image maps up to 4096 x 2304; and frame rates to 120Hz. It should be no surprise that it is the basis of the Digital Cinema standards adopted worldwide.

In addition, it can offer excellent quality at moderate bit rates for mezzanine compression use in broadcast facilities. A system using wavelet compression similar to JPEG 2000 was developed by the BBC and is known as Dirac. Other broadcasters have adopted JPEG 2000 in part due to extremely low coding/decoding latency.

MPEG-2 dominated the market for nearly a generation. It might not be reasonable to expect the next dominant compression format to last that long. BE

John Luff is a broadcast technology consultant.

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

Neutrik — powerCON TRUE1

AC power connector is designed for 16A, 250V; features IEC 60320 breaking supply, and inlet and outlet couplers for easy daisy-chaining of equipment; provides for high-density requirements with a duplex chassis connector; available for self-termination or as a ready-made cord set, with over-molded cable connectors, that offers IP65 protection class IP65.

704-972-3050; www.neutrik.com

Lectrosonics — Quadra

Digital wireless monitor system consists of M4R belt-pack diversity receiver and M4T half-rack transmitter; features digital RF modulation, two or four channels of 24-bit/48kHz digital audio, analog or digital inputs and mixing interface; operates in the license-free ISM band of 902MHz-928MHz and has a throughput latency of 1ms for analog inputs and less than 0.5ms for digital; M4R receiver features a user-friendly interface with high-resolution, backlit LCD and membrane switches, as well as four-channel mixer; M4T transmitter features transmission power of 200mW, locking XLR connectors for up to four channels of analog or digital (AES/EBU) audio sources, high-resolution, backlit LCD and large membrane switches.

**800-821-1121
www.lectrosonics.com**

Ross Video — CrossOver Solo

One-MLE production switcher features 12 external multidefinition SDI inputs, a 10-input multiviewer, SD/HD operation, six internally generated sources, three keyers, two 2-D DVEs, input frame synchronization for untimed sources, internal SD-to-HD conversion, four internal media stores for stills and animations, UltraChrome chroma keyer, internal reference generator with three independent outputs and 100-event memory system with MemoryAI.

613-652-4886; www.rossvideo.com

Apantac — CRESCENT

Line of signal-processing solutions includes 1 x 8 reclocking distribution amplifier, SDI-to-HDMI/DVI converter with looping outputs and an SDI de-embedder with integrated 1 x 2 SDI distribution amplifier; distribution amplifier accepts one SD/HD/3G-SDI input, provides equalization and reclocking, and distributes the signal to eight outputs; supports resolutions up to 1920 x 1080p and can deliver eight 3G sources up to 140m away; SDI-to-HDMI/DVI converter has an integrated 1 x 2 distribution amplifier that supports two reclocked SDI outputs; converts an incoming SD/HD/3G-SDI signal into and HDMI or DVI signal; includes embedded AES or analog audio monitoring outputs; 3G-SDI de-embedder decodes and extracts 16 channels of embedded audio signals and outputs them to eight AES or 16 analog discrete audio outputs.

503-616-3711; www.apantac.com

BTX Technologies — MaxBlox

Solderless termination system reduces installation time and cost by eliminating the need for soldering or crimping; features sled-type bottom to allow connectors to slide, snap and lock into the MaxBlox CD-MX915H hood for a secure cable-mount connection; family includes HD15, D89, S-video and 3.5mm connecters, as well as BTX-MXRCA screw-terminating RCA panel-mount connector; requires only a strip tool and screwdriver.

800-666-0996; www.btx.com

Litepanels — Sola ENG

LED Fresnel light offers beam control of 10 to 70 degrees; features instant dimming from 100 percent to zero with no noticeable color shift; provides manual focus and dimming control via camera lens-style ergonomic controls; runs on 10VDC-20VDC sources or via an AC power adapter.

818-752-7009; www.litepanels.com

MultiDyne — SL-2150

L-band fiber-optic signal conversion module based in a standard one-third of a rack enclosure takes power from either a 12V brick adapter or any source in a range of 9VDC-24VDC; also available in 1RU and 3RU kits; provides low carrier-to-noise ratio, linear performance and ultra-wide dynamic range; features 950MHz-2150-MHz to optical fiber signal conversion, up to 50km range using DFB optics, 9dB RF gain from FTX to FRX, 20dB noise figure and LNB power up to 400mA.

**877-685-843-963
www.multidyne.com**

ComNet — ComWorx CWGE9MS

Managed Ethernet switch provides seven 10/100/1000TX ports as well as two 1000Mb/s ports, which are standard RJ-45 electrical ports or can be configured for fiber-optic media by using the selectable, optional ComNet SFP modules in the SFP port; features IGMP snooping v1/v2 for multicast filtering, IGMP query v1/v2 and X-ring technology, which provides a redundant network path in the event of a failure on the network.

203-796-5300; www.comnet.net

Silentium — AccoustiRACK Active

Soundproof cabinet provides up to 30dB sound reduction, which translates to a 96 percent elimination of environmental noise; leverages active noise control to eliminate outside noise; provides 8kW of heat dissipation by allowing free air movement and heat exchange with the outside of the unit while maintaining a dust-free environment.

469-429-5350; www.silentium.com

Wohler Technologies — AMP1-E8-MDA-3G

Eight-channel audio monitor supports Dolby E, Dolby Digital (AC-3), Dolby Digital Plus, 3G, HD-SDI, SD-SDI, AES/EBU and analog signal sources; processes embedded Dolby D, E, Digital Plus and AES audio with metering and alternate undecoded Dolby, AES and analog inputs; features complete downmixing capabilities; design provides optimally focused sound for operators in an ultra-near-field environment of 1ft-3ft; enables a higher SPL for the operator while reducing overall ambient sound and adjacent-bay crosstalk.

510-870-0810; www.wohler.com

NewTek — TriCaster TCXD850 CS

Hardware control surface for the TriCaster TCXD850 HD portable live production system provides a physical connection to the 24-channel system's functions and effects; provides illuminated push buttons, twist knobs, a T-bar and three-axis joystick to control the TCXD850; features intuitive control layout, virtual input rows, new utility row, utility bus delegate, live virtual set controls, media player controls, positioner controls, transition controls, one-button streaming and one-button recording.

800-862-7837; www.newtek.com

Element Technica — Atom

Camera-specific 3-D rig designed for use with RED EPIC digital cinematography cameras accommodates full-sized PL and PV prime lenses, as well as smaller zooms; provides a full 5K-3-D beam-splitter system weighing as little as 36lbs and featuring interocular and convergence control; allows recording of interocular, convergence and lens metadata; integrates with same cine-style lens control that is also available with Quasar, Pulsar and Neutron 3-D rigs; available constructed of aluminum or magnesium; Atom Pro Kit integrates multiplexing, sync and power-conditioning electronics into the Atom to eliminate those external components from the rig.

323-641-7327
www.elementtechnica.com

Sonnet Technologies — Yin•Yang

Mini hub enables users to connect a FireWire 800 device plus a FireWire 400 device to a computer simultaneously through a single FireWire 800 port; two FireWire peripherals, such as external drives, DV camcorders, webcams and audio interfaces, can be concurrently connected and used; supports one bus-powered device on either port; requires no power adapter and no driver software; works with all manufacturers' FireWire peripherals.

949-587-3500; www.sonnettech.com

Chyron — AXIS

Cloud-computing graphics creator simplifies, streamlines and facilitates the graphics creation workload across many users in a broadcast operation; integrates into existing or Chyron-based workflow; includes high-resolution maps, 3D charts, financial quotes and a virtually unlimited set of tools for topical news graphics creation; provides prebuilt templates for quick creation of graphics for multiple outlets, including websites, mobile devices and print publications.

631-845-2000; www.chyron.com

Newtec — MENOS

Networking system used to exchange multimedia content over satellite allows operators to share video and audio material among several sites scattered across a large geographical area; incorporates fast, cost-effective technologies for media exchange with a complete range of tools to facilitate coordination and communication among personnel across the network; investment costs in DSNGs can be shared through use of the OpenDSNG platform, which allows broadcasters to equip and use a DSNG on both the MENOS network and existing legacy TV contribution networks.

203-323-0042; www.newtec.eu

Technomad — Schedulon 3.0

Updated playback and recording system retains flexible options for instant, manual playback of user-loaded audio from a front-panel screen and push-button knob, while improving the automatic playback functionality through down-to-the-second scheduling; features a nearly 200 percent increase in data transfer speeds, updated user interface, ability to record and play back WAV audio, 2GB of storage and internal power backup option; can function as the audio source for a single PA system or can be used to feed audio to large-scale paging/BGM systems.

617-275-8898; www.technomad.com

Thomson Video Networks Sapphire

Transport stream server provides high-performance MPEG physical I/O, scalable storage capacity and a various set of control interfaces; enables operators to record, store and play back multiple streams; features support for SD and HD content with MPEG-2/4 video, frame-accurate capture and ingest, frame-accurate and seamless multichannel playout, remultiplexing capabilities, support for in-band (SCTE 35) or out-of-band (GPI) triggers, advanced asset management, and scalable storage with RAID security; supports multichannel playout, TV on-demand and media archival, time delay, near VOD, store and forward, ad insertion, and ingest.

877-605-5622
www.thomson-networks.com

OCZ Technology Group RevoDrive X2

PCIe SSD card upgrades the original architecture of the RevoDrive to deliver speeds of up to 740MB/s and up to 120,000 IOPS; eliminates the SATA II bottleneck and leverages a PCIe x4 interface to exploit the full potential of current flash technology; uses an onboard RAID 0 design, as well as employs four SandForce-1200 controllers to maximize data access and bandwidth; bootable to ensure quicker startup and load times; available in capacities from 100GB to 960GB.

408-733-8400
www.ocztechnology.com

Telegent Systems — TLG1123

Analog mobile TV receiver incorporates Telegent's Picture Vivid Engine, which delivers improvements in picture stability and clarity for high-motion video; reduces power consumption by one-third relative to industry standards; available in 6mm by 6mm package; eliminates need for external crystal; features hardware-based controls for brightness, contrast, hue and saturation, as well as an adaptive audio filter that optimizes the filtering of unwanted audio content and delivers an increase in maximum output volume level; designed around a common pinout that delivers forward compatibility to future analog and digital mobile TV receivers.

408-523-2800; www.telegent.com

EEG — DE1285 HD

Caption decoder/VANC monitor card provides all of the functionality of EEG's DE285 HD caption decoder/VANC monitor, a VANC monitoring solution that combines HD-SDI overlay of closed-captioning, audio measurements and key broadcast metadata with a powerful, browser-based VANC analysis tool; live monitoring features include VANC packet presence detection and sorting, highly customizable pause-and-resume triggers and fully automated packet logging; available in a single, modular frame card.

516-293-7472; www.eegent.com

Hosa Technology — Hosa Pro Microphone Cables

Microphone cables feature 20AWG oxygen-free copper conductors, conductive PVC, a 90 percent oxygen-free copper braided shield and 6.8mm outside diameter jacket; include Neutrik REAN connectors, which have silver-plated contacts, zinc die-cast housing, quadrangle design, chuck-type strain relief, rubber boot kink protection and robust locking latch; standard configurations available in 3ft, 5ft, 10ft, 25ft, 50ft and 100ft lengths; hi-Z configurations available in 5ft, 10ft and 25ft lengths.

714-522-8878; www.hosatech.com

Petrol Bags — Digibag

Semi-hard cushioned camera bag is designed in black 900D and ballistic nylon fabrics to safeguard a video-enabled DSLR camera and important accessories; features a top flap that opens extra wide for instant access, contoured upper section to fit a DSLR camera with the lens attached and hinged floor of the upper section that contains twin pockets; two levels of removable internal dividers secure contents and create pockets for storing accessories; additional features include an ergonomic carrying handle, padded shoulder strap and dual-directional, easy-glide zippers.

845-268-0100; www.petrolbags.com

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Help Wanted

CHIEF ENGINEER

LeSEA Broadcasting World Harvest Radio WHRI located in Pineland, SC is accepting resumes for full-time Chief Engineer. Experience with maintenance of high power short-wave transmitters, HF curtain antennas and high power HF antenna switching systems and transmitter cooling systems is required. Experience with ABB SK-55 500KW transmitters, Harris SW 100 transmitters, large power generation equipment, and C-band satellite receive system is desirable. Duties include preventive maintenance, component level troubleshooting, spare parts ordering, and supervision of operators and engineers. Please send resume and salary requirements to: **HR@lesea.com**

Help Wanted

Television Remote Engineer - EIC

IMS Productions, one of the industry's leading mobile television companies, has an opening for a qualified Engineer in Charge. Engineer should have extensive knowledge in Grass Valley Kalypso and Kayenne switchers, RTS ADAM intercom systems, Calrec and Yamaha Audio consoles, Chyron Hyper X 3, N Vision routers, with Jupiter control and Sony HDC cameras. Applicant must also have a large system overview as we cover major sporting and entertainment events nationwide and abroad. Engineer must have the equivalent of an associate's degree in applied electronics with a minimum of 3 year's mobile television experience as an EIC. Above all, the applicant must be a self-starter with good work ethics, great attitude and the ability to work under pressure. If interested please email resume to Robby Greene at **rgreene@brickyard.com** or mail to IMS Productions at 4555 W. 16th St., Indianapolis, IN 46222.

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Broadcast Engineering, February 2011, Vol. 53, No. 2 (ISSN 0007-1994) is published monthly and mailed free to qualified persons by Penton Media, Inc. 9800 Metcalf Ave., Overland Park, KS 66212-2216. Periodicals postage paid at Shawnee Mission, KS, and additional mailing offices. Canadian Post Publications Mail Agreement No. 40612608. Canada return address: Bleuchip International, P.O. Box 25542, London, ON N6C 6B2. POSTMASTER: Send address changes to Broadcast Engineering, P.O. Box 2100, Skokie, IL 60076-7800 USA. CORRESPONDENCE: Editorial and Advertising: 9800 Metcalf, Overland Park, KS 66212-2216 Phone: 913-341-1300; Edit. fax: 913-967-1905. Advert. fax: 913-967-1904.

Net neutrality

Broadcasters must understand its implications.

BY ANTHONY R. GARGANO

During the recent year-end lame duck session of Congress, the FCC adopted a set of rules aimed at assuring open access to the Internet. After adoption of the rules, known widely as net neutrality, FCC Chairman Julius Genachowski said, "For the first time, we'll have enforceable rules of the road to preserve Internet freedom and openness."

What possible controversy could there be with rules that are intended to provide a level playing field to developers and to ensure unfettered Internet access both for those availing themselves of Internet-provided services and those companies providing those Web-based services? Welcome to Washington, D.C., where no potential political controversy stone is left unturned.

Ostensibly, net neutrality assures equal access for users and service providers alike by imposing rules on the pipe owners — such as Comcast, Cox, AT&T and Verizon — that essentially preclude them from being arbitrary and discriminating in throttling back the bit rates of the services flowing through their pipes.

With a straight party line vote by the commission, it seems that neither political party was entirely happy with the rules as adopted. Claims on one side that the rules did not go far enough and left too many loopholes were offset by claims on the other side that the FCC overreached its authority and was imposing unnecessary controls over business.

Complicating matters even further, the rules adopted by the FCC treat wired Internet access somewhat differently from wireless. Incoming Speaker of the House John Boehner, R-OH, has already gone on the offensive. He stated that the new net neutrality rules "will hurt our economy, stifle private-sector job creation, and undermine the entrepreneurship and innovation of Internet-related American employers." He went on to say that "the new House majority will work to reverse this unnecessary and harmful federal government power grab."

On the Senate side, Minority Leader Mitch McConnell, R-KY, has vowed to lead the fight in the Senate "to push back against new rules and regulations." So, the battle over net neutrality will be an interesting one to watch over this congressional session.

The mind boggles at the havoc that could be created by the handful of owners who control all of the nation's broadband pipes.

For the broadcaster, this battle over access and delivery speed of Internet-supplied content has wide-ranging implications. We live in an era of increasing consolidation of media and new media. News Corp., for example, owns newspapers, broadcast and cable networks, a stations group, and satellite delivery of both owned and non-owned broadcast and cable channel content. Comcast owns sports franchises and cable networks; with 23.6 million cable customers in 39 states and 15.9 million high-speed Internet customers, it is the largest provider of such services in the country. Comcast has consummated its deal with GE to take over control of NBC Universal.

In our new media age, Web delivery of both expanded and repurposed news and magazine show content for the broadcaster has become increasingly more important and is not insignificant to advertising revenue. In the broadcaster's own version of a perpetual motion machine, smart station managers increasingly use content to drive website traffic and use website traffic to drive on-air viewership. As Apple/iTunes, Google TV and a myriad of other such Internet-based television delivery services get their business models together, in the future, the Internet will take on an even larger role in the delivery of broadcast station content. Another nascent television delivery vehicle, mobile DTV, is still in the business model formative stages, and some of those models envision a tie-in to the Internet.

The mind boggles at the havoc that could be created by the handful of owners who control all of the nation's broadband pipes. Not that any have done so in the past, nor have any even threatened to do so, but it is easy to imagine a scenario where the intended "level playing field" goes askew.

This year will be interesting for net neutrality. Congressional leaders are on record to overturn the rules. Some broadband pipe owners are already making lawsuit rumbles. Net neutrality will be in the courts and in Congress; the outcome is certain to affect broadcast revenue streams. Broadcasters need to follow the net neutrality happenings, understand the issues and strategize accordingly. BE

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

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