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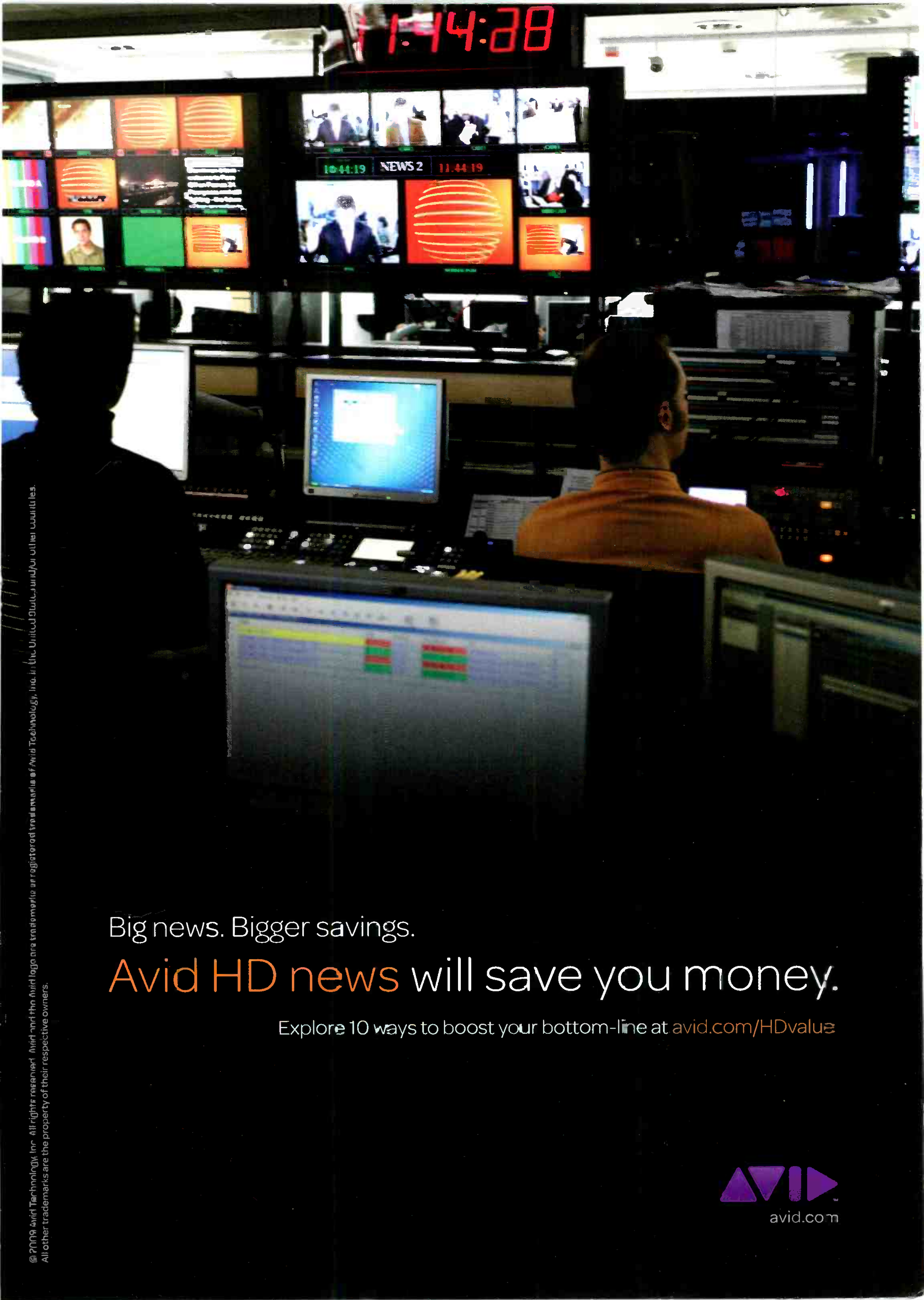
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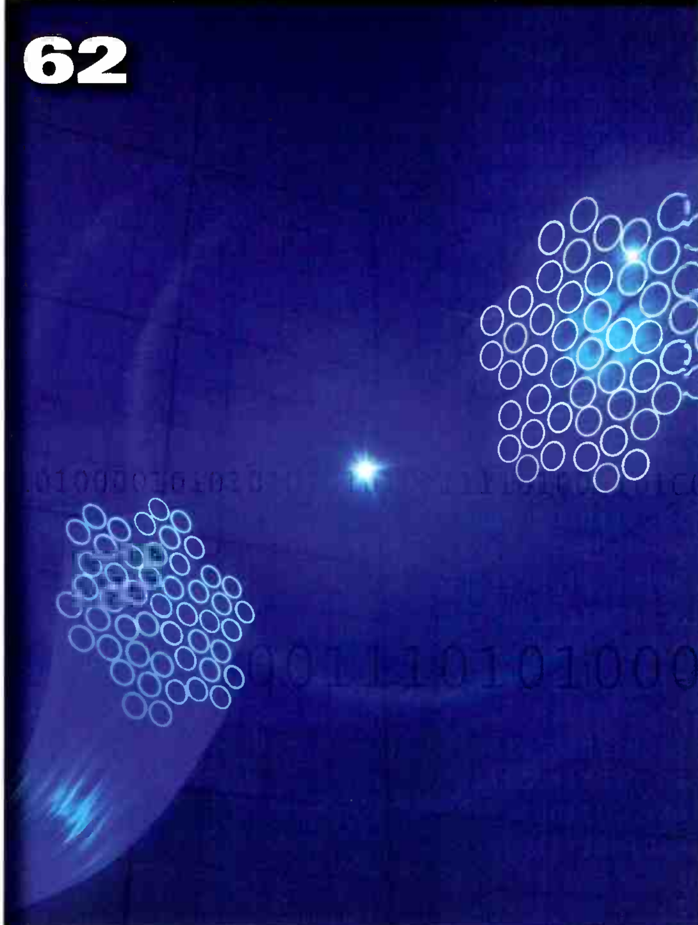

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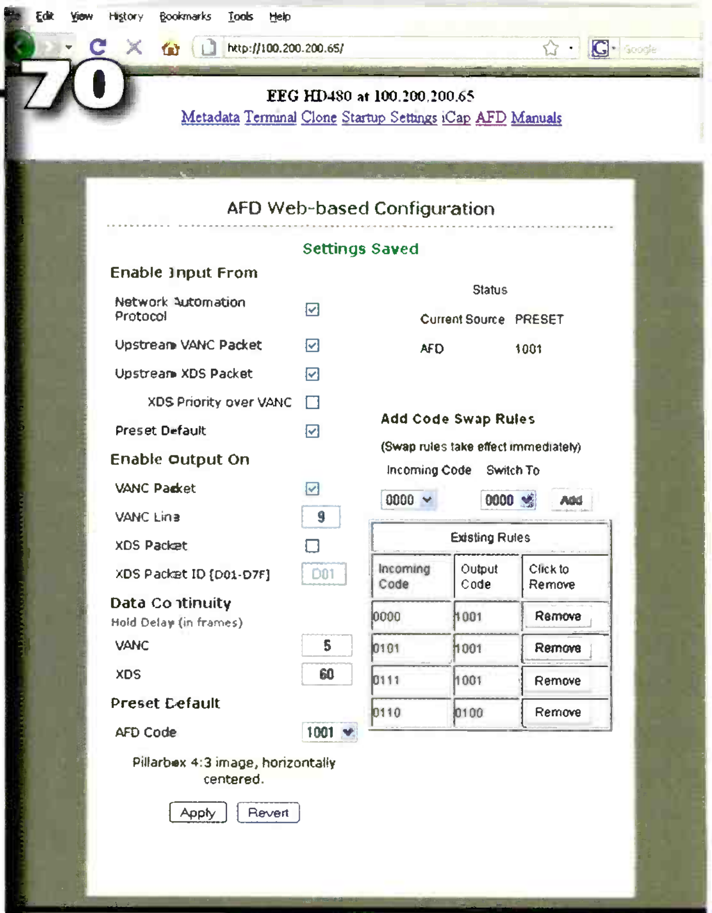
Learn more at *http://broadcastengineering.com/video*

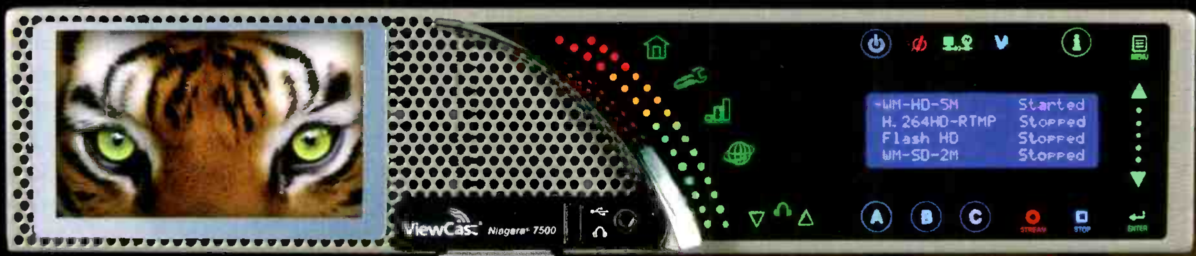
LATEST NEWS!

Nielsen, the TV ratings service, estimates that there will be 114.9 million U.S. TV households for the upcoming 2009-2010 TV season, the smallest increase in the last 10 years.

Learn more at *www.broadcastengineering.com*



Beauty on the outside.
Beast on the inside.



It's easy to be enticed by the alluring good looks of the Niagara® 7500 – the newest HD streaming solution from ViewCast. On the outside, its sleek, innovative design and responsive touch-control interface will excite you. Its brilliant high-resolution HD display will dazzle you. But on the inside, it's a beast.

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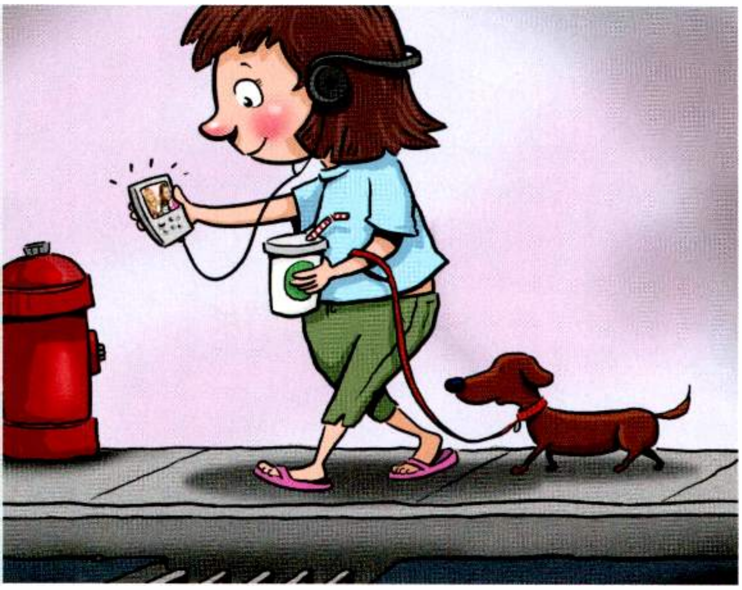
Mobile TV is for the young

I recently had the pleasure of spending about a week with my young adult niece as she visited me between college semesters. The visit turned out to be the perfect opportunity to learn how young people interact with technology. I was quickly surprised at the extent to which she was engaged with, knowledgeable about and reliant on portable devices and the media they held.

Over three days, I watched her replace her cell phone with a new one and then forge headlong into the upgrade and transfer process of moving her contacts, calendar, music and videos from the old phone to the new one. In addition, she replaced her broken laptop with a new one and moved the required content between them. Even for this geek, I was impressed with this young person's skill and familiarity with new technology and the tenacity to organize her information and entertainment on portable devices exactly as she wanted it.



This personal observation was the perfect sidebar to some research I've been doing on the use of mobile devices and Internet delivery of content.

The Pew Research Center recently concluded a project that examines how mobile access is changing the way people consume entertainment. Overall, 56 percent of American adults surveyed say they have connected to the Internet with a wireless device; 19 percent say they do so on a daily basis. That is a 73 percent increase since December 2007.

Thirty-nine percent of the adults surveyed have what could be called a symbiotic relationship with their portable devices. My niece was certainly a testament to that statistic. These young people have pushed beyond the wired and locked-down desktop experience and now embrace on-the-go connectivity. These folks expect to send and receive voice and text messages as well as entertainment at any time, in any place. My niece carried her new cell phone wherever she went, even within the house. I doubt she was ever out of earshot from her new phone — and her connected friends.

The research firm MediaCT says that between September 2008 and April 2009, the percent of users watching long-form streaming video (TV shows) doubled. The firm's study, MOTION, shows that 51 percent of Internet users between 18 and 24 have watched at least one TV show in the previous 30 days. That's up from 18 percent last September.

A Yahoo! survey shows that Internet video consumption peaks twice per day, between noon and 3 p.m. and again between 9 p.m. and 1 a.m. Echoing these numbers is a QUALCOMM study showing that mobile TV viewing spikes in the 1 p.m.-2 p.m. time slot. The company says an average daily viewer spends 30 minutes watching its FLO TV. Nielsen says 13 million wireless viewers are watching television on mobile devices. That's a 52 percent increase from last year.

So, why should you care? These statistics and observations of my niece's use of technology confirm to me that broadcasters have a limited window of opportunity to build themselves a niche in the mobile and Internet video space. Young audiences aren't going to wait for us to get our collective act together. These people will demand that media be delivered on their terms, on their schedules and on their selected portable devices. If broadcasters fail to provide content on those terms, they do so at great financial peril. BE

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

VHF allocations

Dear Harry Martin:

I'm writing to ask a question about a statement in your August 2009 FCC Update column, "Cross-country moves." You stated in the background paragraph that the FCC never allocated commercial VHF channels to New Jersey or Delaware. Did I miss something growing up in Delaware?

WDEL-TV started on Channel 7 in 1949 and later moved to Channel 12 in 1951. Its studios were (and buildings still are) on Shipley Road. It was a DuMont affiliate. I seem to remember that it was owned by Steinman Broadcasting, and later by Storer Broadcasting. I think the station went dark in the late 1950's, soon after the network shut down. At some point, the Channel 12 assignment was changed to non-commercial and co-licensed to Wilmington-Philadelphia, at which time the non-commercial broadcaster in Philadelphia (on Channel 35) asked the FCC for permission to move down to Channel 12. I think it was in 1963 that permission was granted by the FCC.

I'm sorry to be hazy on some of the details, but a quick Web search should confirm most of my memories.

I look forward to seeing more from you in *Broadcast Engineering*!

Cliff Schultz
Senior editor
Center City Film & Video
Philadelphia, PA

Harry Martin responds:

Section 331(a) of the Communications Act was passed in 1982. It provides that the FCC will, upon notification by an interested station, reallocate a VHF commercial TV station to a state that has none at the time of the request without regard other provisions of law. As of 2009, when the notifications were filed to allocate Channel 2 from Jackson, WY, to Wilmington, DE, there were no commercial VHF allocations to Wilmington.

The Channel 7 allotment to Wilmington in the 1940's is news to me. I am a bit of a neophyte, having been born only in 1945.

Splicing MPEG

Dear John Luff:

I was reading your "Splicing MPEG" article online at http://broadcastengineering.com/infrastructure/broadcasting_splicing_mpeg/, and I had a question. Say we have an MPEG-2 transport stream that is transmitted over wire — say MPGA. Is it possible to have another MPEG-2 transport stream (MPGB) to be spliced along with MPGA without having to uncompress the same? I want something like MPGA.1 MPGB.1 MPGA.2 MPGB.2 MPGA.3 to be transmitted, considering that MPGA has three splice points and MPGB has two splice points.

Jacob Jose Neroth
National Game Village
Bangalore

John Luff responds:

What you describe is precisely the intent of MPEG splicers. If the output stream can be variable bit rate, the bit rate of the two input streams does not matter. If, on the other hand, the inputs are different but the output must be constant bit rate, a transrating operation may be necessary in the process of splicing the two disparate streams into one.

Such a problem is often likely when a spot is dropped into a pre-existing stream, where the "hole" is a fixed and deterministic number of bits, and the spot must fit precisely. In part, this can be done by eliminating or adding nul packets (packets with no useful data that simply stuff the stream to match the intended bit rate) to make the splice a bit simpler to achieve. Lining up the GOP structure is the other critical part of the operation. And, of course, the integrity of the tables must be maintained.

Long-GOP editing

Dear Steve Mullen:

I read your "Long-GOP editing" article in the July 2009 issue and had a question. You mentioned that it is a good idea to edit natively in the long-GOP format and only convert on playback or output, etc. You also mentioned that you can send your material to Apple's color program in GOP format but that it will send it back to Final Cut Pro in ProRes. At that point, how do you integrate your color-corrected shots back into your sequence, seeing as they will now be in the ProRes codec as opposed to the long-GOP format you have been natively editing in?

Gabe Haggard
Post production coordinator
Santa Monica, CA

Steve Mullen responds:

Great question! Final Cut Pro 6, or higher, can mix long-GOP MPEG-2 and ProRes 422 in the same timeline. Not only does this feature allow you to "round-trip" to/from color, but also it enables you to render a complex MPEG-2 segment so it will play smoothly at full speed.

TV facilities go green

Saving Mother Earth can be good for the pocketbook.

BY ANGELA SNELL

A recent report developed by the BPM Forum (an organization that helps advance the understanding of business performance management techniques, technologies and processes in global enterprises), in conjunction with server and storage manufacturer Rackable Systems and Intel, said that 99 percent of people think it's important for the media and entertainment industry to reduce its carbon footprint.

Going green is good for the environment, but it's also a way for broadcasters to save money in the long term. And, in this economy, pinching every penny can help you keep your job. This article will explore ways that broadcasters can go green, looking at it from three perspectives: a broadcaster, manufacturer and systems integrator.

NBCU is eco-friendly

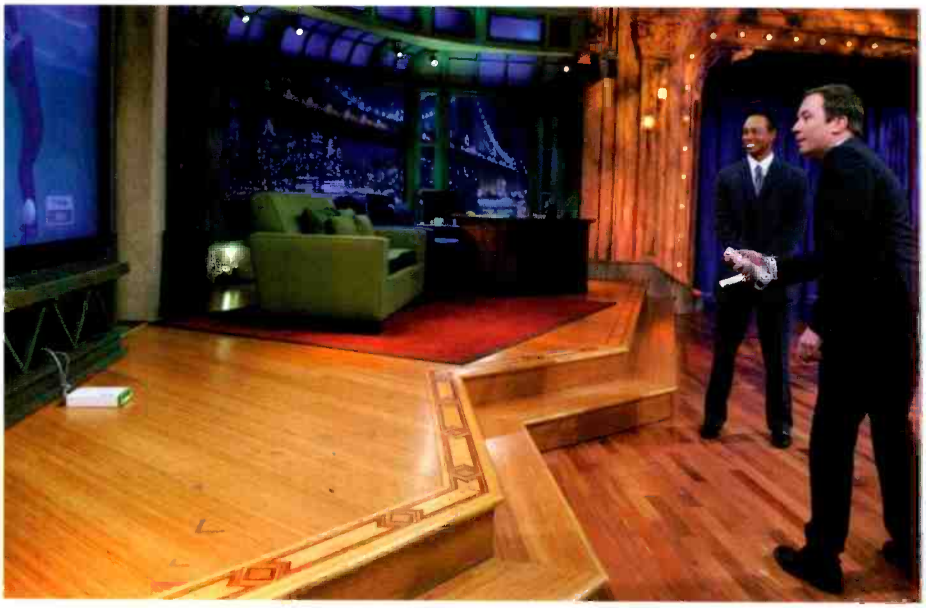
Over the past few years, NBCU has taken a three-step initiative to improve energy efficiency while at the same time reducing costs and streamlining operations. One part of the three-step process focused on consolidating heavy metal operations to increase the efficiency of shared resources.

According to Kendall Bryant, manager of Green is Universal at NBCU, "This enables a focus on improving and maintaining these core resources and allows NBCU to control the growth of the biggest power consumers — servers, equipment rooms, storage, routers, etc."

The second step focuses on minimizing the amount of gear "just left on" in control rooms and production facilities.

Bryant says, "For too long, the practice of leaving equipment on 24x7x365 was overlooked as newer equipment was installed. Now, NBCU is auditing what machines can be shut off without disrupting routine operations. A big opportunity is through the move from analog to digital and SD to HD."

The network has been focused on shutting down old systems and areas that are no longer in use from the SD to HD transition. Bryant says, for years, the industry was running on dual analog and digital systems but now with the official transition, broadcasters can move to a single system. This not only saves on space, but it also saves on energy to run and cool the systems.

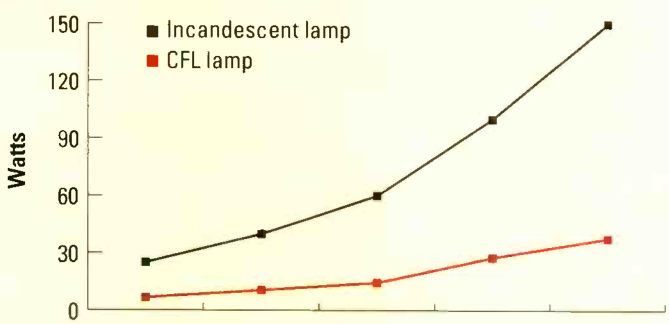


NBC Universal's "Late Night with Jimmy Fallon" set is eco-friendly. It was constructed with FSC plywood, bamboo floors and a recycled desk. Photo courtesy NBC/Dana Edelson.

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

CFLs output less power than incandescent lamps

An incandescent that outputs 25W would equate 7W-9W for CFL.



Source: EPA *www.epa.gov*

The third step in NBCU's green initiative is enabling staff and crew to utilize desktop tools as the technologies improve. This will focus the need for large facilities that have intensive energy and cooling requirements on only specialized functions.

Recently, the network built a new set for the "Late Night with Jimmy Fallon" show, using many types of green practices. Before preproduction had even begun, Leo Yoshimori, set designer, worked with Bob Usdin from Showman Fabricators, a local set production firm, to determine ways in which they could improve the sustainability of the set. The location includes:

- Sets constructed with FSC plywood (wood that is responsibly harvested).
- Low or no volatile organic compounds (VOC) paints, which reduces off-gassing from paint substances.
- Bamboo floors throughout the interview area. (Bamboo is highly sustainable due to its quick growth.)
- A recycled desk. (The desk used by Fallon is formerly the desk of the set designer Leo Yoshimori.)
- Set décor (doors) reclaimed from local salvage stores.
- Metal platforms for the band rather than wood.
- Reclaimed and refurbished seating rather than new seats.
- Carpeting on the audience risers and a band platform made of recycled materials.

According to Bryant, "In Studio 8H, where SNL is taped, we are proposing a specialized lighting grid cooling system. Studio 8H is used for many purposes, so the lights are often left on. To protect the lights from overheating, rather than keeping the entire studio at very low temperatures, a cooling system will be directed toward the lighting grid only, reducing the amount of energy needed to keep the lights operating at optimum capability."

In Seattle, WA, KJR radio station made an agreement with Comcast SportsNet to broadcast TV content from its studio. Advanced Broadcast Solutions employed green practices when overhauling the space so it could be used for both radio and TV. The systems integrator installed Philips Kinetics LED lighting as well as robotic cameras.

Reusing rather than building from scratch has been an important focus of NBCU's green initiative. When the network transitioned MSNBC's Control Room 3A to HD, the team spent two weeks before beginning the project to assess which equipment could accommodate HD technical specifications.

Bryant says, "There was an enormous time and energy savings in this exercise as wires, cables, consoles, jackfields and racks were used from the former control room — not to mention the incredible amount of waste that was diverted from landfill."

Consolidating equipment creates a cost savings through energy reduction. Moving more work to desktops, edit and GFX thereby reducing the need for heavy metal systems also saves space, allowing for a more streamlined operation. Bryant says NBCU is still transitioning but looks forward to when the transition is complete and it can accurately assess the savings.

During this recession, it is the perfect time to inventory systems, pare down to what is necessary and to promote better usage of systems that are already in place instead of building more pockets of new systems, Bryant says.

"Going green isn't just about solar panels and wind farms, but about looking at the way your business operates and improving the efficiency of how you produce and distribute content," she says. "See the opportunity in a down economy with lower numbers of capital projects as a way to focus internally and prepare for the future."

Eco-friendly equipment

A flurry of new broadcast equipment has stormed the market, boasting equal or greater features and functionality but in smaller packages. Now there are products that use state-of-the-art FPGAs, which ensure that electrical component usage is minimized. FPGA technology also extends the life of the product as new features and functionality can be added remotely without costly hardware upgrades. In addition, look for products that are RoHS-compliant, meaning they don't contain lead-based components, which are harmful to the environment.

Nevion's executive vice president of marketing, John Glass, says making an even bigger impact is the performance of these products while they are in ser-

vice. Nevion, formerly Network Electronics, produces global video transport solutions.

"Clearly, the amount of power the product consumes has a direct impact on the broadcaster's carbon footprint," Glass says. "And, the reduced product size plays out in reduced demand on the air-conditioned space in the equipment room; reduction in generated heat means avoiding waste twice — first in spending power to create heat, second in spending power on air-conditioning to remove the same heat."

So what's in it for the broadcaster?

Glass says, "Products that help broadcasters reduce their carbon footprints also help them save money and reduce maintenance requirements, such as cleaning and repairing fans."

The reduced size of green equipment makes it more convenient for broadcasters to deploy the system in a limited space, and it's more portable in temporary deployment situations.

When shopping for new equipment, compare power consumption and the physical footprint of the product. In addition, look at the level of integration offered by different products. For example, selecting a "universal" card that can accept and transmit any professional video format enables broadcasters to purchase and deploy one card instead of many to support a variety of formats.

Martyn Horspool, television product manager, Harris Broadcast Communications, says, "New transmitter designs are up to 30 percent more energy efficient than previous generation designs, reducing power consumption and hence reducing generation of greenhouse gases by the utility company."

Horspool adds that broadcasters can achieve energy savings by using more efficient RF devices, automatic adaptive precorrection (allowing devices to be driven closer to saturation), low loss combining and RF components, and by carefully selecting power supply components to minimize losses.

New transmitter designs are more "power dense" than previous ones, reducing floor space and building size. According to Horspool, reduced room size helps minimize overall system energy costs by decreasing heating, cooling and air-conditioning costs. Most new high-power, solid-state transmitters use liquid cooling systems to efficiently remove heat from the building. A well-designed liquid-cooled transmitter uses liquid not only to cool the power amplifiers but also other heat generating components such as power supplies, RF combiners and RF reject loads. Using these techniques reduces the overall heat load to the building. This can dramatically reduce the size of air-conditioning units needed for the building, therefore lessening energy requirements.

Designing a green facility

From a systems integrator standpoint, Mark Siegel, president of Advanced Broadcast Solutions (ABS), echoes the sentiments above, saying that decreasing power consumption is the main way broadcasters can "go green." The most important considerations are HVAC and electrical.

Siegel says, "Reducing people reduces power consumption. There is nothing more that puts off heat than people. That's a joke. But it's true." Minimizing the number of people in studio audiences and the control room means less heat is generated; hence, it decreases the need to cool down a facility.

Also, consider the way that lighting impacts power.

"For 20 years, we've been looking at fluorescent-based lighting vs. incandescent to reduce the cost of power consumption and reduce the cost of heat," Siegel says.

Now LED lighting is becoming an attractive solution. Broadcasters need to consider how much heat lighting produces, which impacts the amount of HVAC they have to pump into a facility.

A third way that Siegel suggests broadcasters can be more eco-friendly is by using a green screen.

"We cut down an awful lot of trees to create these sets. And these sets are very expensive. To light a green screen, you light it once, and it stays that way. So you create your set, lighting mood and lighting direction within the artificial environment."

Using a green screen rather than a set can be more cost-effective, as it is easier to light and eliminates the amount of power used. At the end of the day, Siegel says it may require additional tooling and expense to establish green practices in a broadcast facility, but the long-term benefits are worth it.

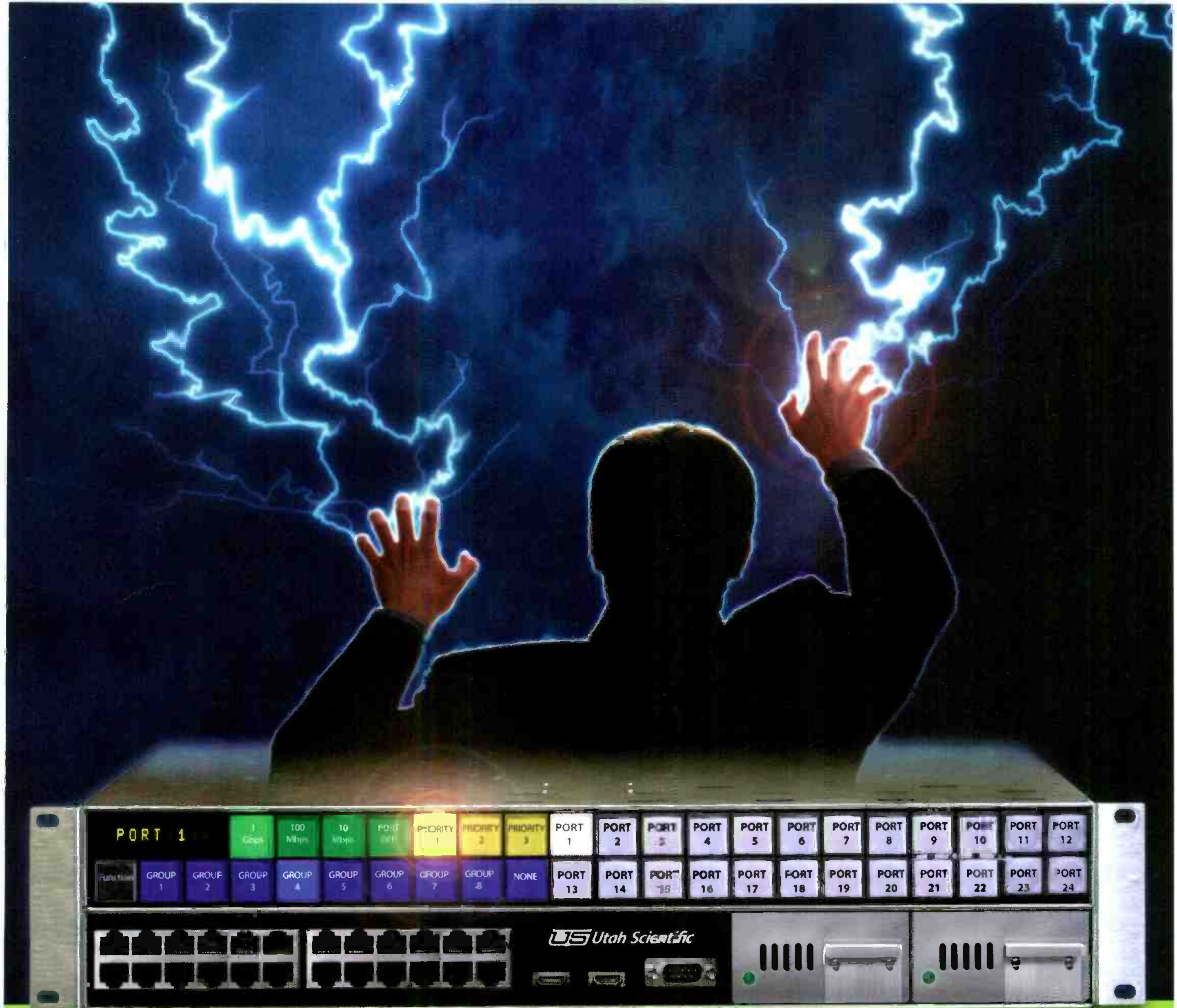
"Unfortunately, the management mentality these days is reducing people," he says. "I think they can look for other places within their facility to reduce. Implement better practices, such as, when a studio is not in use, let's shut that stuff down. Implement better control systems on HVAC. Some people have these very large facilities that they've had for years, and people have been spread out throughout the building. Why not consolidate that space? If you can save $3000-$4000 a month on power or HVAC, that's $3000-$4000 a month that you don't have to sell."

Conclusion

Jumping on the green bandwagon is the popular thing to do right now. Conserving energy, using recycled materials and reducing headcount are just a few things discussed in this article, all of which may save your broadcast TV facility money in the long term. Also consider hiring a systems integrator or contacting your local utility. Both of these resources can offer advice for how to employ green practices and save on power.

For more tips about going green, visit *Broadcast Engineering's* blog at *http://blog.broadcastengineering.com/brad/*. BE

Angela Snell is the production editor for Broadcast Engineering.



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Now accepting apps

The FCC is taking applications for new and major change LPTV and translator stations.

BY HARRY C. MARTIN

The FCC has announced that it will accept applications for new and major change LPTV and translator stations. This is the first such window since 2000. All applications must specify digital facilities; applications for analog facilities will not be accepted. Applications for stations in rural areas could be submitted beginning Aug. 25. Applications for all other areas will be accepted beginning Jan. 25, 2010. Any analog LPTVs that did not pick up a digital companion channel when such facilities were made available in 2006 will now get another chance.

Rural area defined

To qualify as an applicant for a rural area, the transmitter site must be at least 75mi from the reference coordinates for all of the top 100 TV markets. This restriction goes away when phase 2 begins in January. From that date on, applications for new LPTVs, major changes and companion channels may be filed for any community with a site that meets the engineering criteria for such a facility. In both phases, applications will be accepted first-come, first-served, and will be cut off on a daily basis. If two or more conflicting applications are filed on the same day, they will be subjected to the FCC's auction process.

Use of in-core channels

Applications for new LPTVs and replacement translators must specify an in-core channel (i.e., channels 2 through 51). Incumbent analog LPTVs looking for digital companion channels should also try to specify an in-core channel; however, if nothing suitable is available, a channel between 52 and 59 may be used, but only if the applicant makes a special showing. Applicants proposing digital companion channels on channels 52-59 must notify all potentially affected 700MHz band wireless licensees of the spectrum comprising the proposed TV channel and the spectrum in their first-adjacent channels no later than 30 days prior to the submission of their applications.

Specifically, applicants must notify wireless licensees within whose licensed geographic boundaries a digital LPTV or TV translator station is proposed to be located. Notification is also required to co-channel and first-adjacent channel licensees whose geographic service area boundaries lie within 75mi and 50mi, respectively, of the proposed digital LPTV and TV translator station location.

Digital flash cuts

With regard to flash cuts, the FCC reminds LPTV and Class A licensees still operating in the analog mode that they can file on-channel digital conversion, i.e. flash-cut, applications at any time. The commission encourages analog LPTV licensees that are planning on filing flash-cut applications to do so before the FCC begins accepting first-come, first-served digital applications. Such applicants can thereby get in ahead of the expected onslaught of new applications, thereby avoiding substantial processing delays.

Filing procedures

The FCC filing fee for a new LPTV or translator station or for a major change in an existing station is $705. The FCC form required is Form 346. In order to deter speculators from participating in mass filing schemes using abbreviated engineering, upfront short-form applications will not be used. The commission wants to encourage legitimate nonspeculative applications and believes that this goal will be served if all applications have to include full technical showings, site certifications and community coverage showings. There are no FCC filing fees for flash-cut or digital companion channel applications.

Anyone with a plan to file an application of any type should line up an engineer and a suitable site as soon as possible. The commission is already accepting a limited number of applications for rural areas, but a large number of applications is expected to be filed beginning on the Jan. 25 start date for most other communities. Waiting even until Jan. 26 could be too late. BE

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

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

Dateline

- For noncommercial TV stations in Iowa and Missouri only, the biennial ownership report deadline is Oct. 1.
- Oct. 1 is the deadline for TV stations in Iowa and Missouri to electronically file their Broadcast EEO midterm reports (Form 397) with the FCC.
- Oct. 1 is the deadline for TV stations licensed in the following states to place their annual EEO reports in their public files: Alaska, Florida, Hawaii, Iowa, Missouri, Oregon, the Pacific Islands, Puerto Rico, the Virgin Islands and Washington.
- Nov. 1 is the deadline for submission of biennial ownership reports for commercial TV stations in all states and territories.

planting the seed...

Outfitted with dual DM2000's, Record Plant Remote's "The Lounge" digital truck has been busy making waves at numerous live recording events across the country.

We caught up with Kooster McAllister, Owner and Chief Engineer of Record Plant Remote, to gather his thoughts on his Yamaha gear. Here's what he had to say...

"Coming from an analog background, having a lot of faders in front of me is comforting. All 96 tracks can be viewed and accessed on just two layers. Having the two consoles tied together make the DM2000's perform as one large format digital desk. It also gives me the added functionality of being able to call up effects, routing, auxes, etc. from either center section making it easy to get around quickly.

In my line of work where you only have one chance to capture a live moment on stage, you must be able to count on your equipment not to fail. These consoles have withstood being bounced down the road from gig to gig and have always come through for me.

Most importantly, they sound great. Orchestral recordings I have done with them sound simply amazing."

– Kooster McAllister

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Implementing MPEG-4

MPEG-4 can work with VBR encoding and multiplexing to offer more options for program delivery.

BY ALDO CUGNINI

In recent articles, we've discussed variable bit rate (VBR) encoding and multiplexing. This month, we'll look at MPEG-4, and how it can work with both of these processes to afford even more options for program delivery.

Scalable coding

Scalable coding is a way to offer different levels of performance in a compression system — all simultaneously and compatibly. One can think of adding color to the older black-and-white NTSC standard as a scalable scheme. Older receivers would not process the added signal, but newer ones could take advantage of the improvement.

MPEG-4 Part 10 (AVC/H.264) offers various levels of scalability, so that simpler receivers only decode the elements needed for that level of performance. Scalability can provide a more efficient bandwidth utilization when it is desirable to transmit multiple programs of different quality, without having to separately encode each program as a complete bit stream (the simulcast scenario).

With scalability, the program is coded into different layers; a simple decoder will only decode one service (the base layer) and form pictures at that associated quality level, and a more sophisticated decoder will decode multiple services (base and enhancement layers) and use the additional information to produce a higher-quality program.

A scalable encoder is shown in Figure 1. Each layer is coded using the standard MPEG-4 AVC tools. Plus, additional SVC tools are available to increase the coding efficiency. These enhanced tools include inter-layer prediction, where the base layer is used to form a prediction for the enhancement layer.

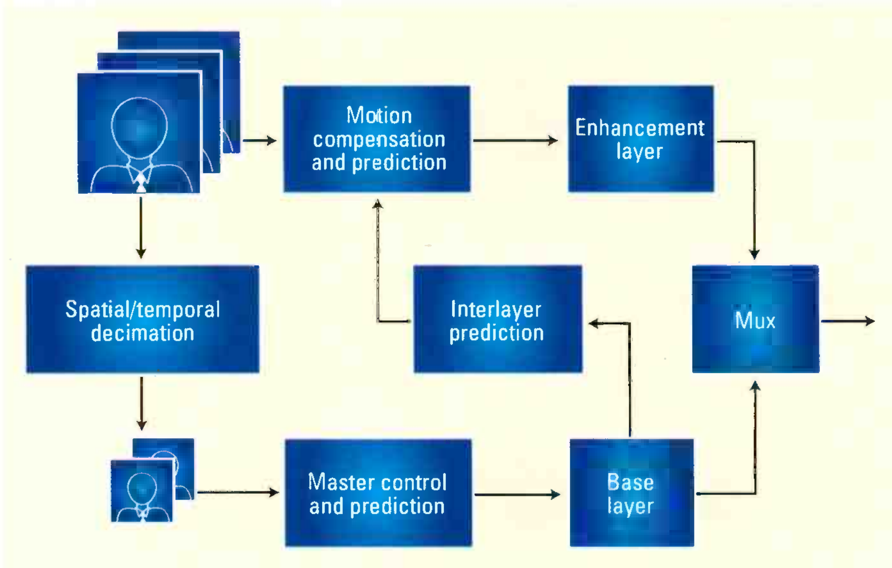


Figure 1. Scalable encoding allows for different levels of performance in a single multiplex.

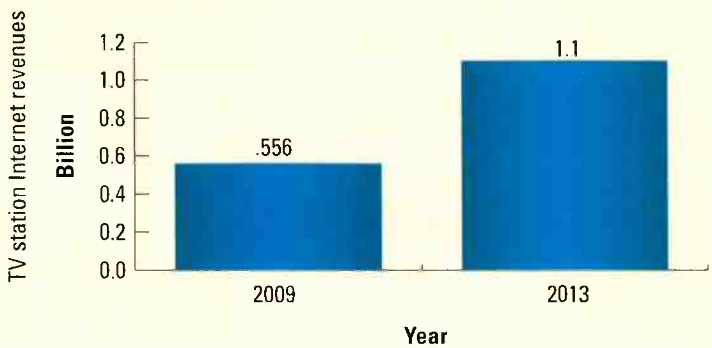
Scalability provides a way to support different native resolutions, or different temporal rates, or even different encoding parameters. In fact, MPEG-2 provides these scalability options, but existing ATSC implementations are limited to Main Profile, so no scalability is possible with that codec over current transmissions. MPEG-4 AVC, however, can be used with ATSC M/H and includes scalable video coding (SVC), so scalability over these emerging mobile services is feasible.

When using spatial scalability, different levels of resolution are provided. This

FRAME GRAB

A look at tomorrow's technology

TV station Internet revenues will reach $556 million in 2009, moving up to $1.1 billion by 2013.



Source: BIA Advisory Services *www.bia.com*

could be used to broadcast to different devices that inherently have different resolutions. One application could be the efficient accommodation of different sizes of displays. Consider, for instance, cell phone performance, where the display is typically less than 3in in diagonal size, and automobile backseat displays or PCs, where the display can be larger than 12in. Another example could be service level differentiation, where a higher-resolution (encrypted) version is accessible for a premium; a variant of this could be a free low-resolution program preview, again with an associated full-resolution version sent as an encrypted enhancement service. Yet another example could be the introduction of backwards-compatible services, so that devices with different performance capabilities could be deployed at different points in time, while maintaining compatibility with the legacy devices.

Note also that "higher performance" usually means greater processing power; the base layer ordinarily requires less decoding complexity than a decoder processing multiple layers, and this translates directly into product cost, too. Temporal scalability is also supported by SVC, so that multiple frame rates can similarly be scaled upon encoding and in devices.

The ATSC M/H specification (currently a Proposed Standard) requires that the video compression algorithm must conform to the Baseline Profile of AVC, bounded by the upper limits specified for Baseline Level 1.3: Only I (intra) and P (predictive) slice types are allowed, and the spatial resolution is set to 416 x 240 pixels. When SVC is used, the video compression algorithm must conform to the Scalable Baseline Profile of SVC, bounded by the upper limits specified for Scalable Baseline Level 3.1: Only I, P, EI, EP and EB slices are allowed, and the spatial resolution of the enhancement layer is either 832 x 480 pixels, or to 624 x 360 pixels.

SNR scalability

An additional option with MPEG-4/SVC is signal-to-noise ratio (SNR) scalability (also called quality scalability), which provides the ability to transmit scalable quality versions of a program, such as by coding some of the picture block transform coefficients in different layers. (The transform coefficients carry the spatial detail information.) In this way, the level of coding artifacts can vary according to the decoder complexity.

SNR scalability provides an interesting option to the encoder. Recall that a VBR stat mux (a statistical multiplexer using variable bit rate encoding) will assign an instantaneous bit rate to different multiplex

channels dynamically, depending on the instantaneous demand of each program. If some of the multiplexed programs are encoded using SNR scalability, then a stat mux can use what is called connection admission control and dynamically drop packets from layers in the scalable streams. A scalable receiver then uses the enhancement stream as it is available. The encoding trade-off becomes that of more channels vs. a higher probability of packet loss.

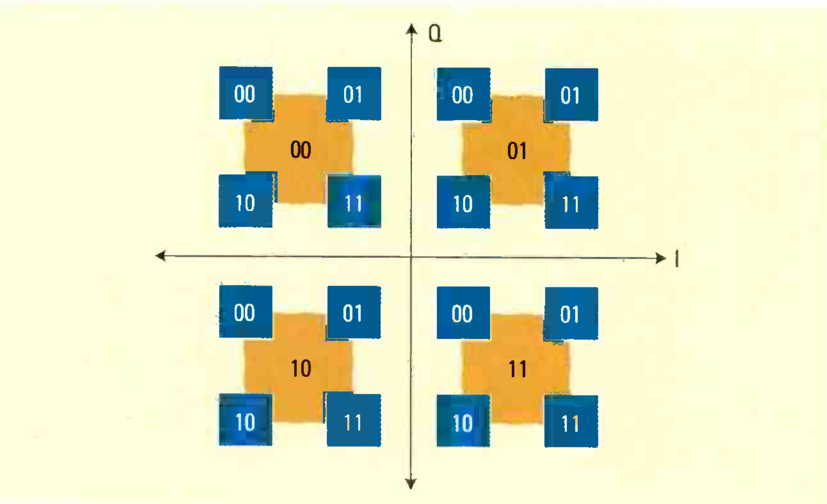


Figure 2. Hierarchical modulation can provide a means for graceful degradation — at a cost.

To get an idea of the benefit of such a scheme, while single-layer MPEG-2 produces generally unacceptable video quality with a packet loss ratio of 10^{-3}, losses at this rate with SNR scalability are generally invisible, even to experienced viewers. This is because video codec developers have focused on producing good error concealment algorithms and designing efficient two-layer coding algorithms.

While ATSC M/H constrains SVC to spatial and temporal scalability, connection admission control could theoretically be used with a combination of these scalability options, with the goal of increasing data throughput at the expense of an occasional fallback to the lower layer. Of course, such an option must be employed cautiously; no one paying for an enhanced service would tolerate routine drops in picture quality.

Hierarchical modulation

Another way to scale transmission performance is with hierarchical modulation, where the transmission can have multiple levels of embedded modulation, each with different levels of protection. (See Figure 2.) In this crude example, the modulation consists of 4QAM for the enhancement layer (the four yellow symbols) and 4QAM for the enhancement layer (the four blue symbols in each quadrant).

Here, the bit rate of each layer is the same, but the symbols are closer together for the enhancement layer; hence, the receiving SNR is worse for that layer, as is the received error rate. (In practice, the enhancement layer would have a higher bit rate — with more symbols — and even lower SNR.) While this kind of hierarchical QAM modulation can extend coverage area and can provide graceful degradation, it comes at a cost — increased receiver complexity, as well as interlayer interference that increases the error rate for both layers.

While QAM is part of the transmission specification for DVB, ATSC uses VSB modulation, which has a different signal constellation. In one sense, ATSC-M/H could be viewed as the "hierarchical" modulation schedule, because the main and mobile services are combined at the transmission layer and have unequal protection. As such, a receiver could be constructed that automatically switches between the two services as reception conditions vary. But, recall that SVC cannot be used with the main (MPEG2) service. This, of course, would require a simulcast transmission, with a concurrent decrease in efficiency. The addition of the new signal, however, does not compromise the received error rate of the main signal.

Considerations

The broadcaster considerations for these scalability options can involve a large number of variables. One can think of the "long tail" business strategy applying here, with some interesting scenarios involving trade-offs between the expected numbers of smaller vs. larger devices, the relative bandwidth needed for the base and enhancement layers, and the costs and benefits of the different options. Let's hope that indecision paralysis doesn't stall the new business opportunities that are poised for deployment. **BE**

Also Cugnini is a consultant in the digital television industry.

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Network monitoring

First determine the broadcast facility's needs for monitoring, and then find the proper tools to do so.

BY BRAD GILMER

When I started working at a CBS facility many years ago, part of my job for four hours each day was network monitoring. It was not very exciting, but it came with the territory. These days, network monitoring has an entirely different meaning, and doing it well can keep your facility on the air.

Why monitor?

Let us start the discussion on network monitoring by asking two questions. First, why do you want to monitor the network? Second, what sort of traffic flows over the network? Once these questions are answered, you can start to look for tools that will help do the job. Your reasons for wanting to monitor the network may include:

- Keeping an eye on available network capacity;
- Being aware of any unusual changes in network usage patterns;
- Looking for network errors and maintenance issues; and
- Providing a log for troubleshooting forensics.

In a typical broadcast facility, there are generally several networks. Most networks in a facility are used for regular network traffic, such as office applications, e-mail and Web browsing. Most TV facilities have networks in the master control area that provide this functionality. Broadcasters make special use of their networks by moving large files, in some cases, continuously. They may also use networks to backhaul feeds from a remote location to the studio. These networks may impose special network monitoring requirements above and beyond that required for office networks.

As said above, one reason to monitor may be to keep track of available network capacity. Clearly, having available network capacity is important. But why is excess network capacity important? And how much excess capacity is needed? The answer comes from understanding how networks function. Ethernet networks rely on a couple of fundamental concepts. First, these networks are designed to move office traffic. The packets are small, and compared with video, the overall file sizes are small. Second, the network assumes that not everyone wants to talk at once. If these two assumptions hold, then it is likely that there will be extra network capacity when someone needs it. And, if by chance, the network is busy when you try to use it (two devices try to talk at the same time — known as a collision), wait a little while, and try again. The network is likely to be free later.

In my experience, all of this works well until network usage starts to go somewhere above 70 percent. Then things go bad in a hurry. Once this line is crossed, collisions become much more frequent. Devices wait a little while, try again, collide, wait again, try, collide, and on and on. As the network slows down, some applications and users start trying to talk more frequently, assuming that because the first attempt to use the network stalled, the best thing to do is to try again. This only adds to the congestion. Finally, remember that because moving video files are large, they take a lot of time to transmit. Video files increase the usage level on a network, not for just an instant, but in some cases for tens of minutes at a time. This sustained high-usage traffic pattern means that the likelihood of collisions increase because of the characteristics of our data.

Video files increase the usage level on a network, not for just an instant, but in some cases for tens of minutes at a time.

The second reason to monitor the network is to be aware of any unusual changes in network usage patterns. This is intuitive, but let's explore some reasons network usage may change. One reason could be that you have installed new equipment, or that the production department has added an evening shift. In other words, the change in network usage can be easily explained.

Other times, network usage may change drastically because of a hardware problem — perhaps a network device has failed in such a way that it spits out garbage on the network as fast as it can. Or maybe there's been a security breach, and someone is downloading large video files from your system. A large decrease in traffic is worth investigating as well. Has the WAN connection to a remote office failed? Has an automatic file conversion process stopped running?

Third, monitor the network for errors and to detect maintenance issues. There are some errors, such as a large number of CRC errors, that should not occur on a properly functioning network. Also, if the network utilization is well below 70 percent, but there are a large number of collisions, you should be concerned. In any case, if there are many technical errors on the network, you may be able to find the cause of the errors and fix them before experiencing a catastrophic failure of the network. These errors may be caused by a bad patch cable or a failing network interface in a router. In any case, hard network errors such as these should definitely be identified and corrected before they become more serious.

Fourth, monitor the network so you have a log for troubleshooting forensics. Forensics is the scientific analysis of physical evidence. If you have been monitoring the network and experience a failure of the on-air automation system, you may be able to trace the problem to a network failure. If you do not have network monitoring logs, then it might not be possible to isolate the network as the cause of the failure.

Monitoring tools

Most monitoring tools are free. While there is a lot of value in commercially available tools, personally, I have never run into a problem I could not solve using the free tools (with a few notable exceptions, which I will talk about below).

Think about what you have available already. Routers, MACs, PCs and servers all come with built-in monitoring and logging capability. Cisco has several applications that allow you to remotely monitor traffic through the routers in a graphical display. Other router vendors provide similar functionality. Do not forget Windows Task Manager, which has a built-in graphical network monitoring tool. Finally, you can download free applications such as Wireshark (*www.wireshark.org*), which provide all sorts of analysis on your network based on packet capture and analysis.

There are cases where I would recommend commercial tools for network monitoring. The first is security applications where you want to detect break-in attempts. The second is MPEG Transport Stream monitoring. There are several commercially available tools that will help you determine where things are broken when using MPEG-over-IP for transport. These provide great functionality, and I have not seen a free tool that comes close to what these applications can do. **BE**

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

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CCDs vs. CMOS

It's a battle of the bands for supremacy.

BY KLAUS WEBER

High-quality broadcast television cameras have been using CCDs as imaging devices for more than 20 years. Now on the marketplace is an HD systems camera based on a CMOS sensor, which has finally come of age in terms of image quality. It seems a good moment to consider the relative merits of modern imagers.

HD cameras are available with frame transfer CCDs, interline transfer CCDs and now CMOS imagers. Each sensor type has its good points and some potential weaknesses. (See Figure 1.) How do manufacturers make the choice, and what should you consider when shopping for new cameras?

Before looking at the different types of CCDs, let's spend some time on the basic functionality. CCDs are called charge coupled devices because they have two sets of components that are coupled.

The photosensitive element captures photons and converts them into an electrical charge. This is a linear effect: The more photons that hit the photosite, the greater the charge — in direct proportion. Once the photons are captured — after a frame, in video terms — the charge from each photodiode is transferred to its coupled readout register, from where it is read by the signal processing.

There are two important points to remember here. First is that the readout register is effectively the same material as the photodiode, so it will be affected by light falling on it. Second, the charge is transferred from one to the other. Once the charge is shifted, the photodiode is empty, and the process starts again.

Frame transfer CCD

In a frame transfer CCD, as its name suggests, the whole frame is transferred from the light-sensitive area of the chip to a storage area on the chip. This results in the largest possible surface area being given over to light capture, which creates the best dynamic range, no smearing and good aliasing performance.

The disadvantage is that it needs a mechanical shutter to ensure that no light hits the chip while the transfer is taking place. This is a manufacturing issue that has had to be addressed, and which adds cost and complexity to the camera front end. But it does produce the best images.

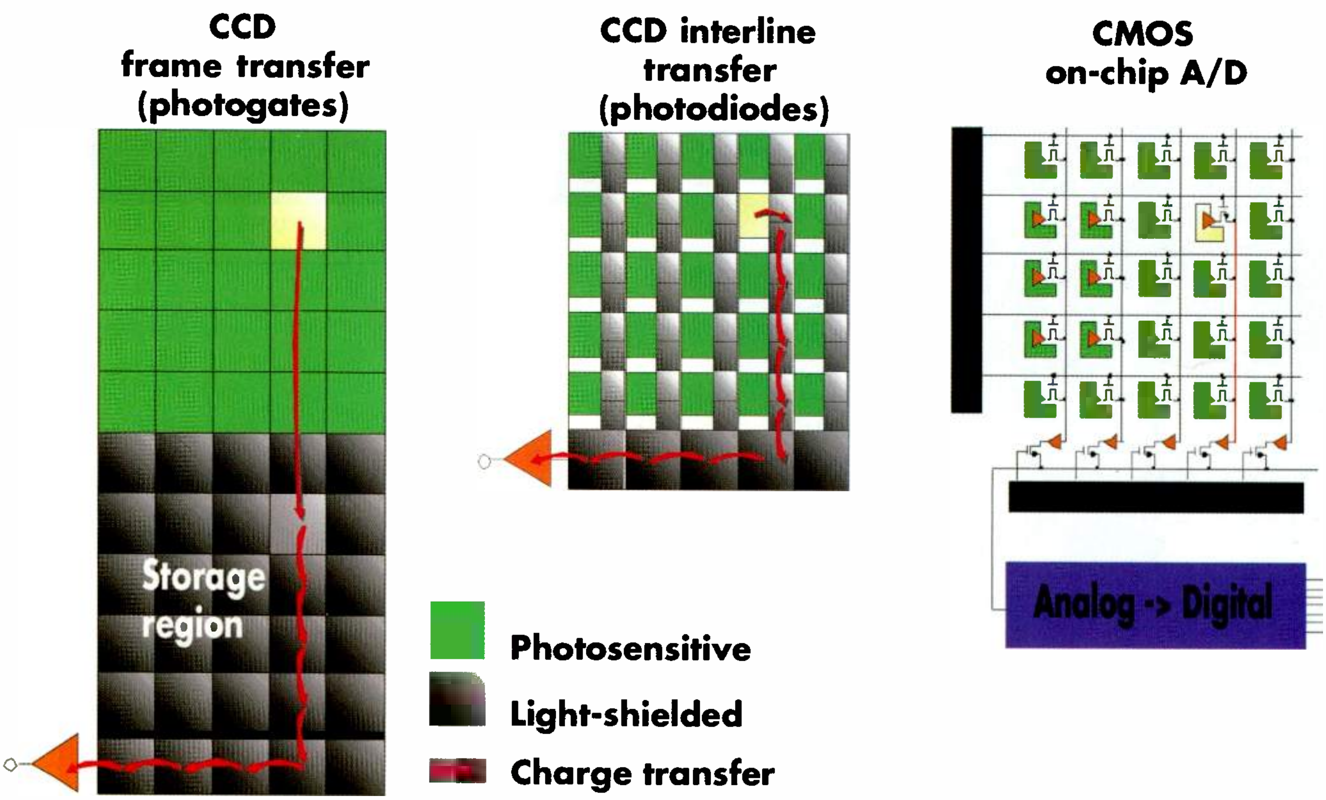


Figure 1. Shown here is a comparison of CCD and CMOS camera sensor technology.

Interline CCD

An interline CCD, again as its name suggests, has the shift register for each row of the sensor alongside the photosensitive component, but masked by a fine metal strip. Transfers are swift and secure, and there is no need for a shutter as the readout register is masked.

The disadvantages include the fact that the light-sensitive area is now much reduced — to only about 40 percent of the surface area. Although microlenses on the surface of the sensor increase the sensitivity and thus reduce noise, dynamic range and aliasing are not improved and remain worse than a frame transfer chip.

Another issue is that the masking is not perfect, so some light gets collected by the shift register, either directly or through internal reflections. This is likely to affect highlights, as will the related problem of a photosite becoming overloaded. Excess charge should be designed to leak away into the substrate of the chip, but it is likely that some will move into both the related readout component and to those around it.

You may remember the performance of early interline CCD cameras, which showed marked vertical smear on highlights, an artifact we would certainly not find acceptable today. Modern interline CCDs are much better, although if you use them at higher frame rates — for example, in a slow-motion camera — or on shorter exposure times, the smear becomes visible.

CMOS imager

This brings us to the CMOS sensor. It differs from the CCD in that it incorporates the front line of processing on the chip itself, rather than being a largely passive device that moves the signal into the readout register to be collected. This means that each photosite has its own amplifier; each uses several transistors around it.

As a result, the light sensitive area is similar to the IT CCDs — relatively small, which is a significant disadvantage to the FT CCD sensors. CMOS sensors for high-quality video use microlenses to achieve a good level of sensitivity. One important difference with CCDs to note, though, is that a leakage of light into any of the amplifiers would not have been transferred through the whole row or line connected to it so there is no vertical smear possible.

The CCDs transfer the charge from the photodiode to the readout register, and in the process empty the photodiode. In a CMOS device, there is no shift, so the amplifier can be sampled at any time during the frame. This is important for two reasons.

First, it gives an active means of controlling an issue known as fixed pattern noise. Second, this same ability to read the signal at any time in the frame will be used to create a camera with a huge — effectively unlimited — dynamic range.

Imagine that the maximum amplified output of a photosite is 100 units. With a CCD camera, if you get 100 units, it's unclear whether that is a true measure of the light falling on the sensor or if you have just hit the limit of the system. But in a CMOS camera, if you get 100 units after 20ms (the frame sampling time) in parts of the picture, you can measure it earlier.

Now the CMOS alternative has made an appearance. It is relatively simple to fabricate and implement.

If you measure at 10ms and find 80 units, then you know (because the output is directly proportional to the light falling on the imager) that the full frame should have been 160 units. You can use that information to adjust either the onboard amplifier or the downstream processing to change that particular pixel's gain to give you the correct level. If you sample at 10ms and it is still 100 units, then sample at 5ms, and so on.

CCD television cameras have a dynamic range of eight or nine f stops. Digital cinematography cameras are a little better, perhaps reaching 11 f stops. A CMOS sensor can deliver several times more dynamic range than the best CCD sensor could. But a practical application for this increased dynamic range would still need to be developed.

Broadcast engineers sometimes look at the still picture industry with a little envy, noting that all the top-quality cameras have already migrated to CMOS. They can do that because of the economies of scale: Consumer pressure and the massive numbers of products sold mean that they can introduce a new generation of sensors every couple of years. In the broadcast business, our revolutions come every five to 10 years.

A look ahead

The current state of play is that most broadcast cameras use either interline or frame transfer CCDs for imaging. Both have their advantages and their disadvantages.

Now a dedicated CMOS alternative has made an appearance. It is more efficient to fabricate, and so today it is being used to provide an economic solution for broadcasters and production companies that need to move to high-quality HD production. In the future, the CMOS imager holds out the promise of dynamic range handling that is much more impressive than anything we have seen. BE

Klaus Weber is director of product marketing cameras for Grass Valley.

Web video scalability

Scaling Internet video creates a seamless experience for the end user.

BY BARB ROEDER

Today's broadband connections allow delivery of streaming video and audio to consumers in a straightforward manner and at increasingly higher resolutions. DSL and cable are available to the home, with speeds ranging from 1Mb/s up to 6Mb/s-7Mb/s. These connections are often shared within a location and are not foolproof. The expanding market for streaming to mobile devices means encoding should scale to fit the available bandwidth of wireless as well. The Holy Grail for producers would be if one source could scale not only to 100kb/s-200kb/s for wireless, but to 3Mb/s and higher for HD delivery. This article will discuss the options, deployed and in development, that may soon make this a reality for broadcasters.

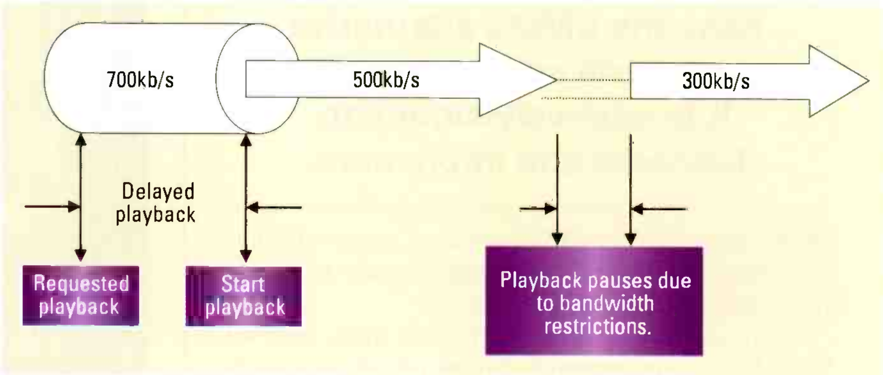


Figure 1. If the user selects a higher bit rate than his or her connection, a long delay will occur before playback. Playback will also pause if the connection slows down.

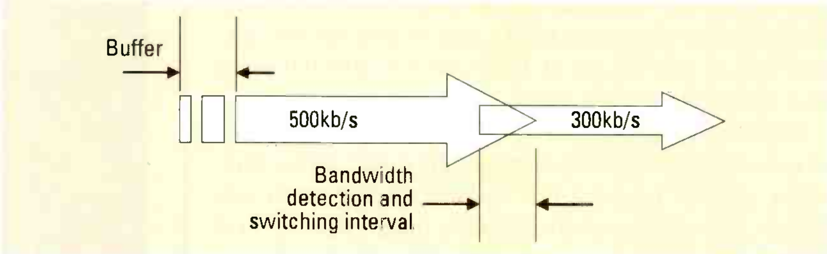


Figure 2. As long as the bandwidth detection and switching interval is smaller than the streaming buffer, seemless playback is achieved.

Encoding multiple bit streams

Let's start with the longest running case of scalability: simply delivering video and audio over a single, variable bandwidth connection. In the past, separate files were encoded at specific bit rates, and users would choose one based on their Internet connection. Platforms, such as RealVideo and Microsoft, evolved so that multiple bit rates were encoded into each file, and servers could determine network conditions and dynamically switch the data rate delivered accordingly.

Today's major delivery formats, including Adobe's Flash video and Microsoft's Silverlight, still adhere to this principle. H.264/AVC also has a version in its scalable video codec (SVC) extension, which can be delivered through servers from both these companies as well as in QuickTime. Move Networks, based on On2's VP6 codec, offers adaptive streaming technology with a proprietary plug-in required on the user side.

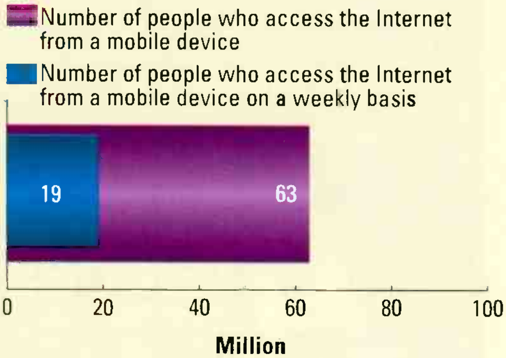
Figures 1 and 2 illustrate how the newer methods create a seamless experience for the end user. In earlier

FRAME GRAB

A look at the consumer side of DTV

Roughly 30 percent of Web use is from a mobile device

Out of 63 million weekly Internet users, 19 million are mobile.



Source: Adweek

www.adweek.com

Innovation from
Pro-Bel and Snell & Wilcox

Automation

A powerful and scalable database engine is the driving force behind Morpheus, configured to provide resilience and redundancy on many levels. From this central core, known as the Eventstore, applications and services are run to provide the most flexible automation system available today.

Operators are presented with a consistent and common user interface removing the need for detailed understanding of the technology. Clear, easy-to-understand icons show users the status of the overall system at a glance.

Device Management enables automatic substitution of devices in the event of failure or loss of connectivity which greatly reduces the need for human intervention. Dynamic resource allocation ensures all devices are operated at optimum capacity, providing highly cost efficient inventory management.

Whatever the device, content or workflow Morpheus Automation can manage it efficiently, effectively and reliably.

Media Management

In the broadcast industry the value of media is realized through the capability to deliver that media wherever, whenever and in the format that is required.

Using state-of-the-art technology, Morpheus manages the acquisition and movement of content throughout the enterprise. Complete flexibility enables content to be sent to a wide range of delivery platforms including linear broadcast, web, mobile and VOD.

Morpheus manages the acquisition and movement of content throughout the enterprise.

Content and metadata can be ingested, moved and delivered as the enterprise demands. Interfacing to external business workflow tools and scheduling systems on both a local and remote basis is handled transparently, ensuring all elements of the operation are synchronized and status aware.

Wherever your system content is needed, whatever platform it's needed on, Morpheus will deliver to meet your deadline.

Meeting Business Needs

The design philosophy at the core of Morpheus is to reduce ownership costs. Building on the premise that automation systems need to evolve to accommodate the demands of new services and delivery platforms, a standard set of rules have been applied to cover common functionality. As a consequence, development costs to add new facilities are kept to a minimum and time to market is dramatically reduced.

Morpheus minimizes disruption and costs associated with integrating new delivery methods or physical devices. With Morpheus there are no fiscal surprises. In addition Snell's world class dedicated support teams are there to assist, providing a broad range of services, including 24 hour coverage, on-site support, spares, remote diagnostics and in-depth technical advice.

The combination of a fully scalable, reliable and resilient device independent architecture, complemented by world class support, ensures Morpheus provides users with future-proof automation that is resilient and highly cost effective.

Operations staff can manage more channels

- Lower personnel & operating costs

Commercial revenues increase

- Sell & present commercials close to air-time

snellgroup.com/morpheus

Routing
Modular Infrastructure
Conversion & Restoration
Production & Master Control Switching
Automation & Media Management

versions, shown in Figure 1, the user might choose a higher bandwidth file than they are capable of receiving and would experience a tremendous wait time before playback could begin. Even if an appropriate bit rate is chosen, when network conditions change, the stream would need to buffer, causing pauses in the playback on the user's side. Multiple bit rate streams offer a built-in buffer so that when the network conditions warrant, playback continues while the server adjusts the bit rate being sent to the client. As shown in Figure 2, if the detection and switching interval is not longer than the buffer time, continuous playback is achieved.

There are a few caveats to the encoding of multiple bit rate streams. One is that the video dimensions must remain constant. For example, a 320 x 240 frame might be encoded at 150kb/s, 300kb/s and 500kb/s. The sophistication of codecs today generally allows this without noticeable degradation, although it is more of a consideration if streaming high-motion, high-detail content such as sporting events.

Another caveat is that to simplify the process, one audio stream may be used for all the video. Again, in most cases this is appropriate because users will detect differences in audio more so than picture quality, but if details of the video are a higher priority, it may justify using a variable audio rate as well.

Another choice that the encoder needs to make is whether motion or picture detail is more important. Most often, frames are dropped first to lower bandwidth requirements. Because codecs can achieve 30fps at moderate broadband speeds, the switch to half that rate could be achieved first by dropping every other frame. Picture quality within the frames would also be compromised somewhat because key frames (or I-frames in MPEG jargon) that use proportionately more bits in the encoded stream would not be dropped. If more than just half the frames need to be dropped in order

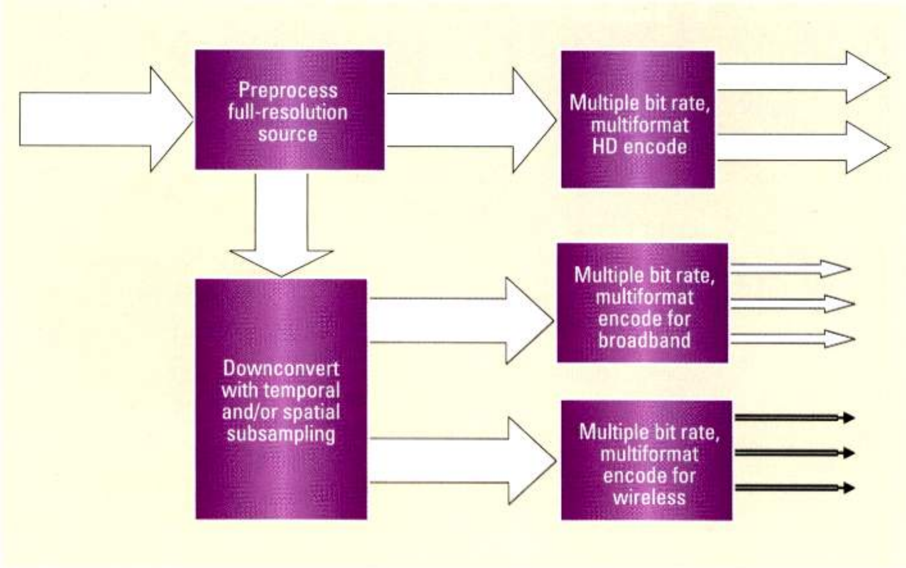


Figure 3. Processing for multiplatform, multiformat, multiple bit rate delivery increases complexity in the studio, encoding facility and for CDNs.

to achieve an acceptable bit rate for delivery, motion rendition could become jerky and more noticeable to the end user.

Frame size, frame rate and audio fidelity all come into play even more when the goal is to achieve multiplatform delivery. Bit rates for mobile delivery are still much lower than DSL and cable modem, and also tend to be much more variable. More sacrifices in picture quality may be necessary, but thankfully, they are much less noticeable on mobile devices' smaller screens, with typical resolutions of 176 x 144. This is also a case where audio fidelity may play a much larger role in offering the end user a quality experience.

Simultaneous conversion

The push today is for simultaneous conversion from source to multiple streams that deliver a wide range of video and audio quality depending on the consumers' choice of platform and network connectivity. Current technology can offer HD video delivery at 2Mb/s-3Mb/s all the way down to 100kb/s-200kb/s streams to mobile devices, and everything in between. The process in a studio or encoder farm is much more complicated than producing a single bit rate stream. (See Figure 3.) HD sources can be encoded for network delivery, while incorporating a multiple bit rate strategy, as described above, for delivery over high throughput connections to different devices in the home. CPU overload can become an issue when streaming HD, but home networks can also deliver HD and SD content to set-top boxes. After first downconverting the HD video to SD, separate multiple bit rate streams would be encoded to lower bit rates for DSL, cable and wireless delivery.

In the production facility, careful preparation of source video is always a top priority in order to achieve the highest quality compressed streams. Proper downconversion is critical when considering compression for network delivery. Artifacts from 3:2 pulldown, deinterlacing and spatial subsampling will be accentuated at lower data rates. Even if done without noticeable artifacts, these processes can create a more difficult signal to compress due to higher local and frame-to-frame differences in the video. This means bits are allocated to "artificial" picture details, which can compromise quality in the final decoded image.

In order to achieve full implementation of scalable video over networks, the infrastructure must be in place across the entire production and delivery path: broadcast facilities, content distribution networks and local connections to receiving devices. Any format choice, whether it's from Microsoft, Move Networks, Adobe's Flash or the standard MPEG-4 SVC, will require that servers pushing streams from encoding facilities to the CDN and CDN to client have the appropriate technology in place. In order to reach the widest audience, multiple formats can be produced, but this doubles or triples the infrastructure for network delivery.

Client devices must also be equipped with the proper player platform. This is typically not an issue for PCs because they are implemented in software, but STBs and wireless devices generally need this requirement in hardware.

While H.264/AVC may seem like the candidate of choice for scalable video delivery, proprietary formats and implementations will continue to push the technology envelope, but we do not have to anticipate another format war in the marketplace. Broadcasters can support all formats, either internally or through third-party providers, so that consumers can make the ultimate choice of how they wish to view online content. **BE**

Barb Roeder is a consultant and president of BarbWired.

Video compression in transition

MPEG-2 and AVC can coexist in modern facilities.

BY IAN TROW

Broadcasters and service providers have a wide variety of options to consider when choosing the correct compression strategy for the contribution and distribution of broadcast content.

With significant investment in MPEG-2, broadcasters are keen to see vendors addressing the need for greater SD compression efficiency for distribution applications. Higher channel densities and the trend for larger flat screens have resulted in renewed interest in re-evaluating MPEG-2 for further compression gains in an environment where bandwidth is both scarce and expensive. HD distribution started with MPEG-2 over cable and satellite, but many HD services are now possible as a result of the compression efficiencies attainable with MPEG-4 AVC.

Current compression systems now demand multistreaming and file-based capability alongside real-time delivery. This article will investigate the issues surrounding the selection of a compression standard, optimum operational bit rate and ideal system configuration.

MPEG-4 compression

When first introduced, the MPEG-4 compression standard was heralded by many as an MPEG-2 replacement. Since then, a series of profiles and levels has been developed within the MPEG-4 standard that successfully addresses many of the shortcomings of MPEG-2. These include greater compression ratios to facilitate HD carriage, resilience to errors introduced by packet-based IP distribution, and the application of MPEG techniques for mobile, handheld and PC streaming applications.

MPEG-4 has been refined to focus on commercial areas with requirements that eclipse the capabilities of MPEG-2. The result is MPEG-4 Part 10, more commonly known as H.264 or Advanced Video Coding (AVC). In terms of compression, H.264 is now viewed as a possible successor to MPEG-2 in broadcast distribution applications. However, it should not be assumed that applications will switch from MPEG-2 just to track the latest in compression technology. Many compression applications will remain MPEG-2 for the foreseeable future because of the large installed base of set-top boxes. Additionally, for some broadcasters, the gain associated with upgrading the compression scheme does not yield the benefit to offset the downside of upgrading in terms of capital outlay and retraining.

MPEG-4 AVC was initially developed for low-bit rate multimedia applications. This made the standard more robust and appropriate for IP-based networks when compared with predecessor legacy standards like MPEG-2. This advantage carries through to the application of AVC in contribution applications, and consequently makes bandwidth more plentiful and workflow shorter.

Beyond MPEG-2 compression

MPEG-2 compression is a tough act to follow, so it should not be assumed that broadcast applications will no longer use this standard. Much of the research effort in video compression has been directed toward improving MPEG-2 to exploit the advantages

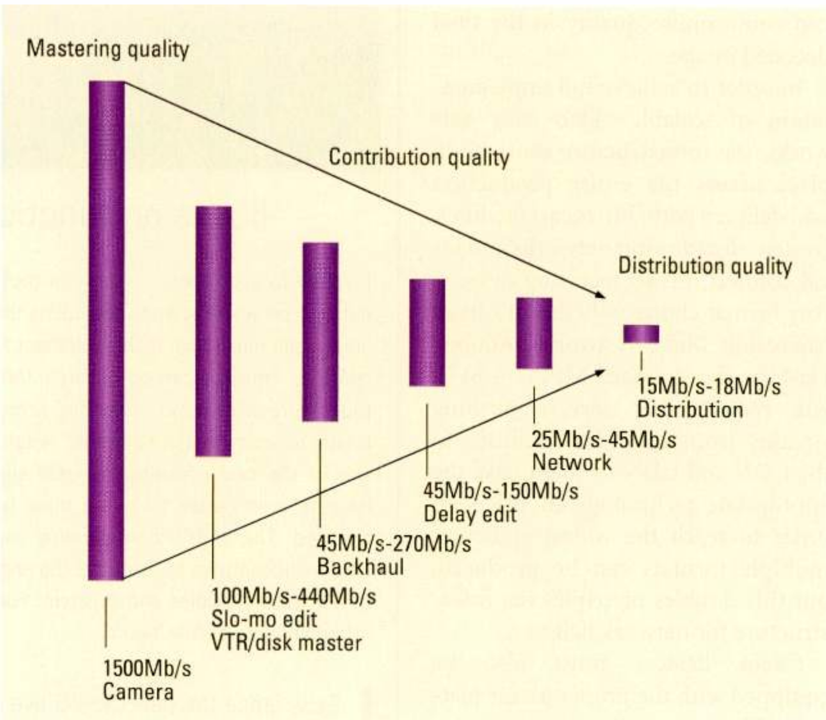
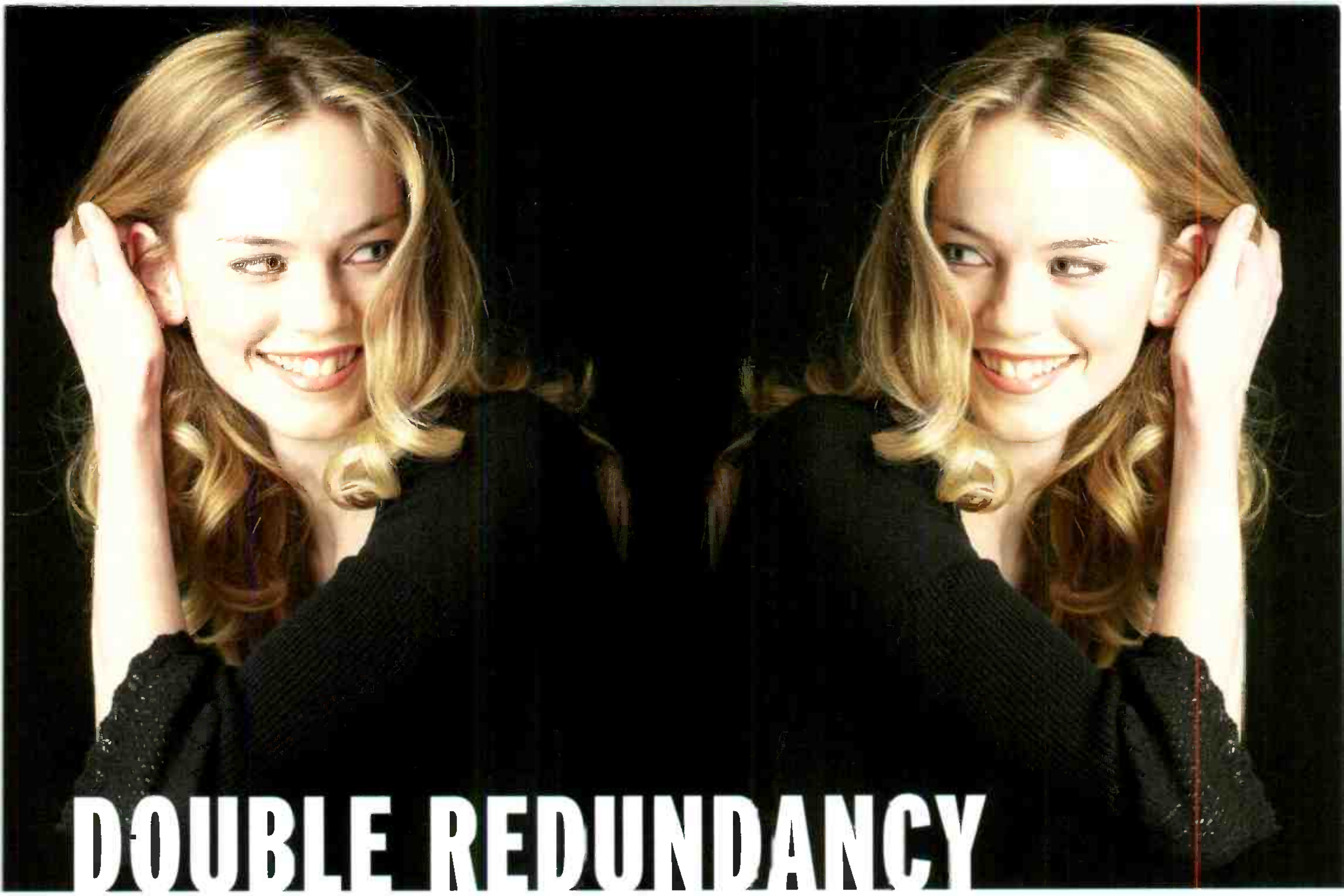


Figure 1. HD MPEG-2 bit rates from mastering to distribution



DOUBLE REDUNDANCY

With over 5500 **NEXUS** Devices running daily in critical broadcast, performance and event centers, NEXUS has become the favorite choice for secure facility wide audio routing. The Stagetec NEXUS system provides centralized or de-centralized routing with a wide range of modular I/O formats and high density fiber optical links with dual path redundancy. The NEXUS system can be easily interfaced with all major management software packages for main control rooms in radio as well as TV facilities. Stagetec mixing desk solutions interface directly to the NEXUS network and, as the Nexus system, are highly scalable.

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PROVEN RELIABILITY Continious development since more than 15 years
REDUNDANCY On fibre optic lines, power supplies, backplane and CPU
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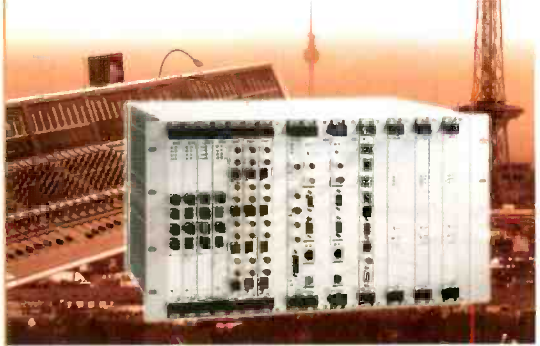

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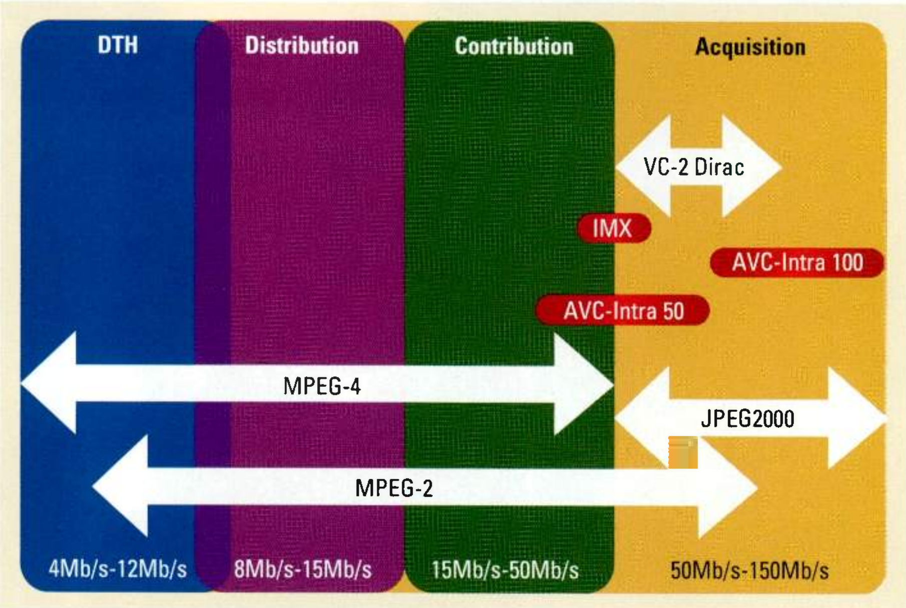

Figure 2. Compression market by standard and bit rate

brought about by more capable processing technology.

Where MPEG-2 has met significant challenge is in bandwidth-hungry HD contribution applications, where the savings offered by a move to a more efficient scheme are seen as commercially essential.

In terms of compression, the following are major factors:

- A significant move toward HD programming;
- Demand for greater compression efficiency;
- Greater use of file-based production techniques;
- Availability of more transmission bandwidth;
- A desire for reduced workflow; and
- Support for multiple playout platforms.

These factors make the selection of a suitable compression scheme for contribution far more complex than when MPEG-2 was introduced into this environment.

The bit rates used in a typical production chain are shown in Figure 1 on page 42. The rates shown are typical of those used in HD 1080i/720p environments with distribution over MPEG-2. The main development in terms of bit rate has come about because of a desire to greatly reduce the emission bandwidth using H.264 to rates of approximately 4Mb/s-12Mb/s.

In terms of mastering quality, 1080p acquisition introduces the prospect of 3Gb/s for full frame-rate carriage. So even though there is more capability to carry higher payloads, for the vast majority of applications, there is still a requirement for efficient video compression to bring the bit rate down to manageable levels. So, what constitutes a manageable bit rate in a contribution environment, and what compression standard can be used?

Both MPEG-4 AVC and MPEG-2 have been applied to multiple markets in the typical production chain. (See Figure 2.) This usage in multiple markets has significant workflow benefits in reducing the complexity of each production stage.

In most areas, direct-to-home (DTH) deployments have been based on MPEG-2, creating an established infrastructure and a significant legacy for which replacement

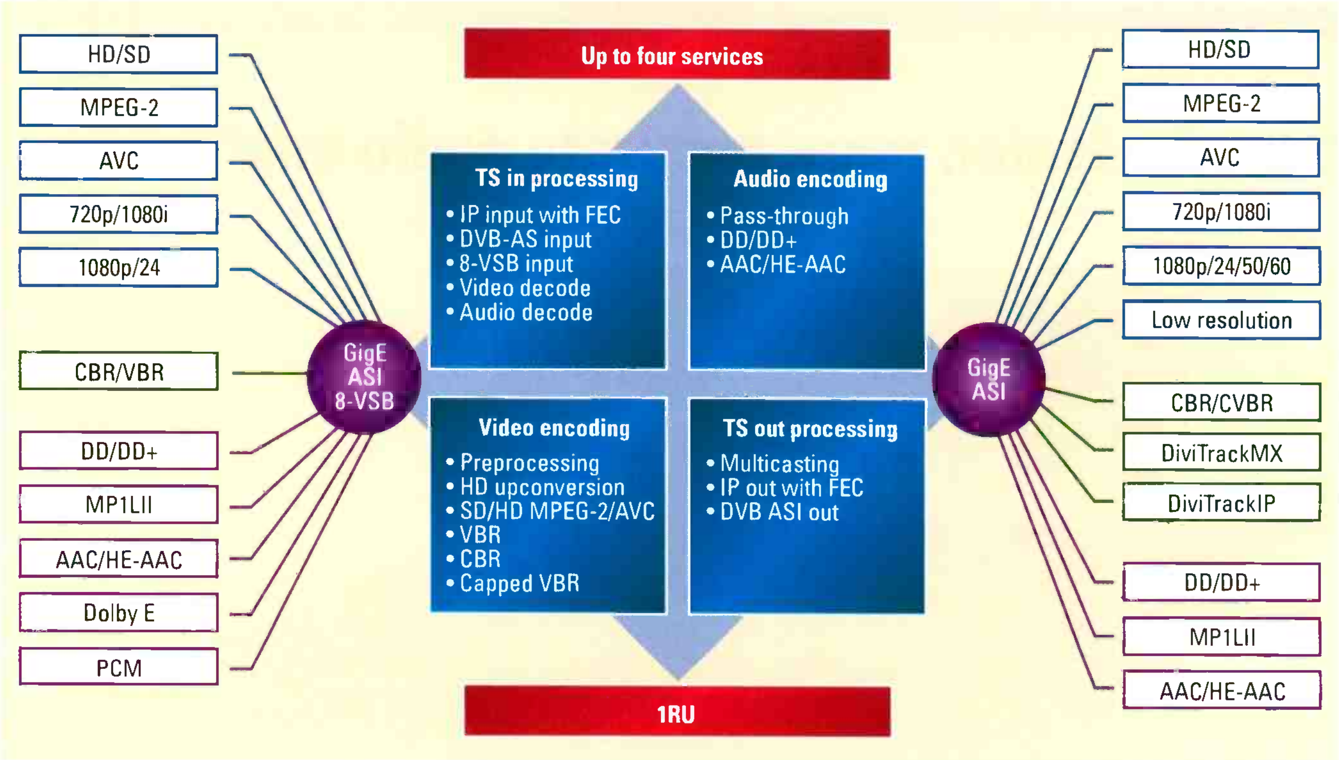

Figure 3. High-quality encoding/decoding

of MPEG-2 by AVC equipment is not a practical solution. Broadcasters and service providers need to work further within the constraints of MPEG-2 on infrastructure that needs replacement or upgrade to a more efficient implementation.

Many early DTH systems now require upgrading simply because they have reached the end of their life cycle. Replacement of these early MPEG-2 systems has led many compression vendors to re-evaluate their stand on video quality and to retract their view that MPEG-2 had no further developments in compression efficiency to offer. Traditionally, four strains of MPEG compression systems have been marketed as broadcast products catering to the SD and HD variants for both MPEG-2 and AVC applications. The benefits of applying techniques learned from AVC, along with the extra processing power available, have yielded a new breed of encoders that not only offer enhanced video quality, but support both MPEG-2 and AVC in dense multichannel architectures. The versatility inherent in such a platform is crucial when addressing

a market with requirements that center around legacy system support, the aspirations a provider has for distributing content and a continued desire for greater bit rate efficiency in less rack space.

For contribution and primary distribution applications, where content is exchanged between broadcasters or fed from remote events, similar ties exist to MPEG-2. Professional profiles and levels were developed to extend the range of applications for MPEG-2. The most notable extensions involved enhanced chrominance support through the introduction of 4:2:2, carriage of ancillary data and allowance for milder compression ratios to preserve image quality. In these professional applications, the inertia behind the continued use of MPEG-2 remains strong.

AVC is making inroads in these applications, where there is a strong overlap in terms of feature sets between the professional and final distribution markets. This overlap exists in newsgathering where 4:2:0 chrominance sampling and high compression ratios are in demand for carriage over narrowband satellite, terrestrial and IP links.

The appeal of AVC has led many second-generation Digital Terrestrial Transmission (DTT) platforms to evolve from exclusive MPEG-2 SD transmissions. Through next-generation encoders, this evolutionary path adds HD AVC services alongside MPEG-2 and eventually supports an all-AVC approach that embraces SD and HD alongside a wide variety of streamed applications. This approach is currently under way for DTT within the UK and will no doubt be repeated in other regions where MPEG-2 is currently the dominant compression standard.

The future for broadcast headends

Greenfield broadcasters are in the fortunate position of not having strong legacy ties to MPEG-2; thus, they are able to deploy systems from the ground up that are fully based on AVC. The resulting streamlined systems, based on the latest generation of AVC encoder products, has tremendous advantages, including the ability to offer the greatest bit rate efficiency, the highest channel density with good redundancy provisioning and the ability to address multiple markets by providing simultaneous streams for a wide variety of platforms.

Video quality is retained within systems that allow content to remain within a particular compression standard. Broadcast content can then be manipulated by adjusting parameters such as frame rate, aspect ratio and compressed bit rate to make them appropriate for the target platform. While this approach is commonly used for broadcast MPEG-2 content, AVC-based systems become very attractive due to the reduction in workflow steps, streamlined infrastructure and retention of picture quality.

Regions that do not have a large MPEG-2 legacy infrastructure can deploy AVC directly with obvious benefits. However, with the vast majority of broadcast content existing as MPEG-2, digital turnaround of such material is a common requirement. Decoding MPEG-2 content has often been performed by separate decoders, but increasingly this functionality is integrated within the encoder. High-end encoders not only have the capability to offer significant coding gains for multiple channels, but also they can now deal with a wide variety of input and output formats. (See Figure 3 on page 46.)

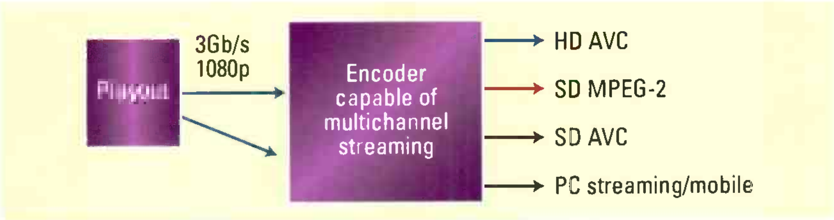

Figure 4. Multichannel streaming

This flexibility is further extended by offering dual encoding channels for each video input. Normally, a low-resolution path has been optionally offered alongside the main video encode chain to allow picture-in-picture capability. Making the second channel a fully featured encoder and adding an up/downconverter to the input of the second channel allows a single encoder to produce two encoded outputs. This functionality is commonly requested by broadcasters and service providers. (See Figure 4.)

Rather than viewing AVC as a challenge to MPEG-2, companies are adding functionality to encoders to ease the introduction of more AVC-based services alongside MPEG-2. In the long term, MPEG-2 infrastructure might well be replaced by AVC, but for the moment, the two standards will coexist. **BE**

Ian Trow is director of broadcast solutions at Harmonic.

Loudness control

An industry standard is needed to measure audio.

BY PETER POERS

Over the decades, audio professionals in the production and broadcast industries have attempted to control audio so their audiences hear programs that are both intelligible and easy on the ear.

Initially, audio professionals did this by simply listening to the audio content. In theory, it made perfect sense because audio is produced to be perceived by the human ear. But in practice, there were reasons why simply listening to what was running on the audio track did not achieve the desired results. It quickly became apparent that the industry needed a means of measuring the audio.

Why an industry standard is necessary

Audio is an electrical signal with a limited bandwidth, so it is possible to measure the voltage. Measurement instruments use logarithmic scaling and can have different characteristics and ballistics of level meter display. A standard audio level meter is not precise when it comes to following the peaks of the audio voltage, but that is not an issue because many peak transients don't transport much acoustical energy. In other words, they are mostly inaudible.

One might think that by combining measurement with monitoring (listening) it is possible to control the audio content. But as engineers have discovered, two pieces of audio

with the same audio level can actually sound very different. What's more, the loudness impression may also sound different. There are many reasons why this is the case, not least the impact that spectral composition, equalization and dynamic range compression can have on the audio content. When these factors are applied, two pieces of audio can end up with a different sound and loudness impression.

These issues have been the subject of debate among experts for many years. The broadcast industry has recognized the need to agree and adopt a common rule to measure loudness, and both the ATSC in the United States and the EBU in Europe are currently working on projects that will set a proper norm to help all broadcasters follow industry standards.

The International Telecommunication Union's Radiocommunication sector (ITU-R) published in July 2006 a new recommended algorithm for estimating program loudness levels for use in digital broadcasting (ITU-R Rec. BS.1770 — Algorithms to Measure Audio Programme Loudness and True-Peak Audio Level). Either Leq(A) or the new ITU-R Rec. BS.1770 measurement method will, on average, yield the same results.

Satellite Telecommunication Networks (STN) in Slovenia monitors loudness with Jünger Audio's Level Magic. The system features an adaptive level control algorithm capable of adjusting the right audio level from any source at any time.

Hurdles audio engineers must overcome

Currently, there are two main ways to distinguish loudness: sensory and perceptual. Sensory loudness is directly related to the neural activity of the inner human ear. It is possible to model this and build a sensory loudness meter. In contrast, perceptual loudness is related to how interested the listener is in the sound. Obviously, this is not something one can model because it is a learned response that varies according to the personal involvement of the listener. As people are different in how they use their senses, there are enormous variations in the information needed to form a perceived reality. This becomes interesting for people working with sound and moving pictures because if the source can be seen, then the mind will prefer the visual evidence to the sound.

Nonetheless, the standard published by the ITU describes a proven method of measuring the audio and getting a result related to loudness. As the production and broadcast industries start to embrace loudness control, they will face some important challenges. They must get used to something they have no experience with. The industry knows how to deal with level control because it has been doing it for years, but as already stated, two different pieces of audio with the same level characteristic can be different when it comes to their loudness impression.

The industry should learn to control audio material by using loudness measurement techniques instead of level measurements because when it comes to complying with the ITU 1770 standard, what the level meter is showing is no longer important. Engineers need to understand that loudness and level are two different things. If the audio material is aligned to equivalent loudness, the level might vary wildly, and that's going to confuse those who have been trained to look for proper leveling.

The way we control audio is going to be very different in the future. The audio engineer still needs to trust his or her ears, but the optical reference instrument of the future will be the loudness meter. Audio monitoring conditions will have to be standardized and aligned in the same way; otherwise, it will be difficult to produce equivalent loudness from different locations and venues.

Another problem related to the practical use of ITU-based loudness control is the lack of references. There are standards for audio levels. These may vary from region to region, but at least people know which alignment level they need to control. The ATSC has given the first recommendation for loudness control, while in Europe, the P/LOUD group

There are already options available, the most basic of which is to run an automated fader driven by the control signal out of the loudness detection.

hosted by the EBU, is discussing the recommendation. If the references are published, it should then be easy to follow them. There is no evidence that loudness perception is different for various regions of the world; therefore, it should be possible to evaluate and set an international reference. However, given the politics involved, one does wonder if this will ever be the case!

The ideal solution

In the end, the industry may need to adopt the right technical solution. There are already options available, the most basic of which is to run an automated fader driven by the control signal out of the loudness detection.

But well-balanced loudness control isn't that easy. Ideally, the industry needs a system that gives short-term dynamic control as well as average level control (compliant to ITU 1770) in one box. With this type of loudness control system, the circuit should give continuous control, regardless of the source and without touching the sound of the audio material. There should be no breathing, pumping or spectral changes — just well controlled loudness. Loudness changes from different feeds and differences between program parts; the process should take care of them automatically and give listeners the results they want to hear.

This type of system also needs to restore dynamic structure and offer inaudible gain control. Transients and peaks should be precisely controlled, even if they aren't represented with the loudness detection.

The process should be easy to set up and adaptive to the program material. And all this together should be performed with a short latency time even if the human ear needs about 200ms to perceive loudness. In order to avoid dangerous time base differences between audio and picture, a minimum latency is required.

Conclusion

We are moving toward a situation where broadcast ingest, playout and distribution facilities will face mandatory requirements to implement loudness-based audio control solutions. However, achieving consistent loudness output would be a lot easier if international references were given and if production facilities began adopting loudness control. BE

Peter Poers is managing director for Jünger Audio.

CISCO

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The Evolution of the Media and Entertainment Cloud

Perspectives from Cisco® and Ascent Media®

INSIDE

Get ready for the next wave of media computing services: the private media cloud. A hosted computing fabric designed specifically for media companies can spur innovation and drive down costs.

The transition currently sweeping the media and entertainment industry is as structural and as fundamental as the introduction of color TV or cable networks. Three key industry changes (consumer demand for more choices, the emergence of online video content, and a push to cut costs in response to economic hardship) are having a profound impact on business profitability. In fact, this impact is so fundamental that media executives are forced to examine the cost structure of their business. When the Wall Street Journal asked Jeff Zucker, president and chief executive officer of NBC Universal, "How do you bridge the gaps between the digital dimes and the analog dollars?" Mr. Zucker answered, "We've got to change our cost structure."[1]

One approach to changing the cost structure is to transform the disconnection and isolation of different business units. For example, many media companies today, including News Corp, Viacom, and Disney, are merging business units or consolidating different services groups. By building a common infrastructure for equipment and services across multiple segments of the business, media companies can amortize technology costs across different business units. When implemented correctly, these projects can generate substantial savings with minimal impact to productivity.

This article discusses a logical extension of this trend, in which media companies use "cloud computing," a hosted technology fabric that provides computational services on demand, to lower operations costs. The article introduces a new concept: the "private media cloud," a custom-built cloud designed for the unique requirements, standards, and services of the media and entertainment industry, and built to address media-specific problems. When multiple companies share a private media cloud, they can deploy new technologies such as Interoperable Master Format (IMF) at a lower cost of adoption.

More importantly, the private media cloud can accelerate innovation by allowing developers to produce content-specific applications such as automatic generation of metadata from content, content repurposing and translation, and automatic embedding of hyperlinks for feature products into content. These kinds of innovations can translate directly into the ability to derive additional revenues from content. Ultimately, a private media cloud reduces the operations costs of distributing content, increases revenues, and unlocks new benefits for content owners and distributors alike.

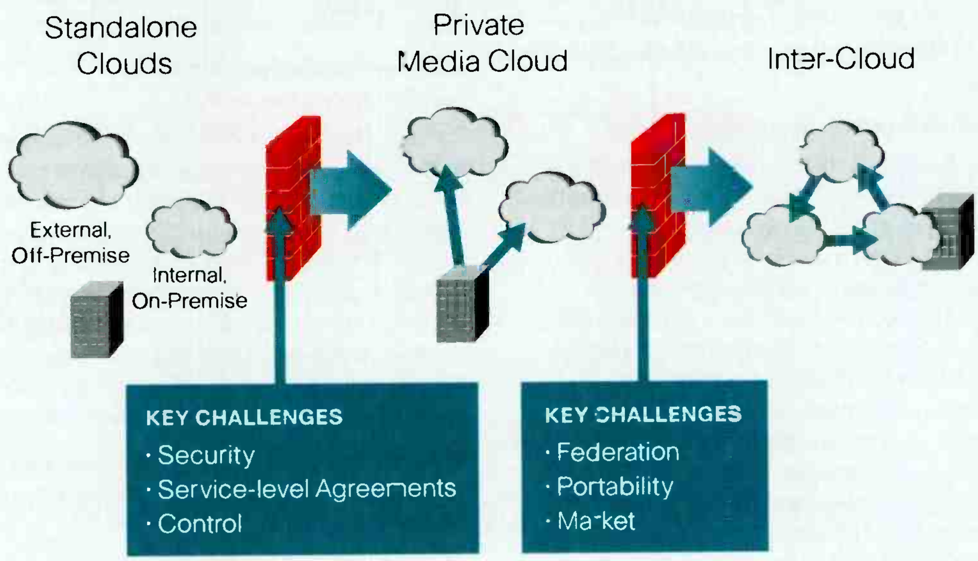
What is a Cloud?

"Cloud computing" is a term applied to large, hosted data centers, usually geographically distributed, that offer various computational services on a "utility" basis. Typically, the configuration and provisioning of subscriber services in these data centers are highly automated, to the point that services are delivered within seconds of a subscriber request. A cloud may be hosted by anyone: an enterprise, a service provider, or a government.

An important aspect of cloud computing is the nature of the services that are being extended to the subscribers. At the most basic level, cloud computing can provide subscribers with compute, storage, and networking resources on demand. However, cloud computing services can also be highly sophisticated and offer subscribers capabilities such as executing content-specific functions (i.e., transcoding a specific piece of content). In general, cloud computing can make a broad range of capabilities, from very coarse functions to hundreds of content-specific functions, available to subscribers. All of these capabilities can be billed back to subscribers on a "pay-as-you-use" basis.

A private media cloud is an extension of the basic cloud computing concept, providing a cloud platform-as-a-service designed specifically for media companies, Figure 1. It supports the standards, services, storage models, and security attributes that are useful in solving common problems along the media and entertainment value chain. A private media cloud is "private" in the sense that it is used to provide intra-enterprise and inter-enterprise services to a controlled number of participating companies with similar needs and requirements. It is built to provide interoperable media services, enabling infrastructure within multiple enterprises to interact transparently with the private cloud.

Figure 1: Evolution of Cloud Platforms



What is an "Interoperable Master"?

In order for media companies to benefit from greater collaboration (whether through a private media cloud or through the myriad other ways in which they interact and serve their downstream constituents), the companies need a common media format. Such a format, named the Interoperable Master Format (IMF), is currently the subject of discussions among several major studios, hosted by the University of Southern California's Entertainment Technology Center. (See www.etcenter.org/IMF.) The goal of the IMF effort is to develop a voluntary specification for a single digital master that can be used as the basis for creating any downstream media deliverable, for any screen size, bit rate, resolution, compression codec, etc. The IMF will store one master set of file-based elements, including metadata, which can be transformed, combined, and packaged for downstream distribution using multiple Composition Play Lists, Figure 2. The availability of high-quality, uniform, interoperable, file-based masters should lower costs, improve time-to-market, and increase interoperability of existing production processes. The IMF specification is intended to be open, so that file-based IMF workflows can be implemented and customized by any content creator, service provider, or distribution partner.

How Does a Private Media Cloud Create Value for the Media and Entertainment Industry?

Media and entertainment firms are continuing to merge previously disconnected business units and partners and to expand shared infrastructure. As a result, digital production, distribution, and business processes are becoming increasingly integrated, interconnected, and collaborative. This trend is occurring both within firms and across firms. A private media cloud approach allows firms to create their own internal cloud, as well as to interact more transparently with external media-tuned data centers that provide private cloud services. The value of this degree of interoperability can be felt in several areas, but especially when implementing and deploying processes across business units, for example, processes associated with the IMF. This value manifests across the value chain, and is shared by content owners as well as consumer-facing firms such as broadcasters and digital retailers.

Let's dig a little deeper into the example of a private media cloud supporting IMF-related operations. Based on their understanding of private media-tuned data centers currently supporting the media and entertainment value chain, Cisco and Ascent have identified several specific sources of value. They include:

Data consolidation

Consolidating video, audio, and metadata outputs from production and post-production processes into a consistent "Interoperable Master Format" can simplify downstream processing, increase reliability, and decrease the costs with which downstream distribution targets can be fulfilled. Media and entertainment content datasets are large compared to those in other industries, at tens of terabytes per title. Aggregate annual industry capacity will be on the order of hundreds of petabytes. Such large, concentrated datasets are well suited to be served from a "private cloud" tuned for the media and entertainment industry. The private media cloud consolidates and optimizes storage, management, and operations costs, and provides a consistent set of "on-ramp" services to facilitate the creation of interoperable master datasets.

Minimized data movement and transport costs

Once data is in the media and entertainment cloud, it pays to leave it there. There is a common misconception that when content is digital, moving it around is essentially free. This belief may be a reasonable assumption for small datasets, but it is certainly not the case for terabyte-scale media files. It takes almost 23 hours to move a 10-terabyte dataset over a Gigabit Ethernet link. A good way to understand the value that the private media cloud offers for data transport is to imagine a factory. A traditional factory has fixed machines, and materials are moved around the factory floor (or even through multiple factories). In cloud computing, the materials and work-in-process stays put, and the machines "come to the data," minimizing data transport latency and costs.

Increased innovation and collaboration

The media and entertainment value chain has historically been predicated upon effective collaboration. However, the industry is only just beginning to take advantage of the kinds of networked collaboration services that can increase the quality of results, reduce cycle times, and optimize end-to-end costs. A private media cloud can and should offer a rich set of such collaboration services. When combined with open interfaces, these services can spur innovation by providing a rich palette of media-tuned services (i.e., metadata extraction, annotations and approvals, and content packaging) that can be quickly extended to cross-function and cross-enterprise collaborative networked processes.

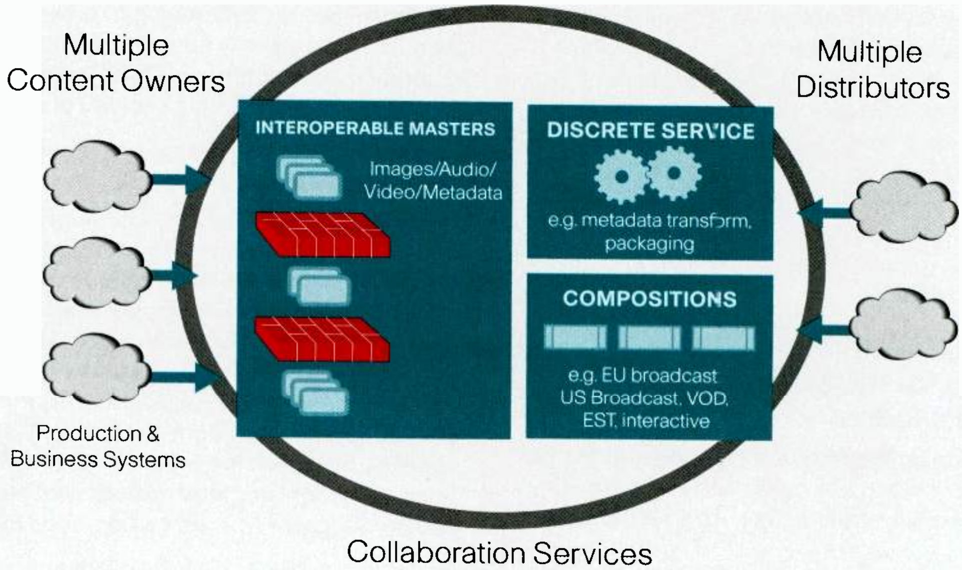
Improved utilization of "media manufacturing capacity"

The digital manufacturing capacity required to support media and entertainment applications can fluctuate wildly. Demand for a particular customer is project- and deal-driven, and prone to spikes that may not be easy to predict. In such environments, building for peak capacity for each customer is simply not a cost-effective option. Instead, a viable "pay-as-you-use" model can be realized through aggregating and smoothing demand, and matching the supply of machines in the "virtual factory" against this smoother demand curve.

Automation of distribution and business-to-business (B2B) syndication of content and metadata throughout the supply chain

The emergence of interoperable masters across multiple feature films and TV episodes from multiple studios can enable an unprecedented degree of automation. Distribution servicing, or the creation of specific entertainment products in the right formats with the correct "digital packaging," can increasingly be automated. A private media cloud can provide automated distribution services that provide coverage for the majority of distribution targets.

Figure 2: Interoperable Masters within a Private Media Cloud



A private cloud that offered these types of capabilities could benefit multiple content providers, service providers, and distributors. To deliver these benefits, however, the private media cloud must be tuned specifically for the media and entertainment industry, and must be transparent, virtual, and open. Customers must be able to transparently observe their resident data, all operations that are performed within the cloud, and their status and associated costs. Customers should also be able to reasonably implement standalone operations on their own premises that interact and interoperate with the media and entertainment cloud in a transparent, virtual whole. Finally, customers should be able to provide and retrieve data, order work, and observe status in an open and nonproprietary manner, using interfaces that allow them to connect transparently to a variety of their own business and production systems.

Private Cloud Benefits for Broadcasters

In addition to the benefits described above, the IMF services available in a private media cloud would also offer specific benefits for broadcasters. A private media cloud can help broadcasters:

Reduce operational costs

A common consequence of the isolation and disconnection of business and infrastructure work centers prevalent today is that the same work is done at multiple places along the value chain, often increasing operational costs for broadcasters. For example, important metadata available earlier in the value chain is not maintained or made available to broadcasters, forcing multiple downstream distributors to recreate the metadata and manipulate the content. A private media cloud can provide broadcasters with a broad array of services, including access to required upstream metadata, as well as various content formats.

Utilize staff more effectively

A private media cloud can help broadcasters to better rationalize their staff by enabling them to use applications, collaborative processes, and services that "come to the data." As a result, a single staff member or team could potentially serve multiple geographies or facilities.

Reduce development costs and time-to-market

In many cases, broadcasters must augment traditional playout services with multiplatform publishing capabilities in order to remain competitive. The many back-end services required to prepare and deliver content for different consumer-facing platforms (transcoding for mobile or PC, DRM-packaging, download, streaming, license management, and serving) can be made available within the cloud. This capability eliminates the need for each broadcaster to develop, maintain, and manage such complementary services themselves. When data is consolidated, there are also significant opportunities to optimize peering and connectivity to consumer-facing content distribution networks, allowing broadcasters to join forces and enjoy economies of scale.

Today's media and entertainment companies are facing fundamental disruption in their business models, technologies, and techniques for provisioning required services. These disruptions are profound, yet they also offer proactive firms an opportunity to enact strategies to harness change, lead the competition, and thrive in the new world order. Cisco and Ascent are working with leading media companies to take advantage of this industry transition. Cisco and Ascent take an architectural approach, in which different aspects of the business are viewed as discrete services. These services can be selectively exposed as a common fabric to employees, partners, and customers throughout the media value chain to lower operational costs and unleash new innovation and collaboration. The "private media cloud" advanced by Cisco and Ascent represents a first step in that direction.

[1] Swisher, Kara. "What's On – and Where?: NBC Universal's Jeff Zucker on why he believes television is still paramount." The Wall Street Journal. June 2, 2009. Retrieved August 3, 2009.

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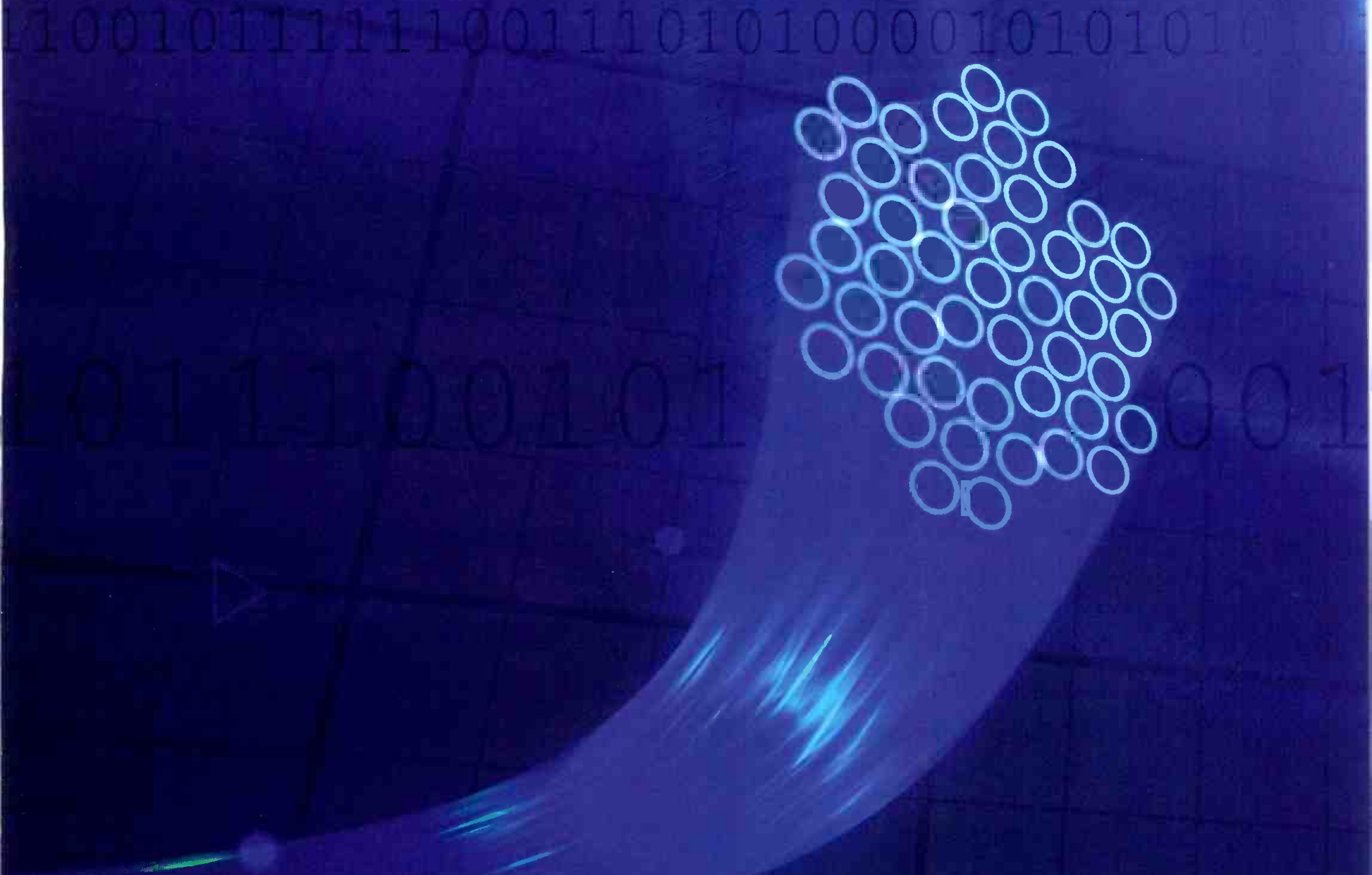
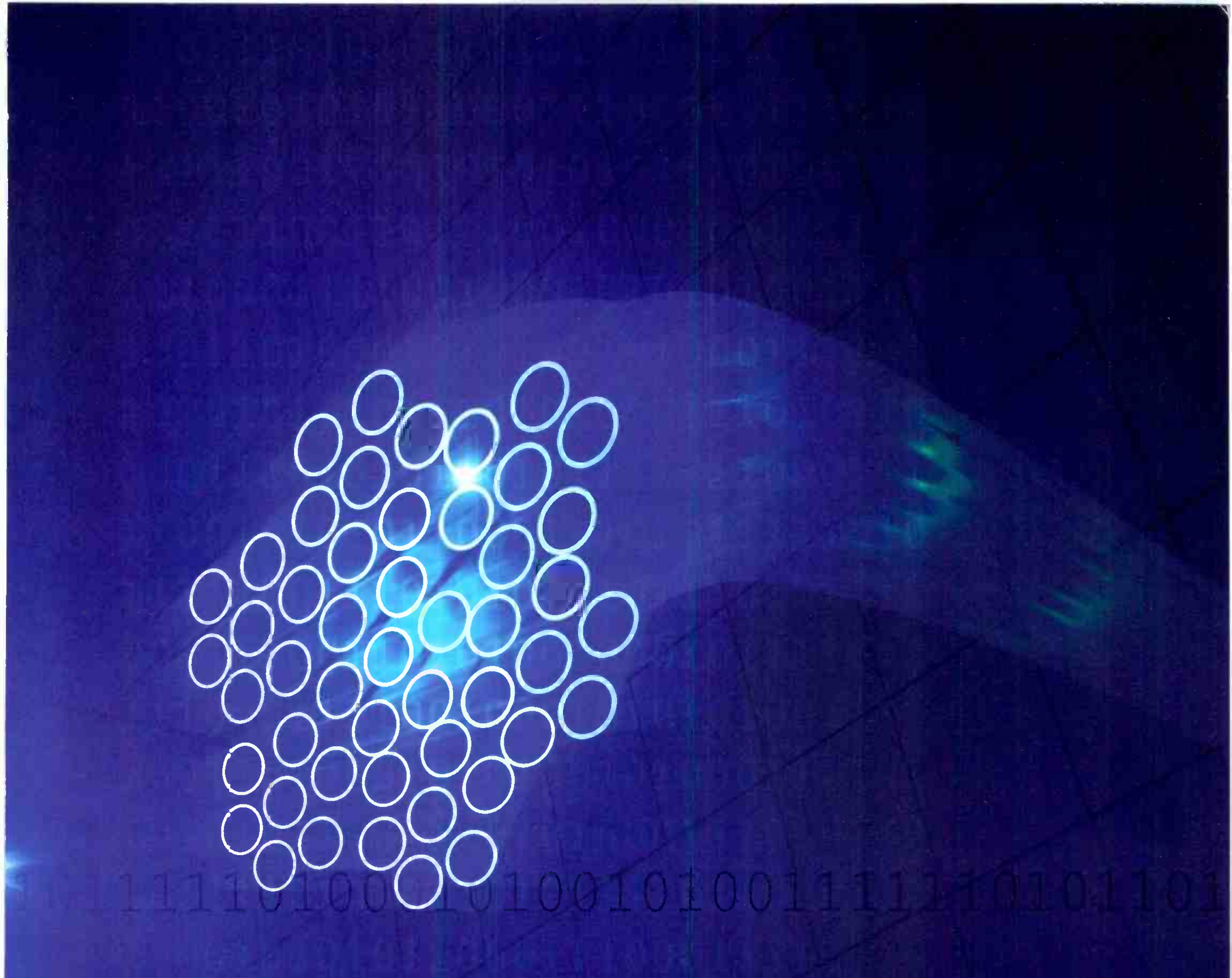
Fiber optics

New 1.5Gb/s and 3Gb/s video bandwidth requirements are driving broadcasters to embrace fiber.

BY STAN MOOTE





Most of us know that fiber optics have been around for nearly four decades. But as broadcasters, we tend to think fiber is for transporting video in and out of the plant — not within the facility. After all, fiber optics is really only for longer distances, isn't it?

Traditional fiber-optics usage

Other than telcos, broadcasters' traditional usage of fiber was strictly limited to specialized needs. I clearly can recall our first fiber customer in the early 1990s — a European broadcaster that needed to run seamless operations between two collocated buildings. As the buildings were close together and only 32 video feeds were required, this project wasn't really anything out of the ordinary. We would only need to pre- and post-equalize the signal, use the lowest loss cable available and suffer a little bit of added noise. Having 32 feeds precluded using microwave STL units due to costs.

The one catch in this installation was that the video requirement was serial digital (270Mb/s), not analog — hence, the move toward fiber. We quickly designed fiber I/O into our routing switchers and satisfied their requirements with 100-percent reliability. Nonetheless, when we discussed this solution with other customers, we soon found out most broadcasters would not embrace fiber. The general consensus was, "For feeds from outside the plant, we leave it up to the local telco/PTT to provide this service."

For satellite distribution of feeds, receivers are often "remoted" from the receiving dish to provide baseband audio/video within the plant. To keep the RF loss to a minimum, remoting the RF connection is typically done by putting the L-Band RF signals onto fiber. Again, this is considered to be more of an external application to the plant.

New requirements for fiber

New requirements in today's industry are driving broadcasters to embrace fiber. As new facilities are built and older ones upgraded, broadcasters are implementing HD at both 1.5Gb/s and 3Gb/s data rates. At high data rates, coax installs need to be augmented with fiber to accommodate all necessary path lengths. Practically speaking, coax is really only good for 200ft maximum by the time one includes connectors, patches and some overhead for nonstandard/emergency patching. Even within a central equipment room, these seemingly short distances get chewed up

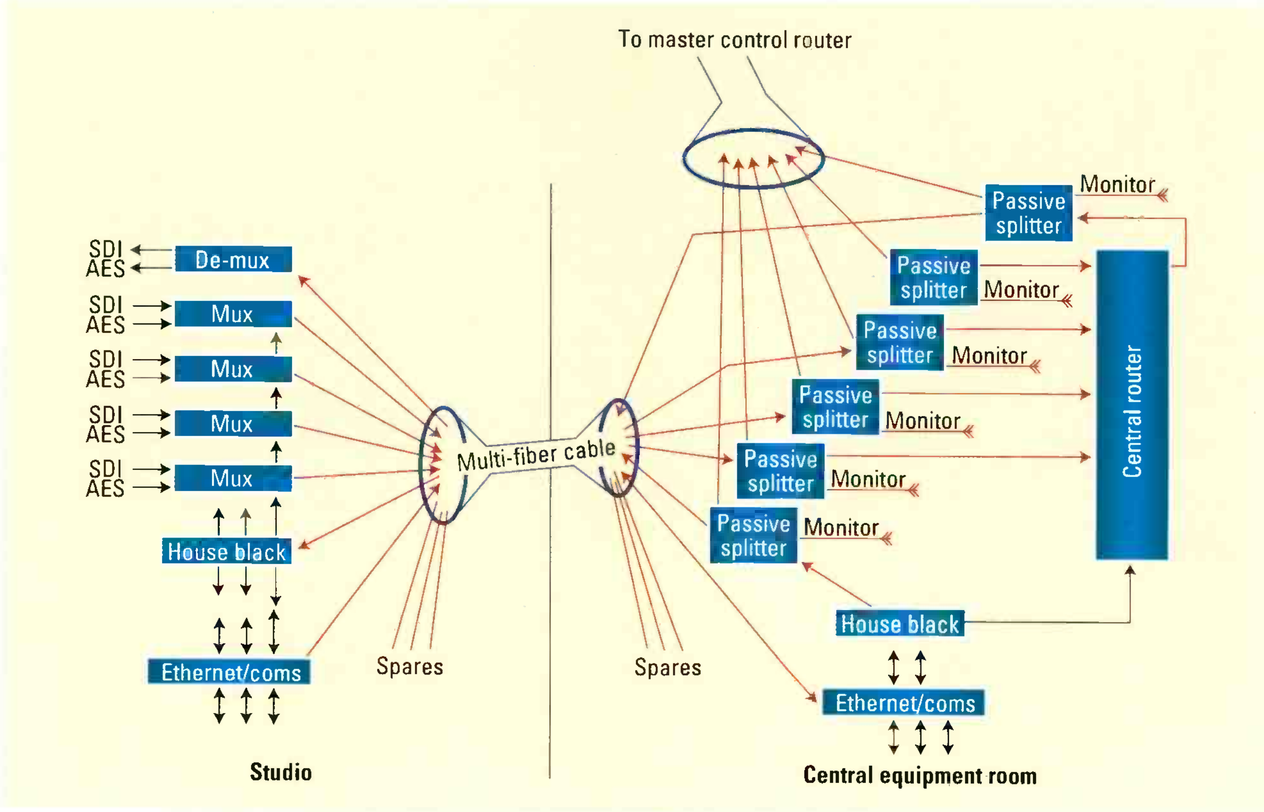


Figure 1. The use of passive splitters and multi-conductor fiber cable minimize installation and monitoring costs while maintaining flexibility for the future.

very quickly in the facilities' cable trays. Meeting SMPTE 424 specs becomes more difficult as inexperienced installers often squeeze the coax with incorrect tray loading or tie wrapping.

Given these factors, more and more broadcast products now offer fiber interfaces. This makes a mixed-mode plant quite simple to consider now that typical products such as A/V processors, up/down/crossconverters, frame syncs, mux/de-muxers and distribution amplifiers offer optical. Mid- and large-size routers now offer user-customization of the I/O for coax or fiber by simply changing out I/O modules to provide the required quantity of optical ins and outs.

Looking at typical central equipment rooms, many sources come into either a central or distributed routing system. Some of these are from local in-house (studio) sources; others are

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Management/Contact: Japan Electronics Show Association

5F, Sumitomo Shiba-daimon Building No.2, 1-12-16, Shiba-daimon Minato-ku, Tokyo 105-0012, Japan

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from various remote feeds. Newer plant designs want to future-proof their basic infrastructure to cover 3Gb/s, and installing fiber makes this pretty simple. Take, for example, having a bank of serial digital frame synchronizers. Due to coaxial distance constraints, it actually was necessary to have a "bank" of frame syncs physically located beside the router. With fiber, there is no need. We can have several smaller groups, or even single units, at far greater distances than we had ever imagined.

Fiber has another unique characteristic over coax — multiple cables in a single jacket. With fiber counts of 6, 12, 24, 48, 72 and 96, install costs go down. Look at the sudden flexibility you've created. Consider a studio that had four outputs, two returns and house black yielding seven feeds. The plant designer dropped in a 12-count fiber. Six months later, this room was needed for a sudden pop-up 1080p event. They wheeled in a second switcher and suddenly were up and running without laying cables. The install time was cut in half.

By using passive splitters, the in-house studio feeds can be distributed to the central router and also additional rooms and routers within the facility at no extra power costs (keeping the install somewhat green). When using splitters, monitoring points basically come for free; this is a real bonus. (See Figure 1 on page 64.)

Using fiber is really scary

The only thing scary about fiber is that looking directly into an active fiber is dangerous. Don't do that. Besides, there is no point; you can't see the light anyway.

Years ago, broadcasters had similar apprehensions about accepting new connector technology such as simple RJ-11s. I recall having to design them out of the newer equipment due to complaints of the difficulty having such a customized connector and specialized training and equipment required to produce the mating ends. Look around any facility now, and you see literally thousands of the RJ-11's big brother, the RJ-45. We all had to take the time to learn how to use these connectors, and the same goes for fiber.

With any new technology, there are lots of confusing options. At a glance, fiber is no different: single-mode, multimode, macro and micro-bends, slack storage, angled and ultra connections and, for that matter, a half a dozen of different types of connectors all begging us to keep with BNC and coax technology. But seriously, the switch to digital has forced substantial changes in BNCs and coaxes over the past decade. And fortunately, a few broadcasters and manufacturers have been using fiber for close to 15 years now, so they have already worked out

Shown here is a variety of physical layer optical test products. The fiber identifier (center) is a unique tool that clamps onto a fiber cable and identifies both the direction and signal presence without disconnecting the fiber. The handheld OTDR (right of center) determines fiber cabling faults. Optical power meter and visible laser source (two units on the left) are valuable tools for any technician's kit.

most of these kinks for you.

Finally, think about this: How many of you have connected up the audio optical out from your DVD player or set-top box into your home theater audio system. Was that difficult?

Smaller bits

With any new technology, we begin with a requirement, and then we need to learn about it — breaking the subject into smaller "need to know" pieces. When it comes to fiber, leave the heavy-lifting technology to the equipment suppliers, just as we do with most technology we use today. Learn about the I/O, appropriate test equipment and the constraints, and move on. Also remember that fiber systems are designed to go tens — even hundreds — of miles, but within the plant, we only need to focus on short distances. Hence, most of the complexity is removed.

Following are the basics on installing and operating fiber:

• *What type of fiber should I use?* There are two types of fiber: single- and multimode. Although two options exist, the choice is actually quite simple: Just use single-mode. Multimode limits the distance even within a large building. Using single-mode, you can go for miles without calculating a link budget. Keep it simple: Only use single-mode fiber.

• *How do I choose connectors?* People always complain about having too many connector options. Well, look in your plant that is filled with DB-9, DB-25, dozens of BNCs for different coax sizes, RJ-11, RJ-45, HDMI, VGA, DVIs, XLR3s in different flavors and min-DINs — not to mention all the specialized ones for cameras and remote operations.

When it comes to connectors, the first thing you need to know is that there are two different ways to join fiber: Angled Physical Contact (APC) or Ultra Physical Contact (UPC). These methods are always indicated as part of the connector part number. The rule of thumb is to check specs on the product you are buying. Typically in broadcast products, only UPC is used. APC provides a more expensive, lower-loss connection when super long distances are required outside the plant. There is no need for APC inside the plant.

Like choosing the fiber itself, making the choice of connector type is also pretty simple: Most broadcasters use SC or LC connectors. They both are snap-in and locking. Try to standardize on one type as much as possible; use patch cords with different ends to convert when required to use a different connector type.

- *What about test equipment?* Don't even consider initiating a fiber install without having some test equipment on-hand. You don't need much to get started. The minimum is an optical power meter and a visible light source. (Choose one that is bright enough to be seen in daylight. This is very helpful for basic physical layer troubleshooting). Having an optical time domain reflectometer can help you quickly locate the physical position of any cable faults that may have occurred during installation or handling. (Remember that some installers ignore the "minimum sweep" rule.)

For broadcasters, it can be beneficial to choose fiber products from a manufacturer that also offers optical test equipment tailored specifically for broadcast use. Many suppliers focus more on the higher volume telco users, whose products are used for installations of literally miles of fiber cable. When ordering test equipment, make sure that its connectors are removable and that you identify and order high-quality adaptors to match your system requirements.

- *Is cleaning important?* With fiber, there's no reason to worry if the connectors are gold-plated or not; they don't corrode. Cables do come with protective end caps to keep them polished and clean. In most broadcast applications, simply removing the caps and making the connection is all you need to do.

Again, in-plant operations have lots of link budget, so there's no need to fuss too much about connector cleaning. Should some cleaning ever be required, don't blow on them or wipe it clean with your finger or shirt. There are several inexpensive cleaning kits available.

- *How can I simplify installation?* For years now, telcos have been installing lots of extra fiber once the ground has been opened up. Now with "fiber to the curb," these efforts are paying off. The same goes for the previous studio example. Much of the cost is in the install, not the cable — so install more than you need.

Additionally, installation crews do need to know how to install fiber to ensure that it doesn't crack. You should know the cable specs for the bending radius and the crush tolerance due to too many cables on top of the fiber and, just like coax, incorrect tie-wrapping. Bending cable too sharply is the worst enemy in the optical world. When you check the cable specs, you will find the bending diameter is typically 1.5in; however, there are newer cable types that allow for bending as low as 0.6in.

Hidden benefits

Besides future-proofing your facility, increasing operational flexibility and eliminating traditional distance limitations, fiber offers a number of hidden benefits:

- *Green operations.* Passive splitters provide monitoring points and distribution points without using power
- *Simplified digital systems timing.* Fiber operates at light speeds. Electrical and optical conversions take less than 10ns, so there's no longer a need to calculate cable runs.
- *Improved house sync.* With fiber, the distribution of color black within your plant — or even to external buildings — is simple. Again, there are no delay issues: Simply use analog video-to-fiber converters to distribute black and tone on fiber.
- *No more cable tracing nightmares.* Because fiber passes visible light, you simply put on a handheld visible light source and find your lost cable in seconds. Passing visible light into a fiber can also help you find faults.
- *Less noise.* Fiber is immune to interference. There is no need to fight ground loops and various electromagnetic or RF noise.
- *Simplified control and monitoring.* Many interfaces are now available to extend Ethernet, intercoms, RS-422, etc., networks over fiber with simple I/O modules. Taking advantage of these greatly unifies your operations.

Summary

After reading through this article and seeing how simple fiber is to use, you will likely ask yourself why you have not embraced fiber before. Don't wait around until you are suddenly forced into implementing a stronger 1.5Gb/s or 3Gb/s plant. After all, your upgraded IT infrastructures demand fiber, so why not use it for video too? Consider fiber today. BE

Stan Moote is vice president of corporate development at Harris Broadcast Communications.

EEG's HD480

The closed-caption encoder and VANC inserter helps broadcasters manage active format descriptors.

BY PHILIP MCLAUGHLIN

Active format description (AFD) has become one of the core technologies that broadcasters use to address the challenges of the mixed HD/SD production and home-viewing environment that currently exists. AFD codes, which supply information about intended aspect ratios to downconverters and other equipment, are enabling streamlined and economical HD/SD workflows where all material is produced and stored in HD only, and converted to SD on a just-in-time basis as needed for transmission. These workflows, while highly efficient in theory, are often limited by problems propagating the critical AFD data cleanly throughout the signal path.

Recent updates to the HD480 closed-caption encoder and VANC inserter from EEG are designed to directly address these challenges, and help make the all-HD workflow leading to high-quality HD and SD delivery a reality.

Inside the HD480

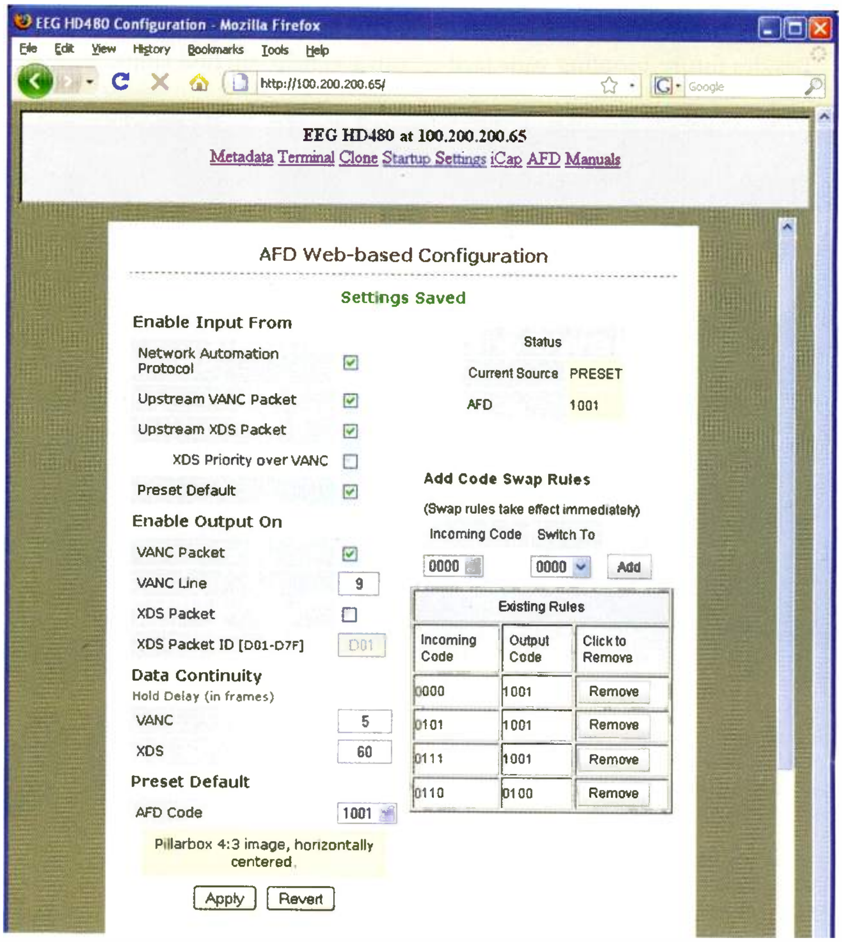
Properly preserving AFD data throughout the signal path can be hazardous for a number of reasons, including multiple insertion points, equipment that makes undesired changes to upstream AFD data and equipment that does not implement the entire set of defined AFD codes. The latest version of the AFD module for the HD480 addresses almost all of these problems.

Driven by an intuitive Web GUI, the encoder acts as a multipurpose standardizing tool, or legalizer, that streamlines quality control and troubleshooting for the smooth carriage of AFD data. It recovers AFD codes from any line of a video signal, while standardizing to a single packet on a user-selectable VANC line. This eliminates common problems with multiple AFD packets appearing in different locations in the same video frame.

Another common problem is small gaps in upstream AFD data, resulting in screen flickers and worse. The HD480 can bridge data over these gaps, holding the last valid code for a configurable number of frames for up to five seconds.

The encoder also provides a unique tool for bridging AFD data around equipment that displays undesired behavior — a custom XDS packet that preserves the core of the AFD packet. This XDS packet is ignored by other equipment, but can be recovered downstream by EEG equipment and reinserted as full standard VANC AFD packets. This is one of the features that gives the unit the flexibility to be placed in a wide variety of configurations within the video stream on the way to distribution.

The core of the encoder's ability to act as an efficient legalizer is an



The EEG HD480 encoder features an intuitive Web graphical user interface that enables broadcast engineers to control and troubleshoot for the smooth carriage of active format description data.

AFD input/output switching matrix. The module accepts inputs from any VANC line in upstream video, the XDS protocol, or a TCP-based automation control protocol, and can also author AFD data based on presets. The unit can output data in standard VANC format, the XDS format, or both. Because there are multiple ways to input AFD, and subsequently multiple ways to output AFD, the system is based on a Web interface that efficiently sets up rules, paths and priorities for the AFD data. For each of these sources, the encoder's switching matrix allows users to set whether they want that data to be used, if present, and what receives priority when there are multiple sources. Regardless of the number of input sources, one consistent AFD packet will appear with each field of the output signal.

The encoder can also set code swap rules that enable dynamic mapping from one AFD code at the input to another at the output. For example, every time the code "0000" comes in, it can be replaced with code "1001." This function is helpful if other equipment in the plant automatically stamps video with undesirable AFD codes, or if ingested material from other content providers similarly arrives with problematic AFD codes. Broadcasters that have problems processing the bar data (which provides information about the locations of any bars on the screen, such as if it is letterbox, etc.) component of the SMPTE-defined AFD packet, and want it removed or normalized, can use the HD480 for this function, as well. These processing filters are run after the input side of the switching matrix, so they will apply for all possible data sources.

The features cover most of the major issues broadcasters experience with AFD workflows today. Multiple codes, code gaps and codes that do not meet ingest specifications are responsible for a wide range of troubling downconversion behavior. Easy automation and multiple prioritized input methods enable the smooth design of complex systems where mixed format data sources are inserted together on the fly. The HD480 has the tools to be used for AFD legalization either prior to server ingest, or after server playout.

The benefit of managing AFD codes

The transition to a fully digital broadcast distribution system makes management of AFD codes essential to the video stream. The AFD capabilities of the HD480 aid HD/SD delivery workflow with a flexible architecture and intuitive Web interface. BE

Philip McLaughlin is president of EEG.

Metadata

As metadata itself becomes more ubiquitous, the bits behind it are more complex.

BY JOHN LUFF

Many years ago, SMPTE and EBU joined forces to work on harmonizing content-related issues associated with interchanging digital bit streams. Though the 1998 report was not the first use of the term "metadata," it clarified terms related to interchanging content in the emerging digital video ecosystem. The preface to the report defines metadata as "a new class of program-related data called metadata. Metadata may be defined as the descriptive and supporting data that is connected to the program or the program elements."

Metadata is one half of the media, the other being the essence, i.e., the actual content itself. Though metadata may be necessary to use essence, metadata can be processed and maintained in a totally separate path than essence. This leads to the potential for corruption, or disappearance, of one class while the other still exists.

Understanding metadata

Metadata includes two major classifications. Structural metadata provides critical information that may be necessary to process the associated content. This is comprised of things like the scan format, compression system used, number of audio tracks and their technical parameters, closed captioning, and unique media identifier (UMID) (SMPTE 330M-2004). Descriptive metadata provides other useful information about the content, such as program title, length, copyright holder and even scripts.

SMPTE 335M-2001 describes in great detail 15 classes of metadata and how they are represented. The overarching description is based on key length value (KLV) encoding. The key is a reference permanently tying the elements together. The length follows and specifies the number of bytes of data, which then follows in the value. This simple structure allows for almost infinite variation and simple parsing of the information.

Of course, it is often inconvenient to have separate metadata and essence. Managing the two independently, in the case of say a SMPTE 292 stream of HD content, would be more difficult. As a result, the concept of a wrapper must be introduced. A wrapper gathers the elements (video and audio essence, and metadata) together and presents one unified delivery mechanism. (See Figure 1.) SMPTE 292 is itself a wrapper, as it contains audio and video, and metadata (including UMID), on a 1.485Gb/s link. In the file domain, a QuickTime file is, in fact, a wrapper, as is MXF.

Using a wrapper allows the media and all of the metadata to be delivered in a unified structure. But there are times when metadata must be separated from the content. For example, in a TV station, the metadata about programs and spots is parsed to traffic, automation, and perhaps asset management and archive databases. Each has a function to perform, and each must be aware of aspects of the content, but does not need access to the content itself. To make the full wrapper available to such applications

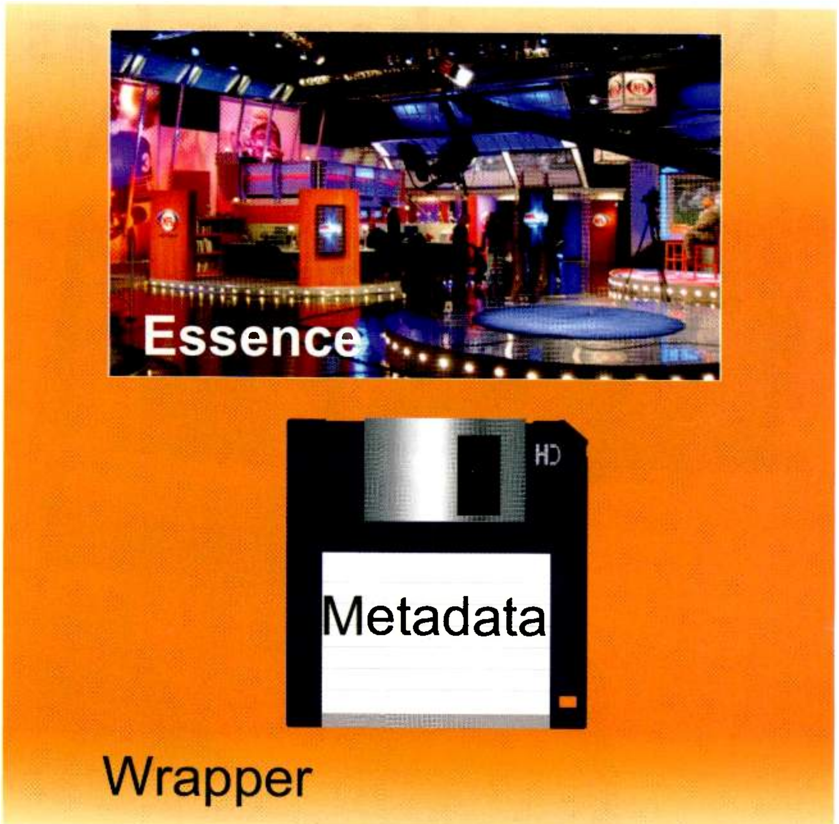


Figure 1. A wrapper collects the video and audio essence, and metadata, into one delivery mechanism.

would make management of their data vastly more complicated and expensive. Traffic gets some of the metadata from a syndicator or programming database. It passes only the bare essential metadata to automation, perhaps no more than house number and start of message/end of message (SOM/EOM) along with the time the event is to play.

Automation sends additional metadata about the content back to traffic for reconciliation after air. An archive system might have a slightly more rich database to allow some searching, and a full MAM system would have a rich set of metadata fields on which searches can be performed.

Keeping data current

A major issue is keeping all data about each piece of content current. Knowing where the most current data is represents an interesting challenge. For example, traffic might have SOM/EOM that were provided by the vendor, but the times might have been trimmed to slightly different values when the media was ingested in master control. MAM would have no knowledge that they had changed either. Propagating those changes is often a complex process with multiple applications communicating, perhaps in real time.

If the metadata inside the wrapper with the content contains the same information, the complications become deeper. Do you really want to permanently modify the metadata associated with the content? To do so implies that the applications have access to the inside of the wrapper. What happens if the metadata becomes corrupted? Or worse, if it is an MPEG file, there is a chance that the syntax of the transport itself can be corrupted. The result could be corrupted essence.

There are other places where the linkage between remote metadata and essence can become broken with dire consequences. When a system is told to delete content (both essence and metadata), often a file system entry is simply expunged, leaving the blocks where the content is stored free for future recording. But if the record in the archive database or the video server's file system is trashed inappropriately, it may prevent access to content that is still valid and present. However, without the metadata (recording the location of the essence), it is easy to see that the content "doesn't exist."

As time goes on, the set of "normal" metadata becomes more rich and complex. In a recent development, YouTube announced that it will be fingerprinting all content for the purpose of making take-down decisions more transparent. YouTube has provided the tools to broadcasters, through third-party vendors, to create the fingerprint. But in the end, that adds a piece of metadata, which must be stored with each item. When a program airs with changed supers, a new fingerprint may be needed, which means more metadata.

Digital rights management information also creates more metadata. One broadcaster sent a request for proposal out a few years ago, which asked that every use of each piece of content be tracked, so if news footage had single use rights, it could be flagged as unavailable after the first use. Because this required every process in the production sequence to be monitored, and metadata made available to all applications and everyone involved, it became horribly complex. So maybe it's the bits about the bits that are becoming more complex as the bits themselves become more ubiquitous. BE

John Luff is a broadcast technology consultant.

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

Compix Media — CynerG²

Character generator simultaneously outputs graphics in either SD-SDI or HD-SDI; brands multiple video streams with different overlay material from a single chassis and one interface; features dedicated logo insertion, EAS message generation and automated, template-based sports score generation.

949-585-0055; www.compix.tv

Anton/Bauer — Dionic HC

Li-Ion battery delivers up to 10A for high-current applications including on-camera lighting; can operate a 40W HD camcorder for more than two hours; features MAXX 1.5 warranty and real-time LCD; compatible with current Anton/Bauer InterActive charger series; meets regulatory requirements including CE.

203-929-1100; www.antonbauer.com

ARG ElectroDesign — FLEX 2400 range

Range of production switches/splitters incorporates modules for distribution amplification, protection switching and diverse routing; available for various formats, including SDI, ASI and G.703; includes dual power supplies and relay bypass cards; features SNMP and Web server for remote monitoring and control, ASI modules for protection switching and distribution amplification, optional 48VDC, automatic configuration, front-panel control, LED indicators for power supply operation/alarm, relay contacts for control and monitoring, and RS-232 for setup.

203-376-3372; www.arg.co.uk

Sound Devices — 788T-SSD

Digital recorder includes 256GB solid-state hard drive; records more than 60 hours of uncompressed, 24-bit, eight-track audio to a solid-state medium; equipped with eight full-featured microphone inputs and 12 tracks of recording; features a stainless-steel and aluminum chassis, providing shock immunity; accommodates individual controls and connectors for each of its eight inputs, as well as numerous additional I/O and data connections.

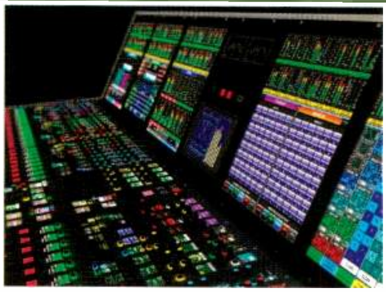
608-524-0625
www.sounddevices.com

Brick House Video — Callisto Micro

SD switcher can handle fully asynchronous (unlocked) inputs in a mixed-signal format (SDI and analog) environment; program and preview outputs are available as both SDI and analog composite with 10-bit processing throughout; features four SDI auxiliary switched outputs, triple-channel frame store synchronizers and a Web server option with external browser control; offers 4:3 or 16:9 blanking; operates in stand-alone mode or can be genlocked to an external reference; installed functions include auto wipe, auto dissolve and auto fade to black.

+44 1962 777733
www.brickhousevideo.co.uk

Calrec Audio — Artemis



Audio console based on Apollo platform, Bluefin2 for processing and Hydra2 for routing; running at 48kHz operation, features up to 640 channel-processing paths, 128 program busses, 64 IFB/track outputs and 32 auxiliaries; includes a second compressor/limiter in each channel, more than 70 minutes of assignable delay, three independent APFL systems and automatic hot-swap redundancy for all DSPs, control processors, routers, power supplies and connections; control surface combines OLED displays, touch screens and light-emitting knobs.

+44 1422 842159; www.calrec.com

Strategy & Technology — TSMonitor

Broadcast interactive application/subtitle monitor implements a number of virtual receivers running on a single server, with each executing a predefined, scripted functional test case; provides traffic light status display on Web browser-based user interface; logs the behavior of all elements for compliance; supports MHEG-5 middleware for interactive applications, EBU Teletext and DVB subtitles with closed-captioning.

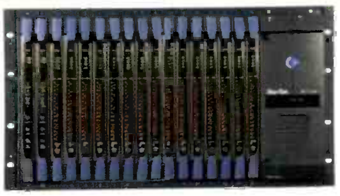
303-926-4993; www.s-and-t.com

Sennheiser — MMK 965-1

Microphone capsule attaches to 2000 series and evolution G3 wireless series SKM transmitters; offers natural and detailed audio reproduction of a large-diaphragm studio condenser; features dual-diaphragm technology, allowing it to switch between cardioid and super cardioid pickup patterns with the flip of a switch; reduces spillover from instruments.

860-434-9190; www.sennheiser.com

Clear-Com — Hybrid Network



Hybrid TDM matrix/IP server network combines time-division multiplexing-based intercom systems with an IP solution; extends the reach of intercom capabilities to more users without more infrastructure; features Eclipse v5.1 digital matrix intercom system with new 32-channel high-density IP connection card; enables broadcasters to dial into the main studio intercom using laptop computers.

510-337-6600; www.clearcom.com

Vector 3 — VectorBox 8000HD

Automated playout system integrates into one unit a universal file format player, comprehensive effects engine, channel-branding capabilities and extensive support for broadcast hardware.

+34 93 415 12 85
www.vectorbox.com

Bridge Technologies — IP-Probe v4.0

VideoBRIDGE IP-Probe update contains system enhancements and new features, including the ability to compare services between different interfaces in the chassis (ASI, RF and Ethernet), full support of RFC 3357 and searchable tables in the Web GUI; available as a free download to existing customers and preinstalled on all new systems.

+47 22 38 51 00; www.bridgetech.tv

Custom Consoles — Media Wall

Flat-screen monitor mount accommodates large or small arrays of LED, LCD and plasma-panel monitors and ancillary equipment; incorporates height-adjustable horizontal beams suspended between 2m silver-anodized aluminum columns; beams are available in 1500mm, 2000mm and 2500mm widths and allow easy attachment of large and small panels using pivoting VESA and plasma-mount fittings; horizontal cable trunking is provided at the rear of each beam and vertical trunking within the columns; equipment pods with 19in racking behind removable vented panels can be accommodated at floor level.

+44 1525 379909
www.customconsoles.co.uk

HaiVision Network Video — Video Furnace System 5

H.264 video-over-IP distribution system incorporates MAKITO HD H.264 encoder for encoding and distributing live video to computers and set-top boxes, for creating scheduled playback channels for enterprise television and signage, and for recording content and delivering VOD.

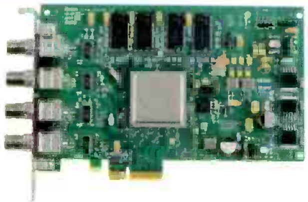
847-362-6800; www.haivision.com

ON-AIR Systems — Simply Series Version 5

Channel-in-a-box solution features enhanced remote viewing of playlists, graphics template improvements, the ability to configure ports to output different versions of the same output from a single playlist, enhanced media management capabilities and enhanced redundancy features; can play out recordings before the recording is completed with a user-defined delay.

+44 845 0942612; www.on-air-systems.com

DVEO HD-SDI Master Quad/I PCIe



HD-SDI input card simultaneously receives up to four independent, real-time HD-SDI streams and stores them in a PC workstation or video server; designed for HD video encoding, post-production processing, ENG and storing HD video for editing applications; features total bit rate of 6Gb/s, onboard DDR memory, automatic cable equalization, embedded audio extraction for up to eight channels, and driver and API support for Windows, Linux and the DirectShow filter.

**858-613-1818
www.computermodules.com**

Zaxcom Zax-Net

2.4GHz RF network distributes remote-control signals, time code, IFB audio and metadata for production sound; wirelessly links Deva/Fusion, wireless digital recording, encrypted IFB receivers and compatible digital slates into a single system; signal is generated by Deva/Fusion and broadcast via IFB100 on a 2.4GHz signal; available for all current Zaxcom hardware via free software update.

973-835-5000; www.zaxcom.com

Electrorack CoolCirc-IT

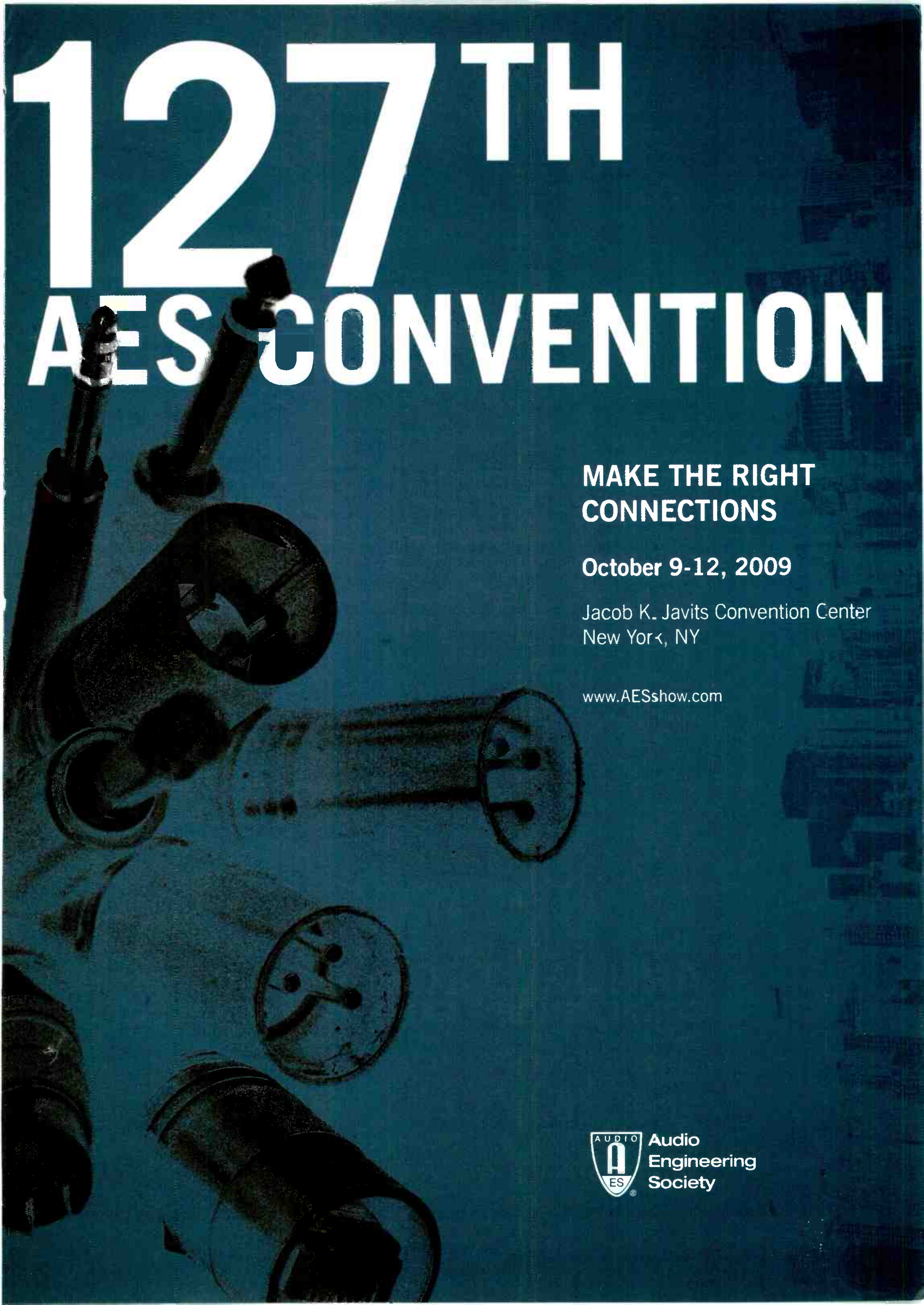
High-density heat containment system dynamically adjusts airflow to match the load in each enclosure; prevents hot exhaust and cold supply air from mixing; fully redundant system uses dual power inputs and two hot-swappable fan modules that scale up to 30kW; equipped with digital displays and LED indicator lights; includes networking module and embedded software with GUI; enables user-defined SNMP traps and alarm thresholds to trigger e-mail alerts when levels fall outside of the desired parameters.

800-433-6745; www.electrorack.com

Softel vFlex HD

Graphics data processing unit provides a compact, single-unit solution for multichannel configurations and highly complex multievent cuing and opting; encodes, decodes, re-encodes and regenerates VBI content, including widescreen signaling, VPS, cuing, Teletext, subtitling, video index and PDC signals; supports OP47 and SMPTE 2031 encoding and decoding for HD-SDI; enables encoding of animated or stationary logos and CG clocks under manual or automated control; features dual power supplies, network interface cards, time code reading, Web-based management, and network, serial and GPI interfaces.

203-354-3602; www.softel-usa.com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The fate of a TV treasure

The Sarnoff Library is looking for a new home.

BY ANTHONY R. GARGANO

A peaceful, tree-lined setting across from a softball field seems like a wonderful locale to house artifacts from the storied, early years of television. The Sarnoff Library, which occupies a dedicated area at Sarnoff's Princeton, NJ, headquarters, ostensibly is a facility dedicated to Gen. Sarnoff's major accomplishments as a titan of the communications industry, and the TV and radio industry in particular.

As such, on display are early inventions and prototypes of the key technologies and devices upon which our industry was built. After all, it was at this lab facility under the auspices of their membership in the Grand Alliance that numerous developments leading to the ATSC DTV standard took place. It was here that the compatible color TV system that formed the basis for NTSC was developed, and it was in the original lab facility in Camden, NJ, that Vladimir Zworykin labored over his early TV inventions.

Photo 1. Sarnoff Museum tube display from invention to modern times

The library also houses a treasure trove of notebooks, photographs, reports and publications that uniquely relate the history of TV technology and the TV industry. It is fascinating to look through the engineering notebooks of those early inventors, read their daily technical diaries and see their hand-drawn sketches.

A master of self-aggrandizement, during his career, the general laid claim to virtually single-handedly creating the radio and TV industries, and his museum does not disabuse that perception. Having established RCA as the premier developer of radio and TV technology for the entire supply chain — from entertainment (he created NBC in 1926) to developing a complete line of professional equipment for the broadcaster and on to offering a full range of consumer receiving devices — some would argue that his claim was not without a modicum merit.

Photo 2. Early engineering model of the image orthicon pick-up tube

Back to the library and museum — evidently the space being dedicated to it is no longer available. This has led to the closing of its doors on July 31. At this writing, there has been no announced new home for the collection, although discussions are underway with several organizations. One particularly unpleasant possibility is that the collection may be broken up and put on display at multiple locations. But even that would be better than losing it completely.

In the meantime, here are a few pictures I took from a final, recent visit to the Sarnoff Library. Photo 1 shows tubes. Remember these? They lit up, glowed red, got hot and so contained the seeds of their own ultimate destruction. Photo 2 shows the image orthicon pickup device, which was developed by RCA under the general and was as revolutionary to TV camera technology in its day as CCD technology has been in more modern times. Nicknamed the "immy," it inspired the naming of Emmy for our industry awards. Photo 3 shows the museum's curator, Dr. Alex Magoun, standing next to a kinescope of "The Milton Berle Show" playing on an early RCA TV receiver. The quality of the kinescope is surprisingly good, and if you look closely, you can discern "Mr. Television" himself, Uncle Miltie, along with guests Frank Sinatra and Tallulah Bankhead. Berle closed his weekly show with "This is Uncle Miltie saying good night." Hopefully, we will get to hear that line again from a new home for the library. BE

Photo 3. Dr. Alex Magoun, PhD, is the curator of the Sarnoff Library.

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

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

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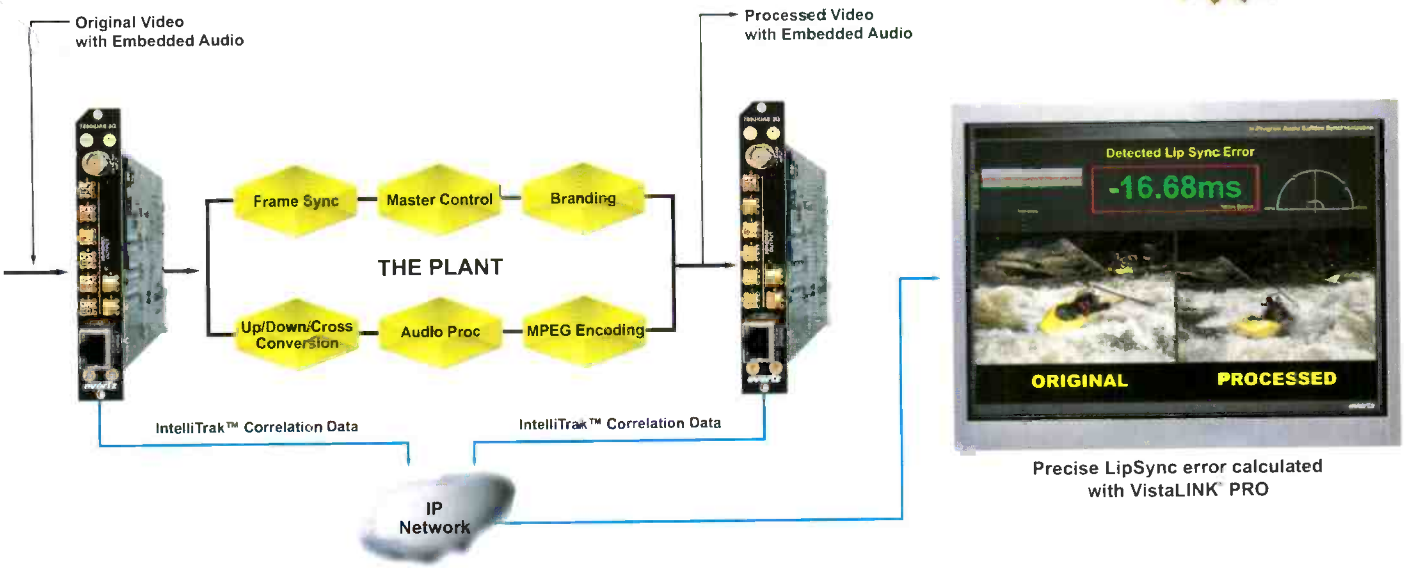

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